Measuring and Mapping the Relationships Between Urban Environment and Urban Health: How New York City’s Active Design Policies Can Be Targeted to Address the Obesity Epidemic

By

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Abstract

The fields of urban planning and public health both emerged in the 19th century and were united in an effort to address poor health conditions that were linked to the urban environment of cities. By the end of the 20th century, planning and public health had drifted apart to a point where they were completely disparate in mission and action. Over the last two decades, public health professionals, planners, and urban designers have begun to reconsider the connections that once united them. There is much that is still unproven about the relationships between the physical, natural, and social environments of cities and urban health, but national and local governments and research groups have designed ways to measure the urban environment and its effect on health.

New York City is a leader in interagency collaboration and citywide initiatives to address urban health issues through planning policy and urban design, specifically the Active Design Guidelines. At the same time, the obesity epidemic is on the rise in most New York City neighborhoods and the disparities among them are great. This thesis will explore mapping as a tool for better understanding the spatial relationships between urban environment and urban health and informing policy and design decisions about the implementation of active design in New York.

While it is currently understood that the social environment has the largest impact on urban health, the results of this thesis suggest that the physical and natural environments are also important contributors to obesity in New York City. This thesis provides recommendations for intervention in all three aspects of the urban environment in New York as a model of healthful planning and urban design. The goal of this research is to aid in the reconnection of urban planning and health in order to address the health epidemics and disparities of the 21st century.

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Introduction

Over the past two decades there has been a resurgence of interest in the relationship between the fields of urban planning and public health. Researchers and professionals in both fields have identified the need for better connections between the disciplines in order to address today’s major health concerns. Currently, there is very limited consideration of public health issues in the planning and design processes of cities. Part of the reason for this limited consideration is a similarly limited understanding of the relationships between the urban environment and health. Research is being conducted in cities around the United States to better understand these relationships and inform policies and design strategies that target health issues. Organizations at the national and local levels have created indicators of the urban environment and health outcomes to measure the impact of the physical, natural, and social environment on health. Much of this research is in the elementary stages, but the momentum to reconnect planning and health is growing, and these relationships are becoming more important for planners and urban designers.

According to the report from the 2011 Cities, Health, and Well-Being Hong Kong Urban Age Conference, New York City is one of the healthiest cities in the world.1 It is also a city that has some of the most innovative policies that connect planning and health to increase the physical activity levels of New Yorkers and create a more sustainable urban environment. At the same time, health disparities between New York City neighborhoods are stark, and New York is not immune to some of the worst health epidemics of the 21st century. The epidemic that many of New York’s policies are currently focused on is obesity and the related conditions of physical inactivity and poor diets. This thesis will look at obesity in New York City as a case study to explore how the

1 In this report, Hong Kong was compared to 129 cities around the world in terms of health, education, and wealth. The health index was determined with a combination of infant mortality rates and life expectancy. New York’s health index was 0.78 (Hong Kong had the highest at 0.88); the education index was 0.80 (Sydney’s was highest at 0.89); and the wealth index was 0.79 (Washington DC was the highest at 0.89). Ricky Burdett, Myfanwy Taylor, and Adam Kaasa, eds., “Hong Kong: Cities, Health and Well-being,” 2011; Antoine Paccoud, “Cities, Health and Well-being: Methodology for an International Analysis,” 2011.
relationships between the urban environment and health are currently understood.

This thesis will answer several research questions. First, how are the relationships between the urban environment, physical activity, and obesity currently understood and measured? Second, how are New York City’s policy and design initiatives addressing the obesity epidemic and how is mapping used as a tool for research and decision-making? Finally, a mapping and data analysis will determine the correlations between conditions of New York City’s urban environment (including physical, natural, and social factors) and rates of obesity. The results of the above research and analysis will inform a set of recommendations for New York City agencies interested in designing and promoting a more healthful city.

My literature review included a historic overview of the fields of urban planning and public health and a “state of the science” on how the relationships between the urban environment and urban health are currently understood and measured. My research also included interviews with current and former employees of New York City agencies involved in the Active Design Guidelines, the FRESH program, and other citywide initiatives that address urban health. I also conducted interviews with members of the Built Environment and Health Research Group at Columbia University.

I collected Geographic Information Systems (GIS) data from New York City agencies, primarily through NYC Open Data and other websites of the City of New York. I also collected data from the 2010 Decennial Census, the 2006 – 2010 American Community Survey, and Census TIGER Lines. For the mapping and data analyses I used ArcGIS to measure and visualize data on the urban environment and obesity rates.

Chapter One will provide the historical background to today’s discussion about the urban environment and urban health. Chapter Two will describe the currently understood relationships between the urban environment and urban health as well as specific tools and strategies for planners and urban designers. Chapter Three will review the “state of the science” of how these relationships are measured, specifically looking at physical activity and obesity in New York City. Chapter Four will analyze current New York City “Active Design” policies, including their innovation,
their limitations, and how mapping is used. And Chapter Five will analyze New York City health and urban environment data both spatially and statistically to uncover correlations and inform recommendations. The conclusion will discuss the implications for the planning and urban design professions in terms of addressing the obesity epidemic in New York City and providing a model for other cities in the United States.
Chapter One
History and Context

The Emergence and Bifurcation of the Planning and Public Health Fields

In order to better understand the importance and relevance of public health in the planning field today, it is necessary to review the history of these two disciplines. Experts from both professions have written about the way that planning and health emerged out of the same urban movements in the 19th and 20th centuries. Some scholars consider the fields to have been one and the same until as late as the 1930s. The history is understood in different ways. In his 1999 article in Town Planning Review, Michael Hebbert explained that city planning arose out of the two “parent disciplines” of medicine and architecture.¹ That same year, the World Health Organization wrote that there were two rationales for urban planning: a need to respond to natural disasters, human health hazards, and the circulation of foods and people through urban areas; and a utopian notion of the ideal city that could be modeled and implemented.² Other scholars have written about the ways in which urban planning stemmed from a combination of public health and landscape architecture.³ Regardless of the language or lens used, a similar trajectory is traced in the various histories of the emergence of planning and public health. The story begins with the Sanitary Movement in 1840’s England, transitions to the Garden City and City Beautiful movements of the early 20th century, to the era of modernism and suburban expansion, and ultimately to the separation of planning and public health as individual and disparate fields.

Prior to the 1840’s, land use patterns in England were determined primarily by the economic market. City services for citizens were provided privately and the role of the government in urban

life was limited. John Snow, who is considered the founder of modern epidemiology, discovered that the source of a cholera outbreak in London was a contaminated water pump in 1854. When Pythogenic theory (or “filth theory”) made it clear that disease was caused by the decomposition of organic matter, the sanitary movement was established to address unclean conditions. Rapid urbanization and industrialization had led to high levels of air and water pollution, insufficient disposal of hazardous waste, and deterioration of the building stock. The health epidemics of the time included cholera, typhoid, yellow fever, typhus, scarlet fever, diphtheria, influenza, and tuberculosis. In order to combat these health issues, sanitary reformers began to develop new citywide sewer systems to rid cities of the diseases they believed were caused by the environment. These systems also marked a shift toward public intervention in city services, which had previously been managed privately. Sanitary reformers are thus considered by many to have been the first urban planners.

In the United States, the connections among sanitation, health concerns, and landscape architecture began with the work of Frederick Law Olmsted and his contemporaries. During the Civil War, Olmsted was the leader of the United States Sanitary Commission, an agency created by the federal government to support sick and wounded soldiers. After the war, Olmsted joined the American Public Health Association, established in 1872. He later became the chairman of the APHA’s committee on “sanitary value and uses of shade trees, parks and forests.”

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4 “Active Design Guidelines: Promoting Physical Activity and Health in Design” (City of New York, 2010), 12.
9 Ibid., 93.
views that dense urban populations and overcrowding were at the root of disease meant that open space and nature were cures for this disease. Olmsted's theory of urban progress, which he formulated in 1868-1871, focused on issues of overcrowding in cities and posited that parks, parkways, and suburban neighborhoods contributed to better health. He also initiated the argument that visual proximity to nature and greenery is beneficial for mental health.

While Olmsted was developing his theory, cities around the country were conducting block-by-block surveys of sanitation conditions with the goal of improving the water, air, and sewage systems. These surveys reflected and supported some of the main ideas that sanitarians developed regarding the effects of the city condition on health. From these surveys, a set of guidelines was developed. Overcrowding and congestion were to be avoided, and thus tenement buildings were problematic. Parks, trees, and opportunities for outdoor exercise were important for the health of city residents. Establishing pure water supply and water-carriage sewer systems, as well as storm water drainage systems was essential for dry, sanitary conditions. And nuisance trades (such as slaughter houses) were to be separated from built-up residential districts. In these initial ideas aimed at ridding cities of disease, the seeds of urban planning theory can be found, and these ideas followed Olmsted and others into the 20th century with the Garden City movement.

Ebenezer Howard's manifesto, revised in 1902 with the title Garden Cities of To-Morrow, established a new model for cities. The Garden City built upon the solutions to unhealthy city conditions that were initiated in the late 19th century, but focused specifically on issues of overcrowding and housing. This model “proposed to solve, or at least lessen, the problems of the Victorian city by exporting a good proportion of the people and jobs to self-contained new towns

Ibid.
Hebbert, “A City in Good Shape”; Peterson, “The Impact of Sanitary Reform Upon American Urban Planning, 1840-1890.” The survey conducted in New York City by the Citizen's Association (a voluntary group of wealthy New Yorkers interested in city governance) in 1864 has been described as the first survey to resemble the planning process (Peterson 1979).
in open countryside." The Garden City model included providing sunlight and air in housing and promoted low-density development to alleviate overcrowding. These prescriptions were appropriate for what were understood at the time to be the environmental causes of disease. In 1913, however, Arthur Trystan Edwards challenged the Garden City model and posited that sunlight and hygienic conditions could be attained in the classic urban fabric, that suburbs were not the only models for alleviating poor health conditions. The debate about the relative health of suburbs and city centers continues today, and with it, generalized notions about the relationships between open space, nature, and health. This debate will be revisited in later chapters.

By 1909, the year when the city planning profession was officially established in the United States, it was only civic elites that had engaged in sanitation and planning efforts. The Progressive Era (1890s-1920s) saw both the charitable endeavors of private citizen groups and also a movement toward organized social work and government-authorized action. Still, the question of who was planning and whom they were planning for is an important one. Jon Peterson describes the civic elites of the time:

Mostly Protestant, upper- and upper-middle class, college-educated, and active in local business and professional life and still beholden to late-Victorian social norms and genteel modes of taste, they have benefited from the new industrial urbanism, but had found its terms unsettling: the massive influx of foreigners; the slum housing; the vice districts; the palls of factory smoke; the raw ugliness of so many streets; the unsightly billboards; the webs of trolley, telegraph, and telephone wires; and their own loss of power over these conditions.

It is clear that city planning was a powerful tool not only to alleviate poor health conditions but also to address issues of blight and to separate residents that were well off from those that were less so.

In January 1909, the Committee on Congestion of Population announced a conference on

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15 Hebbert, “A City in Good Shape,” 439.
16 Ibid.
18 Ibid., 124.
city planning to be held in New York City. It was at this conference and a second one in 1910 that the future of the city planning field was largely determined. There were two competing movements, each with a different leader and spokesman. One the one hand, Benjamin C. Marsh approached city planning from a social progressive background and was interested in bringing justice to the working population of cities. Frederick Law Olmsted Jr., on the other hand, was influenced both by the work of his father but also by the City Beautiful movement and the use of built form to express public ideals and civic pride. Olmsted Jr. wanted to bring order to cities, making them more efficient, livable, and attractive.\textsuperscript{19}

The clash between Marsh and Olmsted Jr. in 1909-1910 ended in a victory for Olmsted. By the end of the second conference, the social progressive roots of the city planning field were largely abandoned in favor of the City Beautiful model of comprehensive planning. A major component of these plans included public parks and citywide systems of open space. These interventions contributed to cities both aesthetically and in terms of improving health conditions. Olmsted Jr. did not agree with the City Beautiful movement entirely and was more interested in the process of planning than the creation of “expertly crafted comprehensive plans.” However, despite his urging, beautification and the creation of comprehensive planning documents remained the dominant approach.\textsuperscript{20}

Another milestone in the history of planning and public health was the advent of zoning. The zoning ordinances of the 1920s were an important tool for planners to increase efficiency in cities but also to establish more hygienic conditions by isolating uses that were deemed unhealthy for the population.\textsuperscript{21} Zoning was associated with social progress, but this progress was narrowly defined (as it had been in the past) and involved exclusionary immunization of the well of from the least well of.

The trajectory of the Garden City movement, City Beautiful, and zoning all contributed to the promotion of suburban development, and it was at this point in the 20\textsuperscript{th} century that the

\begin{footnotes}
\item[19] Ibid., 123.
\item[20] Ibid., 127–132.
\end{footnotes}
planning and public health fields began to diverge. By the 1930’s, cities had, for the most part, been able to control disease and create sound sanitation systems. There was less of a need for reformers and planners to deal directly with health concerns, and therefore less of a need for these professionals to work together toward the same goals. The public health field had moved away from filth theory and toward germ theory, which dealt with the biological causes of diseases rather than the environmental ones.\textsuperscript{22}

When the American Association of Public Health published \textit{Basic Principles of Healthful Housing} in 1939, the focus of these principles was on pedestrian segregation from cars, the benefits of cul-de-sacs and introverted layouts of development, landscaping, and community design. Planning and health were linked in title but not in practice. As Jason Corburn explains, “planning embraced scientific rationality, and quantitative analyses were coupled with aesthetically pleasing designs in order to inform dispassionate and value-neutral public decisions.”\textsuperscript{23} Planners were concerned with issues of traffic engineering, building safety, and other more technical aspects of city design and form.\textsuperscript{24} The humanistic aspect of addressing health concerns had been removed from the planning profession.

In the postwar period, middle-class Americans began buying more cars and moving to the suburbs. Urban cores around the country were becoming depopulated and cities were losing their tax bases, leaving behind abandoned buildings and blighted neighborhoods. As Thomas Campanella explains: “Most believed… that America’s cities were suffering an urban cancer wholly untreatable by the home remedies Jane Jacobs was brewing and that the strong medicine of slum clearance was just what the doctor ordered.”\textsuperscript{25} The 1949 Housing Act, Title I provided federal funding for slum clearance, making way for superblocks and expressways through neighborhoods.\textsuperscript{26} The results of

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{23} Jason Corburn, “Urban Planning and Health Disparities: Implications for Research and Practice,” \textit{Planning, Practice \& Research} 20, no. 2 (May 2005): 112.
\item \textsuperscript{24} Perdue, Gostin, and Stone, “Public Health and the Built Environment,” 55.
\item \textsuperscript{25} Campanella, “Jane Jacobs and the Death and Life of American Planning,” 3.
\item \textsuperscript{26} Ibid., 143.
\end{itemize}
\end{footnotesize}
urban renewal (particularly large scale highways located in dense residential neighborhoods) are recognized today as some of the most detrimental aspects of the urban environment in terms of urban health.

The 1960’s saw the beginning of the environmental justice and the community health center movements. The environmental justice movement sought to address what was considered “environmental racism”, or the systematic targeting of low-income communities of color for unwanted land uses that had the worst environmental and health impacts such as landfills, industrial uses, and congested highways. Community health centers were established to meet the desperate need for health care in inner-city neighborhoods. Both of these movements attempted to address glaring health disparities, which still exist today. The role of the planning field in addressing these disparities is an important topic of investigation that has gained attention recently.

**Recent Reunification of the Fields**

Over the last few decades, in reaction to old and new health epidemics, global and national initiatives have begun to recognize the need to reconnect the fields of urban planning and public health. In the 1990’s, following the environmental justice movement, health professionals returned to a consideration of the environmental causes of disease like pollution, hazardous waste, and the deterioration of buildings, the same concerns that the sanitarians had one hundred years ago. A “New Public Health” movement also emerged with a broader consideration of the social determinants of health. By 1999, the WHO’s Health Cities Project was focused on the impact of behavior, health delivery, and inter-agency coordination to take a preventive approach to health that included issues of the built environment. The WHO’s 1999 report highlighted the aspects of urban environments that support health, including ecology, sustainability, social networks, transportation, and housing.  

What was missing at the turn of the 21st century was a parallel movement in the planning field

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toward what public health professionals had already recognized as a pressing need for collaboration. Planning had begun to deal with environmental issues again through the lens of sustainability, but without a direct focus on health.\textsuperscript{28} This missing link is what today’s researchers and designers are beginning to understand and address. Over the last ten years, the literature in both the planning and public health fields has become more sophisticated about the observed relationships between the physical, natural, and social environments and health.

