Preface

This chapter summarizes preliminary results from a pilot study that assessed the concentrations of urban traffic-related air pollutants (TRAPs) in recreation spaces in the Southside of Williamsburg in Brooklyn, NY. Local residents refer to this subsection of the neighborhood as “Los Sures.” The study was conducted through a partnership between Tishman Environment and Design Center (TEDC), The New School University in New York City (NYC), and El Puente, a human rights organization located in Los Sures. It builds on previous work in the 1990s, which led to local initiatives that addressed asthma disparities and built community health and social capacities, primarily among an underserved Latino subpopulation (Ledogar et al. 1999, 2000; Corburn 2002, 2005). The aim of the current project was and still is (as it is ongoing) to support advocacy for new and improved open/green spaces and the right to clean air and a safe community. Specifically, it advocates for the funding and development of the BQGreen project (Friends of BQGreen n.d.), which it is hoped will contribute positively to the revival of the neighborhood and social dynamics of the Los Sures community.

Introduction

The imprint of the environmental justice movement, which is historically intertwined with social justice advocacy (Bullard 2000), is documented in the struggles of socially disadvantaged groups, including communities of color and low-income and working-class persons across varied geographies in the U.S. All the way from Houston, TX, which recently experienced a climate–health justice crisis (Buncombe 2017), and Institute, WV to Newark, NJ and Brooklyn, NY, communities and advocacy groups galvanized by the intersections of environmental and social injustices sought to resist, fight, and improve their neighborhood environments (Bullard 2000; Corburn 2005; Baptista 2009; Rivlin-Nadler 2016; Traverso-Krejcarek and Galvez 2017). At the center of these struggles,
which draw attention to harmful intended and unintended urban planning, industrial practices, and public policies, are not only the social disparities that many disadvantaged communities face, but also the health inequities they experience, and urban activism they engage in to transform their neighborhoods and ameliorate adverse urban environmental health outcomes (Corburn 2005, p. 35).

“Urban environmental health” refers to the health challenges, historically and in the present, that populations in cities experience (WHO 1991) and face in the context and concert of global environmental and social