It is interesting to compare the urban health landscapes today and one hundred years ago. Environmental concerns remain central, and while today’s pollution stems most directly from automobiles, early 20\textsuperscript{th} century cities were also dealing with pollution from industry. Another similarity is the issue of the quality and condition of housing and other buildings. The first planners were concerned with what have now been termed “sick buildings” and tenement housing. Sick buildings create unsafe indoor conditions when hazardous materials are contained within the buildings. Today, an aging building stock in many US cities creates unhealthy conditions for residents. The WHO also notes the shift in the public health field since the mid-20\textsuperscript{th} century from medical causes of disease to social ones. This is an interesting comparison to draw since the public health field actually began with a more socially-oriented understanding of disease. Both public health and planning are returning to their roots in the Sanitary and Garden City movements. And finally, while this topic is outside the scope of this thesis, it is important to mention that rapid urbanization is a phenomenon being faced by many developing countries, and concerns about sanitation and infectious disease are still relevant today.

Scholars also point out differences between today’s planning and public health fields and those of the late 19\textsuperscript{th} and early 20\textsuperscript{th} centuries. The most obvious difference is in the type of health epidemics that face urban populations today. While infectious disease is no longer a major problem in developed countries, chronic disease is widespread.\textsuperscript{29} Today’s health epidemics include

\textsuperscript{28} Hebert, “A City in Good Shape,” 433.
\textsuperscript{29} Infectious diseases such as HIV/AIDS and SARS still exist, but the public health profession is now geared more toward addressing chronic disease.
diabetes, heart disease, obesity, asthma, and mental illness. A second difference is that the role of government in shaping the urban environment has grown tremendously over the last century. Today, the public sector is involved in almost all aspects of city form through regulations, zoning, public spending, etc. Finally, as has already been noted, while planning and public health professionals were arguably one and the same in the 19th century, today the fields have become so separated that there is rarely collaboration among these experts. Scholars and professionals on both sides call for a reunification of their disciplines to address the pressing health concerns of today.

Campanella writes: “[Planning] has been largely unsuccessful over the last half century at its own game: bringing about more just, sustainable, healthful, efficient, and beautiful cities and urban regions.” This sentiment reflects not only the importance of health in the overall field of urban planning, but also the failure of the field to adequately address health issues. Dowell Myers and Tridib Banerjee propose a mission statement for planners: “Design solutions, forge agreements about urban futures, and inspire collective visions for a good and just society.” What has become clear over the last two decades is that these visions of a just society must include health equity and the elimination of health disparities.

Chapter Two
The Relationships Between Urban Environment and Urban Health

Overview

Over the last two decades, the volume of literature on the relationships between the urban environment and health has grown tremendously. The topic is very broad, and most articles and books that attempt to address it comprehensively organize the relationships into categories. In their 2002 article, for example, David Vlahov and Sandro Galea divide their investigation into three sections: the social aspects of urban health, the physical aspects of the urban environment, and access to health and social services.1 Northridge et al. explain that the relationships between urban environment and health can be understood in terms of the natural environment, macro-social factors, and inequalities.2 And in its 1999 report, the World Health Organization discuss three theories that connect urban planning with health: social justice theory, which deals with issues of housing, education, and safety; political-economic theory, including history, age, class, race, sexuality, and gender; and environmental theory, which is about the physical and social constructs of communities.3

Another way in which this topic is broken down in the literature is through a discussion of various scales. In their 2005 article, Galea and Vlahov present three possible scales of investigation: comparing rural conditions to urban conditions, comparing cities, and examining interurban

variations within a single city.\(^4\) This thesis will examine the third scale of a single city, New York City. Another way in which to think about scale is provided by Laura Jackson who outlines that studies can look at the smallest scale of buildings and grounds, a step higher in neighborhoods, and then at the largest scale with towns or even regions.\(^5\) This thesis will examine the second scale of neighborhoods.

It is clear that there is a wide range of ways in which the topic of urban environment and health can be researched and understood. The level of detail and the scope of a study determine a lot about how specific observed associations can be, how generalizable the findings are, and how useful they will be in terms of informing policy or design. While Chapters Three, Four, and Five will deal specifically with the urban environmental conditions that relate to obesity and physical inactivity, this chapter will provide the foundation for understanding these conditions within the broader context of the existing literature.

**Urban Health**

It is important to note a key distinction in terminology at the outset. Within the larger field of public health, this thesis deals specifically with urban health. Galea and Vlahov define urban health as “the explicit investigation of the relation between the urban context and population distribution of health and disease.”\(^6\) The urban context is important to this definition as it limits the health discussion to aspects of population health that are affected by the environment of cities. There are many other components of public health, including epidemiology, health services, and health economics, but these topics will not be addressed here.

\(^6\) Galea and Vlahov, “Urban Health,” 340.
**Four Lenses**

This chapter will explore the many relationships between the urban environment and urban health through four lenses. The *physical environment* refers to the built form of cities, including housing, transportation, open space, and streets. The *natural environment* includes landscape amenities, climate, air pollution, and hazardous waste. The *social environment* refers to the socioeconomic conditions that affect health, including poverty, social capital, and access to health care. The fourth and final lens combines aspects of the previous three that are understood spatially, including access to healthy food and geographic disparities in the other aspects of the urban environment. It should be noted that these lenses are not completely distinct from each other and that many of the relationships described in this chapter fall under more than one lens. The conditions of the urban environment that affect urban health are so complex and interrelated that it is impossible to separate and isolate them. However, these categories provide an organizational framework.

**To Be Avoided**

It is important to avoid sweeping prejudices that have become prominent in the discussion of urban health over the last few decades. There are many prevailing beliefs about the negative health effects of the suburbs since they are associated with car dependence, sprawling parking lots, and a lack of pedestrian amenities. Indeed, many of the relationships explored in this chapter have two sides, and research studies can produce varying results depending on the measurements, scale, and scope of the work. It is also important to avoid broad generalizations about the relative health of cities. New York City, which has been deemed by multiple sources to have a relatively healthy population as well as innovative policies that address health concerns, is still home to some of the worst health epidemics in the country and even worse health disparities among neighborhoods. Finally, it is important to avoid considering any of the following relationships in a vacuum. As stated above, these relationships are interconnected, and only when they are understood together can they shed light on the role of urban planning and design to improve the health of urban populations.
**Physical Environment**

There are many aspects of the physical environment of cities that have associations with urban health. They include housing, transportation, land use, streets, and open space. Most of these aspects of the environment relate to physical activity and therefore to health epidemics like obesity and diabetes. The built environment can also have effects on conditions like asthma, mental illnesses including depression, and child development.

**Housing**

Housing affects health in many ways. So many associations have been made, and many of them studied in depth, that an entire thesis could be dedicated to this topic. James Krieger and Donna Higgins wrote an article in 2002 outlining the many connections between housing and health as part of a call for more public health action in this area. They explain: “Features of substandard housing, including lack of safe drinking water, absence of hot water for washing, ineffective waste disposal, intrusion by disease vectors (e.g., insects and rats) and inadequate food storage have long been identified as contributing to the spread of infections diseases.”

Even though the public health field has moved in general from a focus on infectious to disease to one on chronic disease over the last several decades, infectious diseases still affect urban populations. Not only do the physical attributes of housing contribute to infectious disease, but overcrowding is also associated with the transmission of diseases like tuberculosis, just as it was over one hundred years ago.

Chronic diseases like asthma are also an issue in the realm of housing. Drainage problems, building structural problems, and leaky roofs are all associated with higher risk of respiratory health issues. Housing that is damp, cold, or moldy can lead to higher asthma rates. And poor quality housing can increase exposure to hazardous materials such as lead, carbon monoxide, and asbestos.

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9 Krieger and Higgins, “Housing and Health,” 759.
Pest infestations such as cockroaches and mice have also been associated with higher asthma rates, particularly among children.\textsuperscript{10} Finally, as a demonstration of how the physical, natural, and social environments cannot be fully separated, housing quality relates directly to the availability and accessibility of affordable housing in cities. The location of housing in relation to places of work, schools, open space, transportation, healthy food, etc. are all important components of health and well-being. The issue of housing is thus a strongly physical, social, and spatial determinant of health.

**Transportation**

Transportation is another element of the urban physical environment that is closely related to urban health. Walking or biking as a regular means of transportation makes physical activity part of daily life, and people who commute in these ways generally have lower rates of obesity. Access to public transportation is often cited as an important component of a neighborhood’s walkability. And modes of transportation that limit the use of automobiles are considered beneficial to health both because they increase levels of physical activity but also because they reduce air pollution from car emissions.\textsuperscript{11}

**Land Use**

Higher density and mixed land use also contribute to a neighborhood’s walkability and thus to levels of physical activity and better health.\textsuperscript{12} Having access to more diverse uses by foot means that people will be more likely to travel to work, to shop, or to recreate on foot rather than using their car. Land use decisions also affect where particular important resources are located. Especially relevant to urban health are where fresh food outlets are located, such as supermarkets and grocery

\begin{itemize}
\item \textsuperscript{11} L. J. Duhl and Sanchez, “Healthy Cities and the City Planning Process.”
\end{itemize}
stores. The location of fast food and other unhealthy food outlets have also been tied to obesity and diabetes, particularly around schools. Similarly, access to health care services, whether they are delivered at hospitals, in private physician offices, or in neighborhood clinics, is key to both preventing and managing disease.

Parks and Open Space

Frederick Law Olmsted was one of the first landscape architects to write about the mental health benefits of visual and physical access to parks and open space. It has been found that parks and gardens have restorative effects on health and that they can alleviate conditions like depression. Parks and open space can also contribute to higher levels of physical activity when they encourage exercise and outdoor recreation. Trees and other vegetation can help to mitigate the negative impacts of air pollution. Trees also provide shade, which can make urban environments more comfortable for pedestrians.

Urban Design

Urban design has the potential to contribute to the urban health of a neighborhood through street and block design. Block sizes and the massing of buildings determine to a large extent the quality of the experience on the street. Small block sizes combined with frequent, safe intersections increase the walkability of a neighborhood by making it more comfortable to travel on foot. Superblocks with single land uses discourage pedestrian activity. The design of a public space can determine whether it is widely used and successful or vacant and unsafe. Vacancy and abandonment in general are detrimental to neighborhood safety and can discourage walking. There are also associations between vacancy and rates of violence in communities, which can contribute to the discomfort that pedestrians feel when walking in areas with a lot of vacant lots.

13 Northridge, Sclar, and Biswas, “Sorting Out the Connections Between the Built Environment and Health,” 565.
Streetscape design can also make an urban environment more walkable. The existence of sidewalks even on busy streets provides pedestrians with a place to walk safely to nearby activities. Sidewalks also need to be wide enough to be accessible. Enjoyable scenery including attractive building facades, street trees, and public spaces can enhance the walking experience and encourage more pedestrians to travel on foot. Street lighting and crime rates affect the perceived level of safety and thus the walkability of a neighborhood. Furthermore, elderly and disabled populations require a more specialized level of physical access to the streets, which involves decisions about street geometry, building materials, and visibility.

Pedestrian and bicyclist safety is another important aspect of urban design that greatly affects the levels of physical activity that are possible in a neighborhood. High traffic volumes and high rates of traffic accidents pose threats to pedestrians and bicyclists. Design interventions such as crosswalks and traffic calming measures can limit automobile speeds and increase safety. Restricting road widths so that they are crossable in a safe and comfortable manner, and creating designated pedestrian and bicycle paths where necessary can make neighborhoods safer and more walkable, increasing physical activity levels.\textsuperscript{15}

Other components of the physical environment that planners and designers need to take into account are visibility issues, shadows, wind tunnels, and topography. Each of these requires consideration when designing a walkable neighborhood that attracts pedestrians and encourages physical activity. The actual capacity for urban design to affect urban health will be addressed more specifically in Chapter Three.

**Natural Environment**

In the public health and urban planning literature, the health condition that is most closely correlated with natural environment conditions is asthma. Asthma is a chronic disease that is triggered by a wide range of environmental factors including air pollution and hazardous

substances. The severity of the disease ranges widely, but the number of people diagnosed with asthma in the United States is on the rise.

Air Pollution

One of the most straightforward associations between the natural environment and health is air pollution. Air pollution, especially high levels of carbon dioxide, has been linked to asthma-related deaths. One of the primary causes of air pollution is traffic congestion. People who live near highways typically have higher rates of asthma due to high levels of congestion and automobile emissions. According to Richard Jackson and Chris Kochtitzy, motor vehicle traffic is the main source of ground-level urban concentrations of air pollutants. These pollutants have recognized hazardous properties that negatively impact the health of urban residents. Road congestion not only has environmental effects but can also cause stress and raise levels of aggression in drivers. Automobile-related crashes and fatalities have been linked to congested roadways.

Industrial Uses and Hazardous Waste

Other sources of negative environmental health impacts are industrial and hazardous waste facilities. Patterns of urban development have revolved around the location of industrial land uses for decades, and the repercussions of these patterns can still be seen today. Property values are lower in areas where industrial uses either still exist or have left brownfields and historically poor environmental conditions. Hazardous waste facilities have rather obvious health impacts on surrounding communities. Garbage removal, sanitation services, and the location of waste landfill sites are still issues that local and national governments need to address in order to mitigate the health impacts. As was the case during the environmental justice movement of the 1960s and 1970s, the policy decisions related to industrial and hazardous waste facilities is an extremely political
issue and one that can contribute to greater health disparities when disadvantaged communities are targeted for these unwanted uses.

Some other environmental issues that have been cited in the literature are urban heat sink and impervious surfaces. Urban heat sink, which negatively impacts health, can be mitigated through the planting of trees and other vegetation. Impervious surfaces interrupt the natural processes of streams, wetlands, and estuarine ecological conditions. They also affect storm water systems and contribute to water pollution. Parks and stormwater management strategies can decrease the amount of impervious surface in cities, alleviating the negative health impacts of pollution.

Social Environment

According to the World Health Organization, while the relationships between the physical and natural environment and urban health are important, it is actually the social and economic conditions of cities that are the primary determinants of health. This statement calls into question the actual role of planners and urban designers in affecting urban health through built and natural form. What will become clear, however, is that an understanding of the spatial aspects of socioeconomic conditions, as well as how they are related to the physical and natural environment, is crucial for a comprehensive understanding of urban health.

In their article “Urban Planning and Health Equity”, Northridge and Freeman write: “As was the case during the Progressive Era (ca. 1890-1920), the social determinants of health and urban planning are again coming to the fore as a framework and a mode for reducing health inequities in urban settings.” It is clear from this quote, and from the history outlined in Chapter One, that the social environment of cities plays a key role in urban health and that in order to fully address

22 L. J. Duhl and Sanchez, “Healthy Cities and the City Planning Process,” 1.
23 Northridge and Freeman, “Urban Planning and Health Equity,” 582.
urban health problems, social factors need to be taken into account. The social environment of cities includes a broad range of factors: “… occupational structure, labor markets, social and economic processes, wealth, social, human and health services, power relations, government, race relations, social inequality, cultural practices, the arts, religious institutions and practices, and beliefs about place and community.”24 The social determinants of health that are most prevalent in the public health and planning literature are socioeconomic status (including income, education, employment), social capital, and access to health care.

**Socioeconomic Status**

Socioeconomic status includes a combination of factors that are related to health. Populations with lower median income or a greater percentage of people below the poverty line tend to have poorer health behaviors and health outcomes. Levels of education are linked to employment and occupation opportunities, which are related to health as well. The impact of work on health includes issues of the actual environment of the workplace such as air quality, hazardous conditions, and injuries. Unemployment and job insecurity also affect the wealth of populations and directly affect their access to health insurance and quality health care. Socioeconomic status has also been found to limit the benefits of other interventions in the physical and natural environment that might positively affect health outcomes. In New York City, for example, it was found that walkable neighborhoods, often associated with increased physical activity and lower obesity rates, were not closely associated with these benefits if the neighborhoods were also low-income.25 This study and others in New York City will be further explored in Chapter Three.

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24 Galea and Vlahov, “Urban Health,” 347.
Social Capital

Social capital is a determinant of health that is less tangible but still researched in the literature. Social capital includes social resources and connectedness and has been associated with lower mortality rates. Neighborhoods with strong social cohesion have been associated with reduced rates of violent crime and increases in self-reported health. On the opposite end of the spectrum, what researchers call social strain can be detrimental to mental health and have repercussions on the social cohesion of a neighborhood. Social strain may be the result of disadvantage, crime, violence, and high-risk behaviors such as alcohol and drug abuse.

Social exclusion can also limit upward social mobility. One of the WHO’s ten areas of social determinants of health is preventing people from long-term disadvantage. Indeed, concentrated poverty and neighborhoods that have long been associated with lower socioeconomic status tend to have stronger, longer-lasting associations with poor health. The concept of social capital is not new to urban planning. Jane Jacobs wrote about the importance of contact among residents and the concept of “eyes on the street”. According to Jacobs, this social cohesion led to reduced street crime and greater happiness. The aspects of the urban environment that can be addressed by planners, including safety and public space, are ones that need to be revisited through the lens of urban health impacts.

Health Care

Another very important relationship between the social environment and urban health is access to health insurance, health services, and quality primary care. The Patient Protection and Affordable Care Act (ACA) has brought this issue to the forefront of the public health field, particularly for the millions of people in the United States who have been and will be affected. The ACA has sparked discussion in all sectors of the health world because of the challenges that

27 Galea and Vlahov, “Urban Health,” 348.
it presents to health care providers and the newly insured. While receiving health insurance will provide great benefit to millions of Americans, the health care system lacks the capacity to properly care for the newly insured. The health care sector is facing major issues related to workforce development and facility infrastructure. The new demand for affordable, quality health care raises questions of not only who will administer this care but also where it will be administered and in what types of facilities. Planners and designers have a role to play in this discussion.

**Spatial Relationships**

A fourth lens combines aspects of the previous three and deals specifically with the spatial qualities and implications of the abovementioned relationships. Issues of access and proximity, whether to health care, healthy food, or open space are spatial in nature. The spatial distribution of urban populations is considered to be related to urban health. Residential segregation, social inequality, and geographic disparities of urban environment resources and conditions can also be understood through a spatial lens.

**Access to Food and Health Care**

Access to food is an important topic for planners and health professionals alike. It is debated whether it is more meaningful to study the relationship between health and access to healthy food or access to unhealthy food. In either case, there is a spatial argument to be made. The term “food desert” began in the United Kingdom in 1990 and has since been adopted by health professionals in the United States to refer to areas with little or no access to large grocery stores that offer fresh and affordable foods that support a balanced diet. There is strong evidence that diet and eating behaviors directly impact health conditions like obesity and diabetes. Planners are also interested in this issue because it can be addressed through land use decisions and regulations which can affect the location of food outlets, the types that are permitted, and the opportunities for bringing local micro-agriculture (such as farmers markets and community gardens) to urban areas. What is becoming increasingly clear is that food deserts are not just about the distance that residents have
to travel to access healthy food, but also about income levels, food costs, and the opportunity costs associated with travel to food outlets. The concept of “access” to any of the abovementioned resources in the urban environment has multiple layers, none of which can be examined independently.

Just as there are now designated food deserts around the country, there are also federally designated “Medically Underserved Areas/Populations”, or MUA/MUPs. These areas have too few primary care providers, high infant mortality, high poverty and/or a high elderly population. There are also Health Professional Shortage Areas (HPSAs), which have shortages of primary medical care, dental, or mental health providers. These areas add a spatial component to the health care access issue described above. The questions raised for planners and designers are how to locate new health providers to reach underserved populations as well as how to improve financial access to health care.

**Population Density**

Population density is another interesting spatial aspect of the urban environment that has observed relationships with health. There have been different understandings of the role of density in urban health. Infectious diseases such as tuberculosis were spread more easily in high-density environments one hundred years ago, and the same concerns around infectious disease exist today. Planners in Olmsted’s day argued in favor of the suburban conditions in which people were protected from the pollution, noise and overcrowding of inner cities. Suburbs have since been condemned as relatively unhealthy environments. Dependence on automobiles, suburban sprawl,

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29 The role of the cost of food in overall food access is a very important topic that is not addressed in this thesis. The research required to determine the actual relationship between food cost, healthy eating behavior, and health outcomes is out of the scope of this study. However, it is clear that any conclusions drawn about proximity to healthy food need to be adjusted when food costs are taken into account.


31 Financial access includes the actual cost of care as well as issues of health insurance coverage and the inability of undocumented immigrants to seek medical help for fear of the repercussions.
and the lack of pedestrian amenities are considered to be tied to high levels of physical inactivity and obesity. There are certain diseases that researchers believe are directly related to higher density. Still other researchers argue that low-density environments can have a negative impact on social cohesion and the ecology of an area when valuable environmental resources are consumed for new developments. As was mentioned at the beginning of this chapter, it is important to avoid broad generalizations about suburbia and instead study the direct relationships between population density and health. As with any of the relationships studied in this chapter, one of the biggest questions raised is whether low-density conditions make people unhealthy in certain ways (physical inactivity, etc.), or whether people who have poor health are attracted to low-density conditions.

**Residential Segregation**

Residential segregation is a component of the social environment, but it deserves a second look because it is spatial. While poverty and low income are determinants of health, it is concentrated, long-term poverty that many researchers are now studying as a major determinant of health. When residential neighborhoods are segregated, resources and social networks are restricted over a whole neighborhood, limiting diversity and social mobility for low-income populations. It is generally understood that demographic diversity is good for the social status of a community and can increase the level of political participation and community engagement. At the same time, there are also scholars who argue that ethnic enclaves produce strong family ties and can be highly beneficial. Within this debate, what is clear is that racial residential segregation often leads to racial disparities in health.

Furthermore, long-term disadvantage is much more detrimental and challenging to address, especially when this disadvantage has been systemic and institutionalized. In the United States, where wealth is largely associated with homeownership, institutional policies that have shaped the homeownership landscape throughout the country have largely dictated the level to which

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neighborhoods are segregated, and these historic inequities are still evident today. Though the Civil Rights movement made discriminatory housing policies illegal, racial discrimination still persists, and it is necessary to consider discrimination and segregation in the context of health. Segregation creates inequities in income, access to resources like schools and health care, and access to low-skill, high-paying jobs. Over time, the results have been declining urban infrastructure, deteriorating physical environment, and stagnated social mobility.

**Geographic Disparities**

Finally, many researchers have written about inequality as a determinant of health in and of itself. Inequality, whether in socioeconomic status, access to resources, or quality of physical and natural environment, disproportionately affects vulnerable populations including immigrants, the homeless, and the formerly incarcerated. The very existence of disparities in any of the conditions discussed above has been linked to poorer health. Inequality in terms of economic opportunity and political power have large effects on the level of political voice that a community can use to gain access to necessary policy interventions, city services, and other improvements to health conditions. Inequality and disparities among neighborhoods also create situations in which people with better resources are able to purchase better and more healthful urban environments, thus leaving the worst health conditions for those that cannot afford to live elsewhere.

In his article, “Urban Planning and Health Disparities: Implications for Research and Practice,” Jason Corburn explains the historical and systemic nature of disparities in US cities. When zoning was introduced as a way to separate toxic industrial uses from residential areas, poor populations were not as well protected from the unhealthy conditions of industrializing cities and communities.

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34 Part of this inequality is the documented targeting of poor minority communities by the tobacco and alcohol industries. Northridge and Freeman, “Urban Planning and Health Equity,” 590; Williams and Collins, “Racial Residential Segregation,” 410.
35 Northridge and Freeman, “Urban Planning and Health Equity,” 591.
often lived in the least expensive housing stock within close proximity to the hazardous land uses. In the era of urban renewal, not only were neighborhoods demolished to make way for a new network of highways, but the houses that remained were also in close proximity to congested roadways and air pollution. Even today, the location of environmentally noxious facilities is a very political decision in which neighborhoods that have greater political clout are able to keep hazardous land uses out.\textsuperscript{36}

Not only do geographic disparities exist in US cities, but they have also been growing tremendously since the 1970s.\textsuperscript{37} The US Department of Health and Human Services has been attempting to address health disparities for at least the past two decades. Healthy People 2020\textsuperscript{38} calls for the elimination of health disparities, but there is a great lack of understanding of the actual causes of these disparities or the interventions that can successfully address them.

**Current Limitations**

While the literature discussed in this chapter has begun to address the relationships between the urban environment and urban health, there are some limitations to the research that has been conducted thus far. One of the most crucial limitations is that most if not all of the research in this area has not been able to prove causation in these relationships.\textsuperscript{39} For example, as Northridge et al. explain, the direct, causal relationships between aspects of the built environment and the level of physical activity of city residents have not been proven.\textsuperscript{40} Despite the lack of scientific proof of causality, a combination of evidence-based practice and an application of what we understand about the determinants of health allows for an understanding of a less rigorous concept of association.

\begin{flushleft}
\textsuperscript{36} Corburn, “Urban Planning and Health Disparities: Implications for Research and Practice,” 111.
\textsuperscript{37} Ibid., 113–114.
\textsuperscript{39} Galea and Vlahov, “Urban Health,” 354; Northridge and Freeman, “Urban Planning and Health Equity,” 587.
\textsuperscript{40} Northridge and Freeman, “Urban Planning and Health Equity,” 587.
\end{flushleft}
The effects of air pollution and indoor air quality on the rate of respiratory diseases such as asthma, for example, can clearly be understood. And associations between environments that promote and encourage physical activity and lower rates of obesity have been observed and to some extent accepted.

There are also some conditions of the urban environment that are less directly related to urban health than others. Williams and Collins explain that there are basic causes of health problems as well as proximate ones. Basic causes directly affect health outcomes. Proximate causes, on the other hand, are related to health outcomes, but “changes in these factors do not lead to changes in the relevant outcomes.” Williams and Collins make this distinction to encourage researchers and practitioners to look at both basic and proximate causes in their work to address health disparities.

Another limitation of the literature thus far is the lack of valid and reliable indicators of the urban environment. Any of the topics addressed in this chapter can be measured in many different ways. Air quality, for example, might be measured as the number of days in a year in which the Air Quality Index was at an unhealthy level. A different air quality measurement might be the level of particulate matter measured by a monitoring station. Coupled with the wide range of possible ways to measure urban environments is the lack of consistent measurement over time that can actually indicate trends and evaluate policies and design decisions based on how urban environment conditions have improved or worsened. Some cities conduct this measurement and analysis better than others, and there are national indicators that are meant to serve as a framework for state and local governments. Chapter Three will discuss some of the indicators and methodologies related to physical activity and obesity in more depth.

Because of this lack of reliable indicators, there is also a tendency in the planning and urban design professions to create generalized guidelines that are based loosely on evidence and have little direct applicability to specific neighborhoods. Many of the national-level websites, tools, and resources are extremely broad and thus unusable by any local entity, whether it is a public

42 Northridge, Sclar, and Biswas, “Sorting Out the Connections Between the Built Environment and Health,” 563.
agency or a private firm. There is a great need to study the specific relationships between the urban environment and urban health in each neighborhood or city context, as these relationships and the relative importance of them vary tremendously depending on the US city under question.43

The planning and public health fields also face the challenge of the lack of a shared vocabulary to completely engage with each other on these issues. Not only are indicators of health and the environment not agreed upon, but one type of measurement might be appropriate for a public health study and irrelevant for planners and designers trying to respond to the study. Data is collected and understood in very different ways. While public health professionals tend to look for statistical significance in actual measurements of behavior and disease, planners collect data through tools like plans, drawings, field observations, and mapping. In very few cities are public health and planning agencies at the same table or discussion. New York City is an exception, and the collaboration among departments will be discussed further in Chapter Four.

Finally, it is important to recognize that a change to the urban environment that is meant to address one health concern may simultaneously worsen another health concern. For example, creating more pedestrian access by building sidewalks and crosswalks in a neighborhood may increase levels of physical activity in an attempt to address health issues of obesity and diabetes. However, if these sidewalks are located close to high levels of automobile traffic or highways, the exposure to air pollution and the risk of asthma and other respiratory diseases actually increases. Thus, none of the relationships listed above can be looked at in a vacuum, and the challenge for planners and designers today is to take as many components of the urban environment into account at once. Chapter Five will provide a potential methodology for combining disparate data sources together into a single study.

**Tools and Strategies**

Different tools are available to planners that can impact elements of the urban environment

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43 The Spring 2013 Health and Urbanism workshop from MIT’s Center for Advanced Urbanism found that the seven cities being studied have different urban health stories and varying possibilities for urban design intervention.
and thus impact health outcomes and disparities. Zoning and land use regulations are the most common tools used. Transportation policies can encourage and incentivize people to use transit rather than their cars. Economic development strategies can target the socioeconomic determinants of health and help to lessen health disparities among neighborhoods. Many local governments and the federal government also institute air pollution goals and regulations that can help to mitigate the negative health impacts of pollution.  

Other tools available to planners and urban designers are design guidelines that outline best practices for the design of various aspects of the built environment. In New York City, the Active Design Guidelines is one of many manuals for design that are shared with both city agencies and professionals in architecture and urban design. Increasingly, the health impacts of these guidelines are being recognized and highlighted. The creation and communication of these guidelines is an important opportunity to explain the potential connections between design decisions and the health of urban populations.

In terms of addressing health disparities and being able to target policies and design changes to the areas of a city that have the highest need (worst health problems, lowest income, etc.), Geographic Information Systems (GIS) is becoming a more popular tool to visualize data and inform decisions. Community visioning exercises are also incredibly valuable for the planning process. Mapping also provides a way for data that is not inherently spatial to be understood in a spatial way, particularly in terms of the geographic disparities among neighborhoods. Even the social determinants of health, described as the most important, can be analyzed through mapping in order to inform where policy and design should be implemented to serve those with the greatest disadvantage. Chapters Four and Five will explore the implementation and effectiveness of some of these tools in New York City, as well as the use of GIS as a tool to better understand the above-mentioned relationships and how urban health issues can be better addressed.

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Chapter Three
Measurements of Obesity and the Urban Environment

Overview

The relationships between the urban environment and urban health have been explored broadly in the previous chapter. The focus of the remainder of this thesis will be on one particular health epidemic: obesity. This urban health issue is important for several reasons. First, it is a widely common condition (35.7% of the adult population in the United States is obese). Second, it is a very serious condition that is linked to health disease, stroke, type 2 diabetes, and certain types of cancer. Third, it is costly; the CDC estimates that in 2008 medical costs were $1,429 higher for people who are obese than for those of normal weight. Finally, there are great disparities in the obesity epidemic. Non-Hispanic black Americans have the highest rate of obesity at 49.5%, all Hispanics have a rate of 39.1% and non-Hispanic whites have a rate of 34.3%. Not only is obesity one of the worst epidemics in the United States, but New York City is also facing the challenge of an increasingly obese population and is developing policies and design guidelines to address this issue.

National Measurements

Two of the root causes of obesity are physical inactivity and an unhealthy diet. In order to understand how planners and urban designers might be able to help combat the obesity epidemic, it is necessary to understand the ways in which obesity, physical activity, and eating behavior are measured. It is similarly important to review the ways in which the urban environment affects physical activity and healthy eating (as described in Chapter Two) and the ways in which these conditions are measured. As mentioned previously, one of the greatest limitations to the

reconnection of the urban planning and public health fields is the lack of shared, reliable indicators for these conditions. A review of the current research is helpful to better understand this limitation and how new indicators might be developed.

Obesity and physical activity are perhaps the most straightforward in terms of measurement. Obesity is typically measured based on body mass index (BMI). BMI is calculated from the weight and height of an individual. A BMI between 25 and 29.9 is classified as overweight and a BMI of 30 or greater is classified as obese. It is more difficult to measure physical activity as objectively as obesity, but there are national standards set by the US Department of Health and Human Services. According to these federal standards, adults should engage in at least 150 minutes of moderate physical activity (such as brisk walking) per week. One minute of vigorous physical activity (such as running) counts for two minutes of moderate activity.

The National Center for Health Statistics, the Robert Wood Johnson Foundation, and the US DHHS have created other indicators of health and the urban environment. While these indicators are generally less specific, they do provide a baseline for comparison among states, counties, and cities. The chart on Page 43 illustrates some of the indicators from the Health Indicators Warehouse, County Health Rankings, and Health People 2020. There are some similar trends in these indicators. Transportation, food access, safety, and access to open space for recreation are recurring themes. Physical activity and obesity are also regularly measured across these sets of indicators.

**Local Measurements**

Cities around the country have developed their own indicators and adapted the national ones to more directly measure their urban environments. An article in the American Journal of

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### Health Indicators Warehouse

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>% of population that walk, bike, or take mass transit for transportation to work</td>
</tr>
<tr>
<td>Healthy food access</td>
<td>% of zip codes that have a healthy food outlet (grocery store or produce stand/farmers’ market)</td>
</tr>
<tr>
<td>Access to school athletic facilities</td>
<td>% of public and private schools that make their facilities available for community groups outside of school hours</td>
</tr>
<tr>
<td>Community safety</td>
<td>Homicide mortality rate, per 100,000</td>
</tr>
<tr>
<td>Food insecurity</td>
<td>% of households with low food security</td>
</tr>
<tr>
<td>Few fruits/vegetables</td>
<td>% of adults that report fewer than 5 servings of fruit/vegetables per day</td>
</tr>
<tr>
<td>Aerobic physical activity</td>
<td>% of adults who engage in moderate physical activity for at least 150 minutes/week, or in vigorous activity for at least 75 minutes/week</td>
</tr>
<tr>
<td>No exercise</td>
<td>% of adults that report no exercise in the past month</td>
</tr>
</tbody>
</table>

### County Health Rankings

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commuting alone</td>
<td>% of the workforce that drives alone to work</td>
</tr>
<tr>
<td>Access to parks</td>
<td>% of population living within half a mile of a park or other outdoor space where opportunities for physical fitness exist</td>
</tr>
<tr>
<td>Limited access to healthy foods</td>
<td>% of population who are low-income and who do not live close to a grocery store or supermarket that sell fresh fruits and vegetables</td>
</tr>
<tr>
<td>Fast food restaurants</td>
<td>% of all restaurants that are fast-food establishments</td>
</tr>
<tr>
<td>Access to recreational facilities</td>
<td>Rate of recreational facilities per 100,000 population</td>
</tr>
<tr>
<td>Violent crime rate</td>
<td>Violent crime rate per 100,000 population</td>
</tr>
<tr>
<td>Adult obesity</td>
<td>% of adults that report a body mass index (BMI) &gt;= 30</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>% of adults aged 20 and over reporting no leisure time (while not at work) physical activity</td>
</tr>
</tbody>
</table>

### Healthy People 2020

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>% of trips to work made by walking, bicycling, or mass transit</td>
</tr>
<tr>
<td>Obesity</td>
<td>Proportion of adults and children who are obese</td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>Mean daily intake by persons aged 2 and over</td>
</tr>
<tr>
<td>Physical activity</td>
<td>% of adults engaged in no leisure-time physical activity</td>
</tr>
<tr>
<td>Aerobic physical activity</td>
<td>Federal guidelines (see Health Indicators Warehouse)</td>
</tr>
<tr>
<td>Access to school athletic facilities</td>
<td>% of public and private schools that make their spaces open to the public (see also HIW)</td>
</tr>
<tr>
<td>Community safety</td>
<td>Homicide rate per 100,000</td>
</tr>
</tbody>
</table>

*Table of health indicators from three national sources*
Preventive Medicine from 2009 entitled “Measuring the Built Environment for Physical Activity” provides an overview of some of these measurements. According to this article, there are three different kinds of data that can be collected about the urban environment. The first is data received through interviews or questionnaires that captures perceived measurements of the environment. Perceived measures, while they may not accurately reflect the actual measurements, are still of interest because it is important to track both how the urban environment changes, but also how people understand and respond to these changes. Furthermore, certain kinds of data such as levels of physical activity are most easily captured through self-reporting. A second type of data is observational data that is retrieved through audits. This type of data is more directly measured but also involves the most work to collect. The third type of data is data that can be used in Geographic Information Systems (GIS). City governments have highly varying amounts of GIS data available. New York City is one of the leaders in data collection and in making data available to the public.

Most of the evidence that researchers point to when discussing the relationships between the urban environment and urban health is derived from self-reported data and perceived measures of the environment, the first type of data. In general, this evidence shows a positive association between increased physical activity and a combination of environmental factors such as presence of recreational facilities, sidewalks, shops and services, and safety from traffic. As is the case with the self-reporting of levels of physical activity, any kind of perceived measurement is not captured objectively, however surveys are used for nation-wide studies such as the County Health Rankings as well as by local governments. In New York City, the Community Health Survey is a cross-sectional survey that samples approximately 10,000 adults aged 18 and older in all five boroughs of New York City. A computer-assisted telephone interviewing system is used to collect survey data, and interviews are conducted in a variety of different languages. All of the data collected are self-report data.

6 Ibid.
The second type of data, data through audits, is the most difficult to collect. While city governments may not have the resources to conduct comprehensive audits of neighborhoods to determine their walkability, for example, entities like academic research groups are able to dedicate resources to thoroughly measure and quantify the urban environment. The Built Environment and Health Research Group (BEH) at Columbia University is a good example, and some of their studies will be discussed later in this chapter.

The third type of data is the one on which this thesis focuses most directly. GIS is a valuable tool for visualizing existing data, but also for creating new data and analyzing new relationships spatially. As of 2009, the most frequently assessed variables in GIS were population density, land-use mix, access to recreational facilities, street pattern, and pedestrian amenities. Each of these variables has understood relationships to urban health that were explored in Chapter Two.

Density

Population density is one of the easiest variables to measure even though there are many ways to measure it. It is not only readily quantifiable, but the data required is collected nationally and locally by many different entities. Density has also been linked to higher walkability and public transportation use. The most common way to measure population density is by dividing the number of residents in a certain geography by the land area in that geography. The Census Bureau measures the population density of many different geographies, including census tracts and census blocks. Other measures of population density are the number of housing units per residential acre. Both of these measurements are for residential density and do not take into account jobs or where people work. There are density measures that deal with both, such as in Gainesville, Florida, where the number of residents and the number of jobs per area are calculated for a density measure.⁷

Land Use Mix

Land use mix is a GIS measurement that is calculated in many different ways depending on the study and on the argument that is being tested. Sometimes land use mix is calculated in order to determine a level of accessibility to commercial uses, jobs, recreational uses, etc. Other measurements try to capture land use intensity, or the diversity and vibrancy of a neighborhood. Still other measurements focus on the pattern of land use and how it is organized across neighborhoods. Each of these kinds of measurements is used to test relationships between land use mix and the level of physical activity. Some studies have looked at multiple land use mix measurements in order to determine which have the strongest associations with physical activity, but the results are inconclusive.

Accessibility measurements include the distance to specific types of destinations such as food outlets, schools, and central business districts. A study in San Francisco developed an accessibility index that included measurements of attractiveness of destinations as well as the travel time required to reach them.\(^8\) Intensity measurements include the number of types of businesses, destinations, or facilities located in an area. Higher numbers of different types of businesses reflect greater diversity and therefore greater intensity. Intensity measurements also include employment calculations. Indicators such as a jobs-to-housing ratio and the number of jobs per capita capture the density of jobs in an area. Number of employees per area is another measurement of job density that falls under the category of land use mix.

Land use mix measurements that measure patterns of land use require more complex calculations. The same San Francisco study cited above also used several indices and factors to capture land use mix patterns. Kockelman’s dissimilarity index measured the number of active hectares in each census tract and for each hectare determined the degree to which each use type differed from its neighbors. San Francisco and others have developed indices that measure the

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proportion of developed land use for six categories: residential, commercial, public, offices and research sites, industrial, and parks and recreation. Resident-to-jobs ratios and resident-to-retail/services ratios have also been used in San Francisco. In Rundle et al.’s study of New York City they measured the building area of commercial and residential uses in each census tract and calculated an index for land use mix. The use of indices and combinations of measurements is necessary to capture the complexities of land use, and the wide variety of measurements across cities is evidence of the subjectivity of these studies but also the limitations of comparison and standardization across studies and cities.

Access to Recreational Facilities

A third layer of data that is often captured with GIS is access to recreational facilities, particularly park space. Depending on the city, recreational facilities might include both public and private facilities. Access to recreational facilities can be calculated either as distance or as a proportion of land area dedicated to recreational uses. Distance is either calculated with a buffer around each park or as a distance along the actual street network, which provides a much more accurate measurement of accessibility, particularly for pedestrians. Density of recreational facilities is another measurement that captures the intensity of recreational use in an area. Numbers of recreational facilities are usually broken down by type (public/private, fee/no-fee, active/passive recreation). A third way in which access to recreational facilities can be measured, particularly using GIS, is the number of people that live within a certain distance from a facility. A buffer of ¼ or ½ of a mile can be drawn around facilities and then a calculation can be made of how many people reside in that buffer.

The easiest aspect of recreational facilities to measure is distance, but as researchers have

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continued to study this topic, it has become clear that distance alone can rarely determine the level of active use in these facilities. Giles-Corti et al. designed a study that also created a measurement of “gravity” for each public open space observed. This gravity measure took into account the attractiveness and size of each space, as well as its distance to residents, and stronger associations were found when these components were added.\textsuperscript{11}

*Street Pattern*

Street pattern is another common GIS measurement that is meant to quantify to a certain extent the design of a street network and its walkability. The understanding is that a street pattern that has more intersections has shorter blocks. Shorter blocks tend to be associated with a more pedestrian-friendly, walkable environment. And the number and directness of pedestrian routes is of particular interest. Some measurements deal directly with block size, looking at street length, block area, and block perimeter and averaging these values across block groups or census tracts. The degree to which high intersection density is actually correlated with increased physical activity is limited. In New York City, a study by the BEH group determined that there was no correlation between intersection density and body mass index.\textsuperscript{12}

*Pedestrian Amenities: Sidewalks*

There are other GIS measurements that try to quantify more directly the aspects of the built environment that might affect pedestrian access and comfort. Sidewalk coverage data, when available, is an important indicator of the amount of pedestrian access a neighborhood provides. Most of the time, sidewalk length is the level of data available. When sidewalk widths are also calculated, average sidewalk width is an indicator that is used, and overall sidewalk area can also be calculated. A study conducted in Chapel Hill, NC used sidewalk coverage measurements to


\textsuperscript{12} Rundle et al., “The Urban Built Environment and Obesity in New York City.”
calculate differences in commuting patterns. Rodriguez and Joo measured the percentage of the shortest routes to bus stops that have sidewalks. They also calculated the difference in commuting time with or without taking into account walking and cycling paths.\footnote{Daniel A. Rodriguez and Joonwon Joo, “The Relationship Between Non-motorized Mode Choice and the Local Physical Environment,” \textit{Transportation Research Part D: Transport and Environment} 9, no. 2 (March 2004): 151–173, doi:10.1016/j.trd.2003.11.001.}

\textit{Pedestrian Amenities: Safety}

Another major component of pedestrian activity is pedestrian safety. GIS measurements of safety are divided into two categories: traffic and crime. Traffic indices include measurements of mean speed and maximum speed of city streets. These speeds are calculated either using speed limits or counting daily traffic. Traffic is also quantified by the number of crashes and accidents involving pedestrians or bicyclists. Crash data is typically available only at the local level, and the accessibility of this data depends on the municipality. Streets are also often categorized by levels of busyness. Busyness might capture traffic volume but also road width.

The second measurement of safety is crime. Crime indices are measured in different ways around the country. The FBI calculates the number of crimes per 100,000 people and includes both violent and property crimes. In San Antonio, TX, the number of violent crimes is published in the local newspaper. And in Cincinnati, OH they measure the number of serious crimes per 1,000 residents per year, as well as the number of emergency police calls. When the crime data is aggregated in this way, citywide, and year-round, it is difficult to use it to create a spatial argument or to target specific policies. Point data of actual crimes, like crash data, is more useful to planners and designers in this context. New York City focuses very strongly on pedestrian safety, as will be explained in Chapter Three.

\textit{Other Measurements}

Brownson et al. go on to list several other measurements that cities around the country use to understand how the urban environment might encourage physical activity. In Minneapolis,
MN, the number of streetlights per length of road is calculated with the understanding that street lighting provides a safer walking environment for pedestrians at night. In several cities, the number of street trees is calculated, with the understanding that street trees both provide a more aesthetically pleasing and comfortable environment on the street, and can help to mitigate the negative effects of air pollution. GIS is also helpful in measuring access to public transportation and bike paths. Several cities including New York City measure the density of bus and subway stops. Distance to the nearest transit stop is also a common measurement for transit accessibility. As more and more cities install bike paths, lanes, racks, and other infrastructure, the distance to these amenities is also being measured.

The variability in the above indicators and measurements is evidence of the complexity of this topic and the lack of clarity in terms of the most appropriate way to quantify the urban environment. It is clear that the measurability of an indicator is one of the most important factors taken into account when it is chosen. Availability of data and the necessary resources to accurately measure an index in a comprehensive and consistent way is an important consideration. And as more research is conducted as to the actual relationships between place, physical activity, and obesity, new measurements and indicators will no doubt be developed. The next section will explain a new data set from the NYC Department of Health and Mental Hygiene and the research studies of the Built Environment and Health Research Group at Columbia University.

**New York City Measurements**

*Physical Activity and Transit Survey*

In 2011, DOHMH conducted the Physical Activity and Transit Survey of adult New Yorkers, which included an accelerometer component and objective measurements of physical activity levels. The results have yet to be published, but a brief was released in February 2013 with overall data. Based on a comparison with the National Health and Nutrition Examination Survey, which was conducted in 2003-2004 and 2005-2006, adult New Yorkers are three times as likely as
adults nationwide to meet physical activity recommendations. Similar finding was that “physical activity varied by race/ethnicity in New York City, where white adults were more likely to meet guidelines at 51%, compared with 25% for Blacks and 23% for Hispanics.” These disparities do not exist at the national level, which suggests that racial and ethnic disparities are perhaps more relevant to urban health in New York City than in other cities. Men are also more likely to meet the guidelines than women, and the most educated adults are approximately twice as likely to meet guidelines as the least educated adults.

Another interesting finding of the 2011 PATS was the correlation between density and physical activity levels (see map on Page 52). According to the brief, “High density areas typically also have a high concentration of stores, restaurants and other destinations, allowing residents to easily walk or take public transit to get from place to place. Even within New York City, the availability of subways and the ease of walking vary with population density, as do physical activity levels among residents.” 20% of adults in low-density zip codes met the physical activity guidelines. 31% of adults in medium density zip codes met the guidelines, and 36% of adults in high-density zip codes met them. Adult New Yorkers in high-density areas are also less likely to be inactive than adults in low-density areas.

A correlation was also found between commuting patterns and physical activity levels. In Staten Island, where 55% of the population drives to work, only 21% of adults met the physical activity guidelines. In Manhattan were 9% of the population drives to work, 40% of adults met the guidelines. These results highlight both population density and transportation factors of the urban environment that are important for physical activity and urban health in New York City.

14 The 2008 Physical Activity Guidelines for Americans from the US Department of Health and Human Services are at least 150 minutes of moderate activity (such as brisk walking) per week in durations of at least ten minutes (one minute of vigorous activity is equal to two minutes of moderate activity). People with more than 300 minutes of activity per week receive larger health benefits. US Department of Health and Human Services, “Physical Activity Guidelines,” 2008, http://www.health.gov/paguidelines/.
16 Ibid., 3.
**Built Environment: Land Use Mix, Transit, and Density**

The Built Environment and Health (BEH) Research Group at Columbia University, founded and led by Andrew Rundle, Associate Professor of Epidemiology, studies the impact of the urban environment on physical activity, among other health concerns. The BEH Group “uses spatial data to examine the impact of the built environment, including land use, public transit, and housing on physical activity, diet, obesity, and other aspects of health.”17 One of their publications, “The Urban Environment and Obesity in New York City: A Multilevel Analysis” studies various aspects of the built environment in order to dissect the associations with body mass index (BMI). The variables of the urban environment that they measured were land use mix, bus and subway stop density, population density, and intersection density. Each of these measurements is understood to be linked to higher levels of physical activity and therefore the hypothesis was that high levels of these measurements would be correlated with lower BMI in the study subjects. Pedestrian-oriented

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environments are characterized by high street connectivity, mixed land use, and high population density. In these kinds of environments, walking and bicycling is encouraged and more frequent.

Population density is usually one of the measurements of the urban environment that is linked to higher levels of physical activity. There is an assumption that a denser urban environment is more urban, less suburban or rural, and is more likely to be walkable. However, in the case of New York City, density is not an issue. While there are varying levels of population density in different neighborhoods, overall New York's density is high enough that it will not be a major factor in determining the causes of health issues and health disparities. Population density was still included in this model to see how it relates to the other factors.

The variables were measured along with covariates of age, gender, race, education, poverty, and race/ethnicity. The results of the study were that, after adjusting for these individual and neighborhood-level socio-demographic characteristics, mixed land use, high density of bus stops and subway stops, and high population density were inversely associated with BMI. In other words, higher levels of mixed land uses, higher density of transit stops, and higher population density were associated with lower BMI. The expected relationships between land use, transit, and density and BMI were supported by the study.

The authors discuss some of the potential reasons for these results. In the case of land use, “mixed commercial-residential land use that places goods and services near residences and the availability of public transit are thought to promote walking and independence from private automobiles.” In the case of population density, “It is possible that a higher population density also supports increased recreational opportunities and food outlets offering a better supply of nutritious food.”

The component of the built environment that did not correspond as expected was intersection.

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18 Rundle et al., “The Urban Built Environment and Obesity in New York City,” 326.
19 One could also argue that living within such close proximity to daily activities might actually limit physical activity if the walking distance to local amenities is too short. As with any of the relationships discussed in this thesis, there is more than one way to argue for an association.
20 Rundle et al., “The Urban Built Environment and Obesity in New York City,” 331.
density. Intersection density was used as a quantification of street design. Higher intersection density corresponds to shorter blocks, which are understood to be better for pedestrians and more walkable. Intersection density, however, was not inversely associated with BMI; higher intersection density corresponded with higher BMI. This result raises the question of whether intersection density was in fact the appropriate measurement to use for street design/street pattern.

Some other limitations of the methodology were the choice of urban environment measurements, the choice of geography, and the consideration only of New York City. The data collected was also only on the subjects’ residential neighborhoods, not where they work or spend the rest of their time. This study used very specific measurement methodologies in the analysis, so more research is necessary. One of the next steps is to conduct similar studies in other high-density cities as well as in low-density places like Austin, Atlanta, and Portland.

An overall concern with this and other studies around the country is the level of causality that can be determined. This research is still in the nascent phase, and there is much still left to be understood about the relationships under question. Many researchers hesitate to target policy decisions without causal demonstration that they will have the desired effect. However, in the work of planning and public policy, best practices and pilot projects are also effective ways to implement changes and evaluate their outcomes. Even without direct causal outcomes, Rundle et al.’s article explains, “… transportation policy, zoning, and other city planning policies may offer tools to promote physical activity and encourage maintenance of a healthy body size.”21 Initial policy considerations are that transit service can be improved if not expanded, mixed land use should be promoted, and superblocks avoided.

Another question that arises from this study is the direction of the relationships. Is it the built environment that affects health outcomes like body mass index and obesity? Or is there another phenomenon in which people with certain health statuses prefer certain urban environments? Furthermore, the underlying question in all of this research is whether socioeconomic status overrides the other urban environment conditions and people that have the resources to move

21 Ibid., 333.
into more healthful neighborhoods do so, leaving poor urban environment and health conditions behind for those that cannot afford to live elsewhere. If this is the case, planners and urban designers need to address the disparities in urban conditions by targeting policy and design in areas of highest need.

*Park Access*

The BEH Group has also conducted research on access to parks and recreational facilities. In 2009, a study by Maroko et al. challenged the commonly understood relationship between high park access and lower rates of obesity. Their results found that Blacks and Hispanics have higher rates of obesity in New York City despite having more access to parks and recreational facilities. Indeed, the County Health Rankings indicate that the Bronx, which has a large Black and Hispanic population, has the worst health in New York State, but the percent of the population that lives within half a mile of a park is higher than the state average at 77%. This finding raises questions about the role of the social determinants of health as well as the physical. Research conducted by Weiss et al. discusses what they call neighborhood “disamenities.” Access to parks is not enough to understand how open space impacts obesity rates. Disamenities such as crime, pedestrian safety, noxious land uses, and vacant lots must also be taken into account.

For their study, Weiss et al. used Census data on race and poverty, and data from the Parks Inspection Program at the New York City Department of Parks and Recreation. For every census tract they measured the number of parks accessible, the number of total acres of parkland accessible, the total number of facilities in each park, and the total number of unique facility types (a measure of facility diversity). They considered accessibility to be within a quarter mile radius of the centroid of each census tract.

In order to capture the disamenities data, they collected point data on homicides and calculated an average density of homicides for each census tract from 2003-2005. To capture

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pedestrian safety, they used point data of automobile accidents that involved pedestrian injuries or fatalities. For noxious land uses, they measured the square footage of industrial and manufacturing uses for each census tract, as well as the square footage of vacant lots.

Using a regression model, the study found that, while “neighborhoods with higher concentrations of traditionally disadvantaged social groups have access to more parks with a greater number of facilities and greater number of types of facilities… lower income neighborhoods have even less access to parks once spatial access is discounted for negative social conditions.” The results suggest that there is a difference between spatial access to parks and social access to parks. Social access may be limited by crime, lack of safe routes for pedestrians, and noxious or vacant land uses. As Weiss et al recommended, “An expansion of the concept of park access to include safe walkable streets around parks and greater safety from crime may allow the higher spatial access minority and lower income populations have to parks and recreation facilities to translate into lower disparities in physical activity and obesity.” As more studies like these begin to challenge the simplistic notions behind previous research, more complex combinations of factors in the urban environment can be better correlated with health outcomes and health disparities.

**Food Access**

Another study conducted by the BEH Group, “Neighborhood Food Environment and Walkability Predict Obesity in New York City”, considered the spatial aspects of food access. Previous studies have considered proximity to health food outlets, access to lower-priced fruits and vegetables, and proximity to convenience stores. In this study, food access and measures of neighborhood walkability were both taken into account. Under consideration were food outlets

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24 Ibid., 308.

that included supermarkets, fruit and vegetable markets, and natural food stores. Neighborhood walkability included measures of population density, transit stop density, transit use, land use mix, and zoning.

In order to distinguish between different types of food outlets, Rundle et al. created three food environment categories. Each food outlet was considered BMI-healthy (supermarkets and fruit and vegetable markets), BMI-unhealthy (fast food restaurants and convenience stores), or BMI-intermediate. For every neighborhood, a density of each category of food outlet was calculated. After developing and running the model, they found that “a higher local density of BMI-healthy food outlets was associated with a lower mean BMI, a lower prevalence of overweight and a lower prevalence of obesity.” The lack of association between BMI and BMI-unhealthy food was perhaps due to the ubiquity of unhealthy food throughout all of the neighborhoods. Furthermore, unhealthy food tends to be consumed at the workplace or during travel, rather than around one’s residential neighborhood. As Ann Forsyth explains in her article “Issues and Challenges in Using GIS to Measure Food Access”, there are many complications inherent in measuring food environments using GIS. This study seems to suggest, however, that increasing access to healthy food is more likely to address the obesity epidemic than limiting access to unhealthy food.

A second study conducted by Bader et al. in 2010 looked more specifically at the disparities in neighborhood food environments. This study added different aspects of the urban environment into the study of food access. They measured access to supermarkets after adjusting for vehicle ownership, public transit access, crime, and poor traffic safety. These measurements also address

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26 These categories were likely chosen based on the likelihood that fresh food would be sold. However, there are cases in which BMI-unhealthy food outlets might sell fresh food or BMI-healthy food outlets might have a limited supply. Furthermore, the cost of fresh food was not taken into account in this study.
29 This relationship is entirely dependent on food costs, which are not addressed in this study or in any of the other data available for this thesis.
the concept of neighborhood walkability, but with different parameters. This study found that “… adjusting for vehicle ownership and crime tended to increase measured disparities in access to supermarkets by neighborhood, race/ethnicity, and income, while adjusting for public transit and traffic safety tended to narrow these disparities.”

Socioeconomic Disparities

While some of the studies mentioned above have not taken into account the social environment of New York and how it might impact health, another study looked at the disparities in urban neighborhood conditions and how they corresponded to income. Poor and nonpoor neighborhoods in New York City were compared. The initial observation was that despite living in “highly walkable neighborhoods”, low-income residents still had high rates of chronic disease related to a lack of physical activity. This study studied aspects of the built environment that are not usually considered: street trees, landmarked buildings, clean streets, sidewalk cafes, felony complaints, narcotics arrests, and vehicular crashes. The goal was to compare poor and nonpoor neighborhoods with these factors to determine whether they should be considered in overall research relating the urban environment to health.

Street tree data was obtained from the DPR’s 2007 Street Tree Census. Landmarked buildings data (which was used as a measure of the level of historically important architecture that can contribute to a more aesthetically pleasing and walkable urban environment) was provided by the Landmarks Preservation Commission. The Mayor’s Office of Operations conducts an annual assessment of street cleanliness, and this data was used for the clean streets layer. Traffic safety was determined by a weighted average of speed limits. Crime data was obtained at the NYPD precinct level. Vacant housing percentages were calculated using the Census. Presence of a bike lane or trail in each tract was measured for active transportation infrastructure. Density of transit stops was also included. Sidewalk amenities data, which included sidewalk cafes, was provided by the

Department of Consumer Affairs. And finally, the research team conducted field observations to supplement the available data.

Not surprisingly, the study found that nonpoor tracts had more street trees, more landmarked buildings, and a higher proportion of clean streets. They were also more likely to have sidewalk cafes. Poor census tracts were more likely to include parks and greenstreets (a finding that corresponds with the aforementioned study by Maroko et al.). But nonpoor tracts had slightly slower speed limits, narrower street widths, lower vehicular crash rates, lower rates of felony complaints and narcotics arrests, fewer vacant housing units, and better access to bicycle lanes and subway stops. Field observations showed that blocks in the nonpoor tracts had more natural features and fewer visible signs of trash or disrepair and were less likely to have excessive noise. Poor blocks tended to have more street vendors and sidewalk shoppers.\textsuperscript{31}

Bus stop density was similar throughout the neighborhoods. The difference in median pedestrian counts was not statistically significant. The field observations seemed to tell a different story than the GIS analysis. “Low-income urban neighborhoods are less conducive to walking than they would appear to be if we considered only population density, land use mix, and other indicators of urban form.”\textsuperscript{32} The results point to a need for improving aesthetic and safety conditions in low-income neighborhoods as a possible way to reduce health disparities. This is an attractive approach for policy makers because it is less expensive and time intensive than density or land use patterns. Improving the quality of life in a neighborhood can also bolster economic development. The ways in which health and economic policy are tied together in New York will be further explained in Chapter Four.

The underlying question in the results of this study is that if one planted more street trees, cleaned the streets, improved safety conditions, calmed traffic, and promoted economic development, would the neighborhood become nonpoor and therefore healthier? Is it possible that


\textsuperscript{32} Ibid., 274.
by improving the urban environment, poor people would be priced out of their neighborhoods to make way for those that can afford this better, more healthful environment? Taking these issues into consideration is important for planners and urban designers moving forward.

Another interesting study conducted by the BEH Group found that “contrary to expectations, built environment characteristics were less consistently associated with BMI among disadvantaged groups.”33 Not only does socioeconomic status affect health outcomes, but when taken into account, it seems that relationships that are explored in the studies above are perhaps less relevant in disadvantaged populations. There are other barriers facing these populations that are not being considered in these studies. When disadvantaged populations face a multitude of problems, including poverty, discrimination, mental illness, and disability, it is difficult to disentangle them to determine the root causes of poor physical health. While it is impossible to include every factor of the urban environment in a single study, finding the appropriate balance and understanding the correct implications is a challenge for future directions in this research.

Chapter Four
Obesity and Active Design in New York City

New York City History

The history of urban planning and urban health in New York City parallels the history of England and the United States outlined in Chapter One. In the late 19th and early 20th centuries, New York City was plagued by an unhealthy urban environment. Streets were unclean, housing (particularly tenement housing) was in disrepair, and overcrowding had become a major issue, especially for the city’s poor. New York had seen enormous population growth in the 19th century from 40,000 people in 1800 to 4.5 million people in 1900. Part of this growth was due to annexation that created a larger footprint for the city, but New York also became much denser during this period. As was the case in other cities, tuberculosis, cholera, and yellow fever were some of the most deathly illnesses of the time, and their causes were traced back to a lack of waste management and a contaminated water supply. Between 1810 and 1856, mortality rates doubled. These mortality rates disproportionately affected the poor population of the city.¹

Beginning in the mid-19th century, New York City began building new infrastructure and instituting policies to address the unhealthy conditions that were causing disease and death. Environmental design was adopted as a tool, and it continues to be central to the City’s urban health policies today. This combination of physical development and public policy reflected the interdisciplinary nature of the urban planning field at the time, and it was manifested in a series of important changes to the environment of New York City. The Croton aqueduct system was created in 1842 to bring in clean water from Upstate New York. In 1857, Central Park, known as the “working man’s lungs” was built, creating refuge from an increasingly overcrowded and unclean city. In 1881, the Department of Street Sweeping was established to address the filthiness of the

¹ “Active Design Guidelines: Promoting Physical Activity and Health in Design” (City of New York, 2010), 12.
streets. This department still exists and is now called the Department of Sanitation, performing a crucial role in the upkeep and cleanliness of the city. These three events helped to provide an immediately cleaner environment with cleaner air, cleaner streets, and access to open space.

New York also began to address the overcrowding issue. In 1901, the Tenement House Act established a ban against dark and airless buildings, attempting to address the unhealthy conditions of tenement housing. In 1904, when the subway was constructed, more of the city became accessible and people could move from the downtown area and alleviate overcrowded conditions. Finally, in 1916, New York's zoning ordinance included new regulations on setbacks for tall buildings that would allow more light and air to enter the streets. These three changes helped to alleviate overcrowding and lessen the pressure of population expansion. The combination of infrastructure, policy, and zoning worked. By 1940, only 11% of deaths were attributable to infectious disease.

**New York City Today**

Today, New York City is still considered a model of the use of public policies to create a more healthful city. The City touts its air pollution controls that have improved outdoor air quality, the smoke-free indoor air acts that have improved indoor air quality and contributed to the anti-smoking campaign, and programs to rid buildings of asbestos and lead and install window guards for child safety.

New York City also aims to be a model of sustainability. PlaNYC, the comprehensive plan for 2030 has outlined the city’s sustainability goals, many of which will have an effect on health. PlaNYC includes sections on water supply, transportation, energy, air quality, solid waste, and climate change. The transportation section includes goals to make bicycling safer and more convenient, enhance pedestrian access and safety, and reduce traffic and truck congestion throughout the city. PlaNYC also includes goals related to parks and open space. While these goals reflect the recognition that health concerns need to be addressed in citywide policies, there is a lack of specificity in PlaNYC regarding the actual effects that initiatives will have. Other policies that supplement PlaNYC and

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2 Ibid., 13.
direct city agencies toward more specific health goals are explained in this chapter.

**Obesity in New York City**

The major urban health epidemic that New York City is currently focused on is obesity, which is linked to physical inactivity, poor diet, and smoking. In 2009, 57% of adults and 39% of children were overweight or obese. Since 2006, childhood obesity has decreased by 5.5%. The City attributes this trend to its nutrition and wellness polices in the public school system. Despite this improvement, obesity continues to be an epidemic throughout the city. While some neighborhoods in New York have seen a decrease in rates of adult obesity, others have increased dramatically. The bar chart on Page 91 illustrates these trends.

The obesity epidemic is not only taking a toll on the well being of New Yorkers, but it is also increasing health care costs and health insurance costs. Obesity-related health problems account for almost 20% of Medicaid and Medicare expenditures in New York. Obesity also contributes to physical disability and absenteeism at work, decreasing productivity in the business sector and negatively impacting the economy. Total health costs from obesity are projected to be $960 billion by 2030, so it is in the economic as well as the health interest of New Yorkers to address this problem.

Take Care New York is New York City’s action plan to promote health. One of the ten objectives in TCNY 2012 was to promote physical activity and healthy eating. In 2009, the goals were to reduce adult obesity, increase physical activity, increase fruit and vegetable consumption, and decrease the consumption of sugar-sweetened beverages. Not only is New York interested in changing the levels of obesity, physical activity, and healthy eating, but health disparities are also an

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3 Smoking has been addressed by several policies in New York and is less relevant to planners and urban designers. This chapter will therefore focus on the physical activity and diet-related causes of obesity.

4 These neighborhoods are defined by the United Hospital Fund. Data from the Community Health Survey is collected and distributed through the UHF neighborhoods, each of which combines one or more ZIP Codes.

5 “Take Care New York: A Policy for a Healthier New York City” (NYC Department of Health and Mental Hygiene, September 2009), 12.

area of focus. According to TCNY 2012, poverty, lack of education, and race and ethnicity are all factors in the disparities in levels of obesity among New York City neighborhoods. There are barriers to purchasing fresh produce for low-income populations including higher costs of perishable foods and a lack of access to grocery stores. Limited access to public parks, bike paths, and recreation centers is also cited as a negative effect of disparities. The mapping analysis in Chapter Five will test these claims in a spatial way.

New York City has many policies and initiatives aimed at increasing physical activity and healthy eating behavior. The Active Design Guidelines is the most prominent initiative that was the result of collaboration among the Departments of Transportation, City Planning, Health and Mental Hygiene, and Design and Construction. The Department of Transportation is involved in several initiatives that supplement the Guidelines and aim to create a more walkable, pedestrian friendly environment to increase physical activity. The Food Retail Expansion to Promote Health program of the Departments of City Planning and Health is a prime example of food access policy. Each of these initiatives and agencies uses data and mapping in different ways. The following sections will analyze the policies, how they were developed, and how they are being implemented and evaluated.

**The Active Design Guidelines and Related Initiatives**

The Active Design Guidelines define active design as “environmental design that encourages stair climbing, walking, bicycling, transit use, active recreation, and healthy eating.” The Guidelines are part of a larger Design and Construction Excellence Initiative and were developed as part of a larger set of publications aimed at enhancing design in the city, including the Street Design Manual. The Guidelines provide recommendations based on a combination of academic research,

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8 The one factor mentioned in TCNY 2012 but not addressed in this thesis is the varying costs of fresh food and the barriers that cost creates for low-income populations to have access to nutritional and healthy food. Future research into food access should take costs into account.
9 The Street Design Manual provides policies and design guidelines for streets and sidewalks. It is used extensively in New York City by city agencies and professionals, as well as in other cities around the country. Part of the focus of the SDM is on new materials, technologies, and design innovations that are being developed around the world. NYC Department of
best practices, and cost-effective solutions. The DOHMH, in partnership with the Columbia BEH Group, are working on an online update to the Guidelines that will include updated academic research, including New York-specific data, research, and case studies.10

The Guidelines describe the relationship between urban design and travel patterns related to physical activity by using the language of researchers Robert Cervero and Kara Kochelman and their book *Travel Demand and the Three Ds*. The “Three Ds” of Cervero and Kochelman are: Density of jobs and density of population; Diversity in terms of the number, variety, and balance of land uses; and Design of the street network and the streetscape. The Guidelines expand this concept to five D’s, adding on Destination accessibility, including ease of travel to the concentrated areas of jobs or attractions; and Distance to transit. In 2002, a comparative study of cities around the country found that New York performed well in four of the five Ds. New York was first in density and overall compactness. It was second in street accessibility and connectivity, fourth in the strength of residential and business centers, and New York had the highest percentage of people who commute to work by walking and transit.11 The D that is missing is Design. These Guidelines attempt to address this missing link.

There are two major sections of the Active Design Guidelines. One focuses on building design and the other on urban design. While the focus of this thesis is on urban design, one of the building design policies deserves specific mention. The ADG team designed a stair prompt sign that instructs New Yorkers to “Burn Calories, Not Electricity, Take the Stairs!” (See image on Page 66). New York has installed over 30,000 stair prompt signs in buildings around the city. These stair prompt signs remind people who are able to take the stairs rather than taking elevators. The Department of Health and Mental Hygiene is tracking the installation of these signs and conducting

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small-scale evaluations at an affordable housing development, a hospital, and a university to determine the effectiveness of this initiative in increasing stair use. This initiative deserves mention because it is one of the most talked about and highlighted projects by New York City government agencies.

The urban design guidelines are divided into seven general areas of study: land use mix, transit and parking, parks and open space, public plazas, grocery stores and fresh produce, street design, and bicycle infrastructure. The correlations between this list and the topics and indicators explored in Chapters Two and Three is evident. It is also clear which New York City agencies are most directly involved in the guidelines. The role of the Department of City Planning is primarily in zoning and land use. The Department of Parks and Recreation is responsible for the City’s parks, open space, and recreational activities. The Department of Transportation leads programs involving transit, parking, public plazas, street design, and bicycling. Grocery store initiatives are
led by a team from the Department of Health, the Department of City Planning, the Economic Development Corporation (not a city agency but an entity closely involved in City initiatives) and the Mayor’s Task Force on Food Policy.

**Land Use**

The land use section of the Guidelines is focused on combining residential and commercial uses, as well as locating them near schools and recreational areas. The goal is to provide more opportunities for people to walk to their destinations, whether they are traveling to work, to school, or to shop or play. Land use and zoning in New York City is a particularly complex process, and sweeping changes are not possible. However, the DCP does recognize the need to update aspects of the zoning code to contribute to efforts to make New York a healthier city. For example, there was a recent zoning amendment requiring all commercial and multifamily residential buildings to include bicycle parking. Incremental steps to ensure that future development takes physical activity into consideration are at the heart of the Guidelines’ recommendations in this section.

Another important land use initiative is the FRESH Food Program, which will be discussed later in this chapter.

**Open Space**

The Guidelines also include recommendations for the design of parks, open spaces, and recreational facilities, which is perhaps the most straightforward aspect of the urban environment that can be linked to physical activity. In order for people to exercise, particularly to exercise outdoors, spaces need to be accessible, safe, and attractive. Furthermore, creating outdoor spaces that are maintained by the City provides a cost effective way for New Yorkers to exercise without needing to join a gym.\(^ {12}\) One of the goals of PlaNYC is to provide a park or open space within a ten-

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\(^ {12}\) The Department of Parks and Recreation also has numerous programs geared toward creating recreational and exercise opportunities for New Yorkers. These include exercise classes, inexpensive gym facilities, and fitness education. NYC Department of Parks and Recreation, “Public Programs,” n.d., http://www.nycgovparks.org/programs.
Before and After Schoolyards to Playgrounds Program: PS 138
NYC Department of Transportation
minute walking distance to all residential neighborhoods. The placement of future open spaces is very important to the City, and open space is a major component of new large-scale developments.

The NYC Plaza Program of the DOT adds public plazas to the network of public open space that the Parks Department maintains. The Plaza Program works with community organizations to sponsor and maintain plazas in neighborhoods around the city. Community groups apply to the program and the selection process determines where and how the new plazas are developed. The Plaza Program is one of the DOT initiatives that require communities to apply for public resources. One of the criteria for plaza selection is whether or not the neighborhood lacks open space. Site context, including the surrounding land uses and buildings, proximity to transit, and significant view corridors and historic sites are also considered. These criteria provide a sense of how this initiative is targeted and implemented. Proposals that are located in low- or moderate-income neighborhoods are given priority, which is an indication that disparities in these amenities across
New York City neighborhoods are being addressed in certain initiatives.

There are also programs that provide different kinds of space for recreation outside of parks and plazas. The Schoolyards to Playgrounds program is run through the Parks Department. Through this initiative, hundreds of schoolyards have been opened to the public and made accessible after school on weekdays and during the day on weekends and holidays.\(^{13}\) This program specifically targets under-served neighborhoods. The photos on Page 68 show the before and after of PS 138 in the Bronx. Play Streets is another program of the Parks Department in conjunction with DOHMH and the DOT in which streets are closed to traffic and opened up to pedestrians for play activities on a recurring basis. One of the purposes of this program is to provide places for children to play while new parks and playgrounds are being developed.\(^{14}\) Finally, Summer Streets is a program run by the DOT in which almost seven miles of New York City’s streets are closed to traffic and opened up to pedestrians and bicyclists. This event happens annually on three consecutive Saturdays during the summer\(^{15}\) (see photo on Page 69).

**Transit**

The transit section of the Guidelines explains that, while New York City’s transit system is already extensive in terms of subway and bus access, the question of where to locate buildings and building entrances is still important. The key recommendation is that future development should focus on transit corridors and ensure that entrances are near transit stops to encourage transit use. The DOT is also expanding transit service in order to make it more accessible and efficient. The Select Bus Service is the new bus rapid transit system that began on Fordham Road in the Bronx in 2008 and has now been expanded to several other routes. This service includes dedicated bus lanes.

\(^{13}\) NYC Department of Parks and Recreation, “Playgrounds,” n.d., http://www.nycgovparks.org/facilities/playgrounds/. This program relates to the indicator mentioned in Chapter Two that measures the percent of school athletic facilities that are made available to the public.


that give buses priority in traffic. A streamlined boarding process allows for faster fare collection and quicker boarding times. Furthermore, changes to the geometry of the road, including bus bulbs and widened sidewalks for people waiting for the bus, have made the streetscapes safer and more comfortable for pedestrians.

Another DOT initiative is the installation of new bicycle infrastructure. DOHMH estimates that half of a million New Yorkers ride bikes. The DOT also collects data on bike ridership into and out of Manhattan, and the American Community Survey collects data on how many people commute to work by bicycle. All of these indicators show that bicycle ridership is increasing. New York City is expanding the network of bike routes to accommodate new bicyclists. The new Citi Bike program will be introduced in May 2013, and New York will join the other US cities that have instituted bike share programs to increase cycling and physical activity.

Street Design

The street design section of the Guidelines is very closely tied to DOT initiatives, as DOT has jurisdiction over much of the public right of way in New York, including streets and sidewalks. On its website, the DOT explains that it “works to transform New York’s streets to improve pedestrian safety, increase accessibility and enhance the environment.”16 One of DOT’s primary messages is that if New York is safe, it will be more walkable. Furthermore, if the city is safe for vulnerable populations such as the elderly and people with disabilities, it will be safe for everyone. These time-tested notions are driving many of the streetscape design projects and safety policies that are currently being spearheaded by the DOT.

The Guidelines highlight the importance of connectivity in the street network with small block sizes and accessible pedestrian paths. Contact between cars and pedestrians should be minimized with buffers like parked cars and street trees. Traffic calming measures also help to ensure the safety of pedestrians. The Guidelines recommend setting minimum road widths and installing

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curb extensions and medians to allow pedestrians to cross the street over shorter distances. Raised speed reducers also help to slow down traffic. The DOT’s goals include providing shorter and more direct crosswalks and creating safe, comfortable travel paths for pedestrians, cyclists, and motorists. According to the DOT, a safer and more accessible city is a more walkable city and one in which physical activity becomes more possible and more frequent.

Part of creating a walkable city is addressing the aesthetic quality of streets. Amenities such as benches and seating, street trees that provide shade, drinking fountains, restrooms, and adequate street lighting can all contribute to a more comfortable walking and/or shopping experience. The Urban Art program at the DOT, coupled with other public art programs around the city, also help to enliven the streetscape and public space to make them more inviting for pedestrians.

The Times Square redevelopment (pictured above) is touted as one of the great successes of increasing pedestrian accessibility and walkability in the city. It includes many of the street amenities described above in an effort to bring New York into the 21st century. As DOT Commissioner Janette Sadik-Khan wrote in an article in Business Week:
If you look at a picture of Times Square from the 1950s, 90 percent of the space was dedicated to cars, and just 10 percent to pedestrians. Not much had changed 55 years later. If you were a company and you didn't change the way you did business for 50 years, you probably wouldn't be around. Our policy has been to really try to address that balance, bring people back into the mix, and bring design to the table. We're looking at our streets as valuable public places, and we need to make it easier and safer for people to walk around and bike.17

The DOT has been framing its policies (particularly the more controversial ones) through the lens of economic development for a long time, but the issue of safety has also become extremely important as the DOT pushes to reclaim New York City streets for pedestrians and bicyclists.

The DOT has also initiated three different safety programs. Safe Routes to Schools focuses on schools that have the highest accident rates on nearby streets and identified 135 priority public schools in its first round. Safe Streets for Seniors aims to increase visibility and lighting and make crossing the street safer through traffic calming measures. This program targets neighborhoods with both a high density of senior citizens and a high number of pedestrian accidents and injuries. Safe Routes to Transit aims to make the transportation system more connected by improving pedestrian movement around subway entrances and bus stops. The results are expected to be more walking and transit use, as well as less traffic and cleaner air.18

Finally, another important initiative of the DOT is WalkNYC, a pedestrian wayfinding signage system that is being developed. Wayfinding is expected to increase pedestrian activity by making more neighborhoods in New York accessible for residents and tourists alike.

The Health Argument

Throughout the Guidelines, the principles of accessibility, visibility, and safety are emphasized. In much of the promotional material of various city agencies, economic development

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18 NYC Department of Transportation, “About DOT.”
Food Retail Expansion to Support Health

Legend
- Area where zoning and discretionary tax incentives are available
- Green: Area where zoning incentives are available
- Grey: Area where discretionary tax incentives are available

Note:
Tax incentives are discretionary and will be assessed on a per case basis for eligibility in the FRESH program.

Please contact FRESH for more information on eligibility.
is also an important factor. What has yet to fully take hold is a similar argument, equally important if not more so, that urban health issues can be addressed through these policies.\textsuperscript{19} The Active Design Guidelines were developed through collaboration among several agencies, but the team itself was relatively small. There is great interest throughout the city government in making health part of every conversation that impacts the urban environment.

**FRESH Program**

The FRESH program, Food Retail Expansion to Support Health, was the result of a study conducted for Mayor Bloomberg’s Food Policy Task Force by DOHMH, DCP, and the NYC Economic Development Corporation. The study found that approximately 3 million people live in areas in high need of a supermarket.\textsuperscript{20} The DCP created a Supermarket Need Index that combined eight different factors: population density, residents’ access to a car, percentage of the population that is low income, diabetes rates, obesity rates, level of fresh food retail, and capacity for new grocery stores. Based on the results of this mapping exercise, high-need areas were identified, as well as areas in which zoning incentives and discretionary tax incentives are available (see map on Page 74). As a result of the findings of this study, a zoning text amendment was proposed to increase the number of full-line supermarkets in New York’s highest need areas.\textsuperscript{21}

The goals of FRESH are to make healthy food more accessible to New Yorkers, to reduce food costs, and to address the obesity epidemic. Not only are there health benefits to providing more grocery stores, but there are economic benefits as well. According to the DCP website, “New York

\textsuperscript{19} Wendy Feuer, Assistant Commissioner, Urban Design & Art, New York City Department of Transportation. Interview by author. New York City, March 11, 2013.

\textsuperscript{20} NYC DCP used ZIP Code Business Patterns (ZBP) from the US Census to collect data on fresh food retail. ZBP uses the North American Industry Classification System (NAICS) to determine the definition of “supermarket.” NAICS code 445110 is for Supermarkets/Other Grocery, excluding convenience stores. Also excluded from this definition are meat and fish markets and specialty food stores.

City has the potential to capture approximately $1 billion in lost grocery sales to suburbs. The loss in sales is enough to support more than 100 new neighborhood grocery stores and supermarkets.”

This economic argument further strengthens the policies that DCP has put in place to develop new healthy food outlets.

The DCP is using a combination of zoning regulations and financial incentives to create opportunities for new grocery store development. The DCP has set standards for the amount of square footage of grocery stores that are required per population: 30,000 square feet per 10,000 people. Only two community districts, both in Manhattan, meet this standard, with the others, particularly in the outer boroughs, falling far behind. DCP’s recommendations include ensuring that future rezoning takes the supermarket need index into consideration, city-controlled sites should be considered for supermarkets, a New York Supermarket Commission should be established, and the Economic Development Corporation should work to promote this development.

The Use of Mapping

In each of the policies and initiatives listed in the previous section, New York City agencies have use mapping as a tool at some point in the process. The ways in which mapping is used range from a communication tool to a research method to a targeted tool for policy development. One of the most powerful attributes of maps is the ability of many people, regardless of profession or background, to understand them. It has been noted previously that the public health and urban planning fields lack a common vocabulary. Mapping is therefore an incredibly important tool for planners and urban designers working with public health professionals to address issues of urban health.

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23 Once again, economic development arguments are of utmost importance in the development and promotion of New York City’s policies.
25 Skye Duncan, Associate Urban Designer, New York City Department of City Planning. Interview by author. New York City, March 28, 2013.
Obesity rates in 1985 (top) and 2009 (bottom), US Centers for Disease Control and Prevention
**Communication and Research**

At the beginning of the Active Design Guidelines, maps are used to highlight the rising obesity epidemic in the United States. A series of maps from 1985 to 2009 show drastic increases in obesity across the country (see maps on Page 77). Maps are also used to show diabetes and obesity rates in New York City by neighborhood (see Chapter Five). These maps highlight not only the high rates of these conditions but glaring health disparities among the neighborhoods. These maps are accompanied by graphs and charts that better quantify the data and show trends over time, but the Guidelines have harnessed the power of maps to illustrate the spatial distribution of this information.

Even more powerful is the interactive progression of the national obesity maps that are presented at Active Design Guidelines trainings and workshops. These maps have an important impact on audiences as they watch the colors change in expected and unexpected regions. This progression can be seen on the website of the newly formed Center for Active Design, which is now looking not only at New York City but also at other cities around the country for opportunities to educate architects, urban designs, and planners, and to implement the Guidelines.

The DOT uses maps in various ways to both communicate information but also, presumably, to identify areas of highest need. Maps that can be found on DOT’s website include a map of the bicycle routes and bicycle infrastructure around the city. DOT also maps future bicycle routes to indicate its progress and inform the public of future interventions. Another map on the DOT website is a map for the Select Bus Service which informs the public of the new routes. The website also includes a presentation on the Safe Streets for Seniors program that uses maps to show where pedestrian crashes involving senior citizens have occurred, providing justification for where programs have been implemented. These maps are useful both for communicating policies to the public but also for identifying where interventions are most appropriate.

The DOHMH also uses maps for many aspects of its work. It is a very valuable research tool

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26 Suzanne Nienaber, Center for Active Design. Interview by author, March 11, 2013.
to determine where health problems are the most acute and where intervention is most needed.\textsuperscript{27} Much of the data that the Health Department collects, including maps, is made available to the public online through the Environmental Public Health Tracking Portal.

\textit{A Tool for Policy Development}

In the case of the FRESH program, the Supermarket Need Index (SNI) was a relatively sophisticated use of mapping not only as a research tool but also as a direct argument for targeting the FRESH program in certain areas. In Juliana Maantay’s \textit{Geospatial Analysis of Environmental Health}, members of the team from the DCP and the Health Department wrote a chapter on how the SNI was developed. They used GIS to combine multiple layers of information into a suitability analysis in order to determine which areas in New York City would be most suitable for a new supermarket or grocery store.

The SNI includes a wide range of factors that include the social, economic, and spatial determinants of access to fresh food. High population density, low access to automobiles, and low household income were the socioeconomic factors that are linked to supermarket need.\textsuperscript{28} With a denser population, more supermarkets are needed to serve that population; without access to a car, residents are less able to travel to obtain fresh food, and low household income limits options for purchasing food. Low share of fresh food retail (the proportion of fresh food retail to all food retail) and high capacity for new supermarkets were the spatial, land use factors that went into the index. Finally, the SNI includes health factors that determine to some extent the severity of the health problems associated with supermarket need. High rates of diabetes, high rates of obesity, and low consumption of fresh fruits and vegetables were considered indicators of high supermarket need.

The indicators were not all measurable at the same scale; some were available at the census tract level, others at the neighborhood scale. The socioeconomic factors were available at the census tract level. Low household income was determined using eligibility for Community Development

\begin{itemize}
\item[27] Sarah Johnson, New York City Department of Health and Mental Hygiene. Interview by author, March 15, 2013.
\item[28] Smith et al., “Developing a Supermarket Need Index,” 205.
\end{itemize}
Block Grants. CDBG eligible census tracts have at least 50% of residents low- or moderate-income. Population density is available through the Census and is usually calculated by number of people per square mile or square kilometer. For the SNI, however, the Getis-Ord Gi GIS tool was used for both population density and to determine lack of access to a car.

The proportion of fresh food retail to all food retail was determined using the 2007 Zip Business Patterns from the Census. Fresh food retail was defined using the North American Industry Classification System code for “Supermarkets and Other Grocery (except Convenience) Stores.” The capacity for new supermarkets was determined using the Thiessen Polygon GIS tool that created trade areas around each supermarket and included an estimate of the total population within each of these trade areas. The assumption was that more people served by less supermarket square footage merited a higher rank on the SNI.

Finally, the diabetes, obesity, and consumption of fruits and vegetables indicators were determined using the New York City Community Health Survey. As mentioned in Chapter Three, the CHS is a very powerful tool that is unique to New York City. It is a telephone survey that is conducted every year to obtain health data from adult New Yorkers. A major limitation to this method is the error inherent in self-reported measurement. It is very difficult, for example, for survey participants to correctly estimate the number of hours spent doing vigorous physical activity in the past month. The Physical Activity and Transit Survey (also described in Chapter Three) attempts to supplement the self-reported data with objective measurements, but the CHS is still the most comprehensive data source available.

Each of the indicators was turned into a raster using GIS and given a specific weight. Since the Department of City Planning has the ability to affect land use and the built environment most directly, the indicators that were not diet-related were given more weight. Each indicator was given a value on a scale of 0 to 3 and then mapped. The results, combined with areas of the city in which discretionary tax and financial incentives are available, can be seen on Page 74.

Sarah Wolf and Maggie Veatch, New York City Department of Health and Mental Hygiene. Interview by author, March 27, 2013.
Limitations

The SNI is a great example of how mapping is used to inform policies in New York City. It is also important to identify the limitations of this methodology and how the results might have been different given a different set of data or weighting. It is important to include socioeconomic factors into an analysis like this one, but it is then difficult to understand what issues are the most pressing to address. In the Bronx, for instance, where there is a high supermarket need but also low income, is the appropriate solution to provide more square footage of supermarkets or to help the population with employment and economic opportunity so that they can afford fresh food? Alternatively, would the most effective solution be to provide fresh food that is also low cost in these communities?

Another key limitation of both the SNI and the active design policies is a lack of evaluation mechanisms for determining how well these programs are addressing the obesity epidemic. The SNI has not been revisited since it was developed because of a lack of resources, despite new data being available. Another challenge is that changes in obesity or obesity-related conditions such as diabetes will not be able to be measured immediately. One of the largest benefits of the Community Health Survey (despite the limitation of self-reported data) is the consistency of the questions each year, which allows the City to track trends over time. The CHS, combined with a systematic measurement of the implementation of the policies above, could not only determine how well these policies are performing, but could also provide evidence and best practices for future initiatives and for other cities.

Final Notes on New York City

New York City is unique in the level of collaboration among different agencies. The Active Design Guidelines is just one example of a joint effort that has allowed multiple angles of a single

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30 The DOHMH’s Healthy Bodegas Initiative is providing low-cost fresh food in bodegas throughout the city. See Chapter Five.
issue to be addressed simultaneously and in a comprehensive way. Since 2006, New York has hosted Fit City conferences for professionals in many disciplines to discuss policy and design interventions that can increase physical activity and access to healthy foods. At the Fit Nation conference in New Orleans, one of the activities divided participants into groups in which each person was from a different city and a different agency. This format simulated the condition in which professionals from various backgrounds could share expertise and explore policy and design solutions together.

New York City is indeed a model of collaboration in many ways. However, it is also clear that the health argument that is highlighted by the Active Design team has not yet been fully integrated into the work of all agencies at all levels. At an Active Design training session at the DOT, for example, it was clear that while health concerns affect people in their personal lives on a daily basis, most people do not integrate these concerns into their professional practice. One of the goals of the Active Design Guidelines and the many training sessions that have been held with city employees and planning and design professionals in New York is to make health part of the conversation, to increase the awareness of the health impacts of policy and design decisions. New York City is ahead of the curve in this regard, but there is still work to be done.

Finally, it is important to note how the policies described above are being used to address disparities in health throughout the city. Many of the DOT programs to enhance street design involve application processes and community engagement. One of the services that the DOHMH provides is technical assistance to community groups and outreach to underserved neighborhoods that might otherwise not be aware of, or not have the capacity to apply for, these programs. Through this assistance and outreach, communities that need these enhancements most are better able to compete for them. Citywide policies, while not aimed at the highest need communities, are also considered to address health disparities as they raise minimum standards throughout the city. Minimum grocery store footage and minimum park access are two examples of these kinds of policies.

32 Ibid.
The measurements of the urban environment discussed in Chapter Three and the implementation of the policies discussed in this chapter will be further explored through a mapping analysis in Chapter Five. Some of the observed relationships between the urban environment, physical activity, and obesity will be tested, and recommendations for New York City will be provided.
Health in the New York MSA

The New York Metropolitan Statistical Area (MSA) comprises twelve counties in New York State, twelve counties in New Jersey, and one county in Pennsylvania. Mapping obesity data from the County Health Rankings reveals information about New York City in the context of the MSA. It is clear from the map on Page 86 that, while the boroughs of New York City do not have the worst rates of obesity in the MSA (counties in New York State and Pike County in Pennsylvania are the worst), the Bronx and Staten Island stand out with higher than average obesity rates. Indeed, the County Health Rankings, among other sources, have indicated that the Bronx is the least healthy county in the entire state, based on a combination of health factors and outcomes. Queens, on the other hand is ranked 19 out of 62 counties, Manhattan is ranked 21, Staten Island is ranked 24, and Brooklyn is ranked 49. These rankings include measurements of smoking, obesity, inactivity, health care access, healthy food access, and socioeconomic factors.

The bar chart on Page 87 further shows the relatively poor health of Bronx County compared to the other counties in the MSA. Out of all 25 counties, the Bronx has the highest percentage of these combined poor health indicators. The data in this chart include measurements of obesity and physical inactivity, as well as environmental conditions associated with these health issues (limited access to fresh food and smoking). Finally, socioeconomic factors including lack of insurance, unemployment, and poverty are added to the bar chart. The results reveal interesting relationships among the MSA counties.

The counties are organized based on their distance from New York City. According to this

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1 The larger Combined Statistical Area includes more counties in these states as well as counties in Connecticut.
2 The County Health Rankings provide identical measurements of a series of health factors and health outcomes for every county in the United States. The results are provided in tables and maps online. “County Health Rankings,” 2013, http://www.countyhealthrankings.org/.
Obesity rates in the New York Metropolitan Statistical Area

The Bronx and Staten Island stand out with higher obesity rates than most of the counties in the MSA.

Source: 2012 County Health Rankings
Poor health indicators in the NYC MSA
The Bronx is the least healthy county in the MSA and in New York State
data, outside of the five boroughs, the counties closest to New York tend to have better health while the counties farther away have poorer health. Another interesting comparison is the percentage of people who have limited access to fresh food. Despite the overall poor health of the Bronx, limited access to fresh food is extremely low, as it is for the other four boroughs. Finally, it is worth noting that the socioeconomic factors are worse in the Bronx than in any other county, particularly childhood poverty.

**New York City Health**

As mentioned in previous chapters, the majority of New York City health data is collected through the Community Health Survey, an annual telephone survey conducted by the Department of Health and Mental Hygiene. Obesity rates are calculated based on body mass index (BMI). The obesity measurement is measured more objectively than the other data in the CHS. However, the data is aggregated over large neighborhood areas. The neighborhoods used by DOHMH are based on combinations of zip codes and are known as the 42 United Hospital Fund areas. Some of the areas are combined, resulting in 34 neighborhoods across the five boroughs. These geographies are very large, meaning that a level of detail is lost in the analysis and mapping of this data. However, it is still useful to see if there are spatial correlations between the conditions of the urban environment studied in previous chapters and the results of the CHS on adult obesity in New York City.

One of the most important uses of the CHS is the ability to track trends over time. Citywide, the obesity rate in New York City has risen over the past decade. However, the bar chart on Page 91 reveals more specific data about the neighborhoods in which obesity rates have increased and decreased. The neighborhoods are organized based on the percentage change in obesity rate from 2003 to 2010. At the top of the chart is the Fordham-Bronx Park neighborhood, which

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3 A similar trend can be seen in the county level data for other US cities such as Atlanta, which have been studied in the Spring 2012 Health and Urbanism workshop.

4 All of the data in the CHS is self-reported. Weight and height are also self-reported, so there is room for error in the obesity measurement as well, but it is easier for survey participants to measure these data than, for example, the amount of physical activity they engaged in over the past month.
saw an increase of 81%. Twenty-one other neighborhoods also saw an increase. Twelve of the 34 neighborhoods saw a decrease in obesity, and the Washington Heights-Inwood neighborhood had the greatest decrease of 32%. These two neighborhoods are also similar in terms of demographic data and will be examined further later in this chapter.

The map on Page 90 shows the adult obesity rates in 2010 in orange with an overlay of the neighborhoods in which obesity had increased since 2003. It is clear that there are geographic disparities in the obesity epidemic across neighborhoods. The worst obesity is found in parts of the Bronx, Brooklyn, and the northern edge of Staten Island. These three areas also saw some of the highest increases in obesity since 2003. The maps in the following sections will layer other available data sets on top of or next to this obesity data to provide an understanding of the spatial distribution of conditions in the urban environment, both good and bad, that might have an effect on the level of obesity in these neighborhoods.

**Physical and Natural Environment Analysis**

The first citywide relationship shown on the map on Page 93 includes a layer of all of the parks managed by the Department of Parks and Recreation. Each park was given a ½ mile buffer to represent walking access, consistent with the City’s goal to provide a park within a 10-minute walking distance for every resident. It is clear that much of New York is accessible to parks. Even a layer with ¼ mile buffers around all of the parks covers most of the city. Added to the parks layer are two layers identified as “disamenities” in Chapter Three. Highways not only cause air pollution but also make it more dangerous to walk near them, limiting pedestrian activity. The Department of Transportation also uses traffic accident data to determine how safe it is for pedestrians and bicyclists to travel around the city. While traffic accident data was not available at a small enough scale, truck routes, which are often wide and relatively unsafe for pedestrians, are an appropriate related measurement. This map shows highways and truck routes that limit access to parks, even when most of the city is within the ½ mile buffer. The level of crime is another important factor in how accessible open spaces actually are for pedestrians. The number of personal crimes by NYPD
Obesity rates and increases in New York City neighborhoods
The Bronx, North Central Brooklyn, and Northern Staten Island had the highest obesity rates in 2010 and there are great disparities in obesity rates among neighborhoods.

Obesity rates and increases bar chart (opposite page)
The neighborhoods are organized from greatest increase to greatest decrease in obesity rates from 2003 to 2010.
Source: 2010 and 2003 Community Health Survey
precinct is layered onto this map in a grey hatch.5

Two other layers that were studied in the context of walkability to open spaces were sidewalk coverage and street trees. New York City collects data on both of these layers, but when they were mapped, these layers did not seem to have strong spatial correlations with obesity rates. Different data sets may have more detail on the sidewalks (such as width, quality, etc.) and the trees (condition, etc.) that could further inform this analysis. Even without these layers, we can see a spatial correlation between crime, arterial routes, and obesity, particularly in the Bronx and Staten Island. It is clear that, although much of the city is spatially accessible to parks, these other factors might deter people from traveling to them and using them for regular physical activity.

The second citywide map on Page 94 shows various transit layers. Bus stops are quite ubiquitous throughout the five boroughs. Subway stops, on the other hand, are much more prevalent in Manhattan, less so in the Bronx, Brooklyn, and Queens, and completely lacking in Staten Island. Bicycle infrastructure is also concentrated in Lower Manhattan and northwest Brooklyn, both areas with low obesity rates. This map suggests that there is a relationship between access to alternative forms of transportation and obesity rates, but perhaps subway and bicycle access is more important than bus access in terms of encouraging physical activity. Buses are much slower than subways and their service runs much less frequently. New York City is addressing this issue through the implementation of the Select Bus Service in the Bronx and Manhattan. SBS presents an attractive alternative to new subway lines which are slow to implement and extremely expensive. This analysis suggests that increasing SBS service in areas with limited subway access could help address physical inactivity and obesity. Furthermore, it will be interesting to see how the obesity rates change over time once the new CitiBike bike share program begins in May 2013.

The third citywide map in Page 95 shows the spatial distribution of industrial uses, vacant lots, and highways, all of which are understood to be detrimental to neighborhood walkability, thus reducing physical activity and increasing obesity rates. The strongest correlation exists between the amount of industrial use in an area and obesity rates. This is likely due to the fact that areas

5 Personal crimes include murder, rape, robbery, and felony assault.
When highways, truck routes, and crime are layered on top of the parks layer, areas in which these disamenities overlap are correlated with areas with high obesity rates, particularly in the Bronx and Northern Staten Island.
**Transit access**

Bus stops are ubiquitous throughout the city, but subway stops and bicycle infrastructure are located primarily in areas with lower obesity rates.
Concentrations of industrial use are spatially correlated with higher obesity rates.
around industrial uses are less walkable, not only because of air quality issues but also because of
the quality of the streetscape. Vacant lots occur at a smaller scale and are less clustered throughout
the city, so it is difficult to discern a spatial correlation. Highways with 300meter buffers are perhaps
more strongly correlated with asthma rates than with obesity rates in New York City, though their
existence in relation to open space has already been explored.

Finally, an interesting citywide comparison to examine is the density of supermarkets
and the FRESH designated areas of high supermarket need and discretionery tax and financial
incentives. The map on Page 97 shows all grocery stores in the city (based on NAICS codes) and
the FRESH areas highlighted in grey. There is actually a very high spatial density of supermarkets
in the FRESH designated areas. This result is similar to that of the County Health Rankings, which
showed that all five boroughs have a very low percentage of people with limited access to healthy
food. In the Bronx and Brooklyn, the FRESH areas also correspond to areas with high obesity rates.
Two conclusions might be drawn from this map. The first is that the layers of data included in
the Supermarket Need Index (see Chapter Four) include more than the number of grocery stores
(income, travel behavior, etc.) and are therefore a much better indication of supermarket need
than mere spatial proximity. However, it is not helpful to compare the FRESH areas with citywide
obesity rates since obesity rates were included as a layer of data in the SNI and therefore skew the
results toward areas with high obesity rates.

The second conclusion to draw from this map is that there are many factors that affect the
ability to purchase and consume fresh food other than the number of grocery stores in an area.
These factors include food costs, employment and income, and the size of fresh food outlets. While
the FRESH program is dealing primarily with the size and number of supermarkets, the Healthy
Bodegas Initiative is addressing some of the related issues. This initiative of the DOHMH works
with neighborhood stores and bodegas to increase the availability, affordability, and promotion
of healthier foods including reduced-fat milk and fruit and vegetables. Another component of
the initiative is working with community organizations and residents to increase demand for
The FRESH designated areas have high densities of supermarkets, which suggests that there are other factors beyond supermarket density that are related to healthy food access.
healthier food. The program is being piloted in the District Public Health Office boundaries,\textsuperscript{6} which correspond closely with the FRESH areas, and the results of the initiative should be mapped to determine future steps for further implementation.

**Socioeconomic Analysis**

In previous chapters, there is an underlying possibility that socioeconomic factors such as income and race might override the conditions of the physical and natural environments in their determination of urban health outcomes. The map on Page 99 seems to support this possibility. Two of the areas with the highest percentage of under represented minorities, lowest income, and highest population density are the South Bronx and northern Brooklyn. These areas also have some of the highest obesity rates in the city. This spatial correlation is very strong. However, the Washington Heights – Inwood neighborhood in upper Manhattan has a similar socioeconomic condition and one of the lowest obesity rates in the city. Furthermore, as noted earlier in this chapter, Washington Heights – Inwood also had the greatest decrease in obesity rates between 2003 and 2010. The next section will zoom in on the area outlined in this map to compare elements of the physical and natural environment that might be contributing to the drastic difference in obesity rate when income, race, and population density are held relatively constant.

**Zoomed In Analysis**

The map on Page 101 highlights the two areas of Washington Heights – Inwood in Manhattan and parts of the Fordham – Bronx Park and South Bronx neighborhoods in the Bronx. The first comparison that can be drawn is in the access to subway stations. The light blue \( \frac{1}{4} \) mile buffer around stations shows that, while Washington Heights – Inwood has high access to the subway, large parts of the Bronx lack this access. As mentioned previously, bus stops are present throughout the five boroughs, but subway access might be deemed more important because of its more reliable

\textsuperscript{6} District Public Health Offices were established by the DOHMH in neighborhoods that have the poorest health: South Bronx, North and Central Brooklyn, and East and Central Harlem.
Socioeconomic factors

High percentages of under represented minorities, low income, and high population density are spatially correlated with higher obesity rates, but the area outlined in blue will be explored further because of the unexpected relationships in the Washington Heights - Inwood neighborhood.
and fast service. The Fordham Road Select Bus Service line (installed in 2008) is also shown in blue on this map. Bus rapid transit is a promising tool for enhancing transit access in neighborhoods like the Bronx that are currently underserved by subway infrastructure.

This map also illustrates conditions that are potentially detrimental to the walkability of an area and thus might contribute to higher obesity rates in the Bronx. The prevalence of industrial uses is spatially correlated with higher obesity rates throughout the city, probably due to a corresponding lack of walkable streetscapes in areas closest to industrial parcels. This relationship seems to hold in this map as Washington Heights – Inwood has almost no industrial use and the Bronx area has several clusters. Railroads, shown in black, are also more prevalent in the Bronx than in Manhattan, particularly along the western border of the Bronx.

Highways and truck routes cut through many of New York’s neighborhoods and these two areas are not exceptions. What is worth noting, however, is the relationship between these arterial roads and the location of parks. In Washington Heights – Inwood, there are large waterfront parks that are located around some of the highways, likely counterbalancing the negative effect of this infrastructure on walkability. The photographs on the bottom of the page support this assertion. On the left is Highbridge Park, which intersects with the Cross Bronx Expressway and Washington Bridge on the Manhattan side of the Harlem River. The photograph on the right shows the Bronx side of these bridges with a lack of park space and an extremely unwelcoming pedestrian experience. Locating park space around major arterial roads not only helps to mitigate the air pollution caused by traffic congestion, but it can also contribute to enhancing the streetscape around these roads that might otherwise deter people from walking or bicycling.

The parks in Washington Heights – Inwood are incredibly important assets for the neighborhood. They are historic parks with many recreational facilities, playgrounds, etc. The Vision 2020 NYC Comprehensive Waterfront Plan seeks to provide similar amenities in the Bronx, and is focusing some of its effort on the Harlem River border. It will be important to track how these physical and natural environment changes will affect obesity rates in these Bronx neighborhoods.
Data Analysis

Given the similar socioeconomic conditions of the Washington Heights-Inwood neighborhood and parts of the Fordham-Bronx Park and South Bronx neighborhoods, park access, subway access, industrial use, and highway proximity were studied spatially in the previous mapping analysis. These layers were then extracted from the maps to be analyzed more specifically in relation to obesity rates. One of the limitations of studying park access through a simple buffer is that the actual size of the park is not taken into account. Parks data was thus collected as the percentage of zip code area that is park area. Subway access was determined by the percent of zip code area located within a ½ mile subway buffer. Industrial use was measured as the percent of industrial area in each zip code. And highway proximity was measured as the percent of zip code area located within 300 meters of a highway. Each of these measurements was taken at the zip code level and then aggregated over the UHF neighborhood geographies so that it could be compared with the obesity data from the CHS.

The first round of analysis looked at these four factors compared with the 2010 obesity rates. At the citywide level, very little correlation was found. However, as previously mentioned, the Washington Heights-Inwood neighborhood not only had one of the lowest obesity rates in 2010, but it also had the greatest decrease in obesity rate from 2003 to 2010. Similarly, Fordham-Bronx Park (one of the Bronx neighborhoods in the zoomed in analysis) not only had one of the highest obesity rates in 2010, but it also had the greatest increase in obesity rate from 2003 to 2010. The second round of analysis took this information into account and organized the UHF neighborhoods by obesity rate change over time rather than the 2010 static obesity rate.

The bar chart on Page 104 shows the 22 neighborhoods that saw an increase in obesity rates from 2003 to 2010 in order from greatest increase to smallest increase. Fordham – Bronx Park is first on the list, and the South Bronx is also on this chart. Stronger correlations were found between the negative environmental conditions (industrial area and highway proximity) and an increase in

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7 This data was collected using a spatial join in ArcGIS. A park that intersected a zip code would be given its entire area, even if the whole park did not fit into the zip code, which explains why some of the values are above 100%.
obesity rates. As the bar chart moves from right to left (toward greater increases in obesity rates), there is a trend of higher industrial area and higher proximity to highways until the last six zip codes. This trend supports the expected relationship between industrial use, highway proximity, and greater increases in obesity rates.

An additional layer of demographic information is added to the Upper West Side and Southern Staten Island neighborhoods. These neighborhoods stand out because they are both high income and have low percentages of underrepresented minorities, both social factors that are commonly understood to contribute to higher obesity rates. Despite high income and low minority populations, both of these neighborhoods have some of the highest increases in obesity rates from 2003 to 2010. They do not have high percentages of industrial area or highway proximity, so there are perhaps other conditions of the urban environment that are contributing to this unexpected relationship.

The bar chart on Page 105 shows the 12 neighborhoods that saw a decrease in obesity rates from 2003 to 2010 in order from smallest decrease to greatest decrease. Washington Heights – Inwood is last on the list with the greatest decrease of 32%. Stronger correlations were found between the positive environmental conditions (park area and subway access) and a decrease in obesity rates. While not exact, there is a general trend of higher park area and higher subway access in the areas that saw a greater decrease in obesity. This trend supports the expected relationship between park area, subway access, and greater decreases in obesity rates.

Demographic data was added to the Central Harlem – Morningside Heights and Washington Heights – Inwood neighborhoods because they are both low income with high percentages of underrepresented minorities. Once again, these neighborhoods challenge the expected relationship between socioeconomic status and health. Not only did these two neighborhoods see some of the greatest decreases in obesity rates from 2003 to 2010, but they also have the highest percentages of subway access and park area. These results further support the assertion that conditions of the physical and natural environments can contribute to urban health.

This analysis suggests that there is perhaps more value in analyzing the relationships
Neighborhoods with Increase in Obesity 2003 - 2010
from greatest to smallest increase
Sources: 2010 Census and CHS 2003, 2010

$93,811 median income
23% URM
+57% change

$83,559 median income
12% URM
+65% change
Neighborhoods with Decrease in Obesity 2003 - 2010
from smallest to greatest decrease
Sources: 2010 Census and CHS 2003, 2010

Park Area
Area Near Subway

East Flatbush - Flatbush
Borough Park
East Harlem
Ridgewood - Forest Hills
Upper East Side - Gramercy
Downtown - Heights - Slope
Southwest Queens
Rockaway
Greenpoint
Central Harlem - Morningside Heights
Chelsea - Village
Washington Heights - Inwood

$38,411mi
$35,714 mi
80% URM
79% URM
-32% change
-20% change
between the urban environment and obesity rates in terms of trends over time rather than static obesity measurements. The results also suggest that, while socioeconomic conditions are highly correlated to static obesity measurements and these conditions are very important for urban health in New York City, there are elements of the physical and natural environment that also have some correlation with changes in obesity rates and should be studied further.

Limitations

The biggest limitation of the spatial and data analyses above is the large geography of the UHF neighborhood from which all the correlations (or lack thereof) are drawn. While Census data such as race, income, and population density can be collected at a much finer grain, and GIS data such as parks, land use, and roads can be visualized very specifically, the available health data from the DOHMH only exists at the UHF neighborhood level. Further data collection and research is required to determine whether the correlations observed above actually hold at a smaller geographic level and whether there are even strong correlations that are evident when a more fine-grained analysis is conducted.

A second limitation is the level of data available for the various urban environment layers. New York City is a leader in both collecting data and making it available to the public. However, there are more specific attributes of layers that can better inform the above analysis. Parks data, for example, can include information about the quality of parks, the availability of specific facilities, to what extent they are used, etc. The top photograph on Page 107 shows a Green Street in the South Bronx, which is listed as a park but likely does not do much to encourage physical activity in the area. There are also layers of data that have been collected by independent research groups such as the Columbia BEH Group that city agencies do not have the resources to collect at a comprehensive scale. For example, conducting surveys of streetscapes can provide data on facade conditions, lighting, crosswalks, etc. that can serve as better measurements of neighborhood walkability. The bottom photograph on Page 107 shows a blank facade in the South Bronx that, despite the newly planted street trees and new sidewalk, discourages pedestrian activity on this street. This condition
Green Street, W 170th Street, Bronx

Blank facade, W 170th Street, Bronx
is not captured in the GIS data that is currently available.

Even with the current limitations, there are still spatial and data-driven correlations that can be drawn between park area, subway access, industrial use, and highway proximity and changes in obesity rates over time. Addressing some of these limitation will provide even more specific results that can further inform policy decisions related to active design. Based on the above analysis, the Department of Transportation should increase Select Bus Service in areas with limited subway access. The Department of Parks and Recreation should push forward its plans to enhance the Bronx waterfront, particularly in areas in which the highway and railroad make streetscapes dangerous and uninviting for pedestrians and bicyclists. Streetscape improvement projects should be targeted toward areas with high levels of industrial uses, vacant parcels, highways, and truck routes. Finally, land use decisions regarding industrial uses and others that might be detrimental to walkability should be made with health considerations in mind.

**Future Analysis**

The unexpected relationships in some of New York City’s neighborhoods between socioeconomic conditions and changes in obesity rates raise important questions for future research. It will be interesting to examine further what other conditions of the urban environment might be contributing to the decrease in obesity rates in Washington Heights – Inwood and Central Harlem – Morningside Heights and the increase in obesity rates in the Upper West Side and Southern Staten Island. Looking more closely at Washington Heights – Inwood and Central Harlem – Morningside Heights, it appears that demographic shifts over the last decade could have contributed to the decrease in obesity rates\(^8\), but it is unlikely that socioeconomic status is the only

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8 Between 1990 and 2005, median household income increased from $23,100 to $35,042 for Hispanic residents of Washington Heights – Inwood. This change is notable, but the range is still low. In East and Central Harlem, the percentage of the population that is Non-Hispanic White increased from 11.5% to 17.4% (East) and from 3.5% to 16% (Central) between 2000 and 2010. Center for Latin American, Caribbean & Latino Studies, *Washington Heights/Inwood Demographic, Economic, and Social Transformations 1990 – 2005 with a Special Focus on the Dominican Population*, Latino Data Project (The Graduate Center, CUNY, December 2008); Center for Urban Research, The Graduate Center, CUNY, “Demographic Change in Metropolitan
story to be told in these neighborhoods.

Future research should also include how the policies examined in previous chapters have evolved over time. While the parks of Washington Heights – Inwood are historic, it would be interesting to explore how park usage and access have changed, particularly in the context of the Active Design Guidelines and PlaNYC. This analysis would likely need to include policy changes over at least the last two decades since it takes several years for CHS measurements to reflect changes in the urban environment that affect obesity rates.

Finally, Looking at obesity data alongside measurements of physical activity, asthma rates, and other health conditions would provide a much more comprehensive picture of urban health in New York City. Other relationships can be uncovered, and some of the relationships found in the above analysis might be strengthened or challenged. Finally, the District Public Health Offices collect health data at a finer grain than the CHS and would thus be important resources for future research that could examine more closely the relationships between urban environment and urban health in areas with high obesity rates such as the South Bronx, North and Central Brooklyn, and East and Central Harlem.

Conclusion

The history of urban planning and public health and the need to reconnect these fields with meaningful research, policy, and design were explored in Chapter One. Chapter Two explained the many ways in which the physical, natural, and social environments impact urban health. Chapter Three analyzed the measurements of obesity and the urban environment both generally and in the context of New York City. Chapter Four reviewed New York City’s active design policies in the context of the obesity epidemic and how mapping is used as a tool for research, communication, and policy development. And Chapter Five used New York City data to spatially analyze understood relationships between the urban environment and obesity.

The most important conclusion from this research is that, while the social environment has an impact on urban health, there are other ways for planners and urban designers to intervene in the physical and natural environments. Socioeconomic status is a crucial factor that cannot be ignored in this research. Indeed, a recent New York Times article on Mayor Bloomberg’s attempt to limit the size of sugary drinks sold in certain establishments in New York City highlighted the fact that poverty is rarely taken into account when such policies are considered.\(^1\) The article calls for recognition of poverty as a public health problem in and of itself. This criticism is well founded, but this thesis has shown that addressing poverty is not the only solution available.

Another important conclusion is the powerful role of mapping in the reunification of urban planning and public health. Mapping is already being used by many agencies in New York City, but the information being mapped is often only one type of data describing one type of problem. Further collaboration both among city agencies but also among different departments in each agency is necessary in order to fully understand spatial relationships among the aspects of the urban environment that the government deals with on a daily basis.

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It is also clear from this research that the Active Design Guidelines and related initiatives such as the FRESH Food Program and streetscape improvement projects should not be applied in the same way throughout the city. Some interventions are more necessary in neighborhoods like Fordham – Bronx Park than they are in the Upper East Side. And while parks are spatially ubiquitous throughout the city, the quality of the parks and of the streetscapes around them requires further investigation and thoughtful intervention. And while “Design” is the missing “D” in the Active Design Guidelines, the socioeconomic conditions of each neighborhood must be taken into account when policies are implemented. New efforts related to food access, for instance, should remain aware of the importance of food costs.

Another important neighborhood condition that needs to be considered when implementing active design policies is the level of awareness and capacity for community organizations to not only demand city design services but to apply and compete for them. The DOHMH has programs in place to provide outreach and education to community groups, and the District Public Health Offices have partner organizations in the Bronx, Brooklyn, and Upper Manhattan, but these efforts should be more integrated into the active design policies. The Departments of Transportation and City Planning should take advantage of existing partnerships with community health organizations and work to increase awareness of the relationships between the physical and natural environment and the health conditions that the DOHMH is working to address.

Part of increasing awareness and further establishing New York City as a leader in active design is evaluating policies and initiatives as they are implemented. As this thesis shows, the research on urban health and the conditions that contribute to it is still in the nascent stages. New York City has a unique opportunity to demonstrate changes in urban health conditions that stem from design and policy decisions. Developing more sophisticated ways of measuring the urban environment and tracking these measurements over time will be crucial steps to better understand how planning and design can help to address the obesity epidemic and minimize disparities.

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2 There is a great opportunity to address the geographic disparities in obesity by mapping and understanding urban environmental conditions and targeting interventions where they are needed most.
Identifying best practices and collecting the data to support them will allow New York City to continue to be a model of sustainable and healthful urban planning and design.

Finally, New York City’s active design policies are an important vehicle for transforming our understanding about urban planning and public health. The results of these initiatives can help to build the argument for other cities to include urban health considerations in their planning decisions. The collaboration among New York City agencies that made the Active Design Guidelines possible is commendable, but it will be important for this collaboration to reach beyond a designated team and begin to inform how urban health is discussed by the many disciplines that can have a powerful impact on this issue that affects all New Yorkers. The power of this research rests on the ability of experts in all areas of city government to bring health back into the conversation.

In her article “The Planners’ Century”, Judith Innes writes about planners: “What we do best is make connections – among interest, public agencies, and professions and disciplines; between public and private sectors; and ultimately between government and the public.”3 I would argue that the policies in New York City related to active design and food access are examples of these connections, and that the role of planners and urban designers is to continue to explore the relationship between the urban environment and health in order to connect the dots among agencies and sectors to address the biggest health epidemics and disparities of our time.

**Bibliography**


Geronimus, A T. “To Mitigate, Resist, or Undo: Addressing Structural Influences on the Health of


Neckerman, Kathryn M, Gina S Lovasi, Stephen Davies, Marnie Purciel, James Quinn, Eric


Roe, Matthew. New York City Department of Transportation. Interview by author, April 15, 2013.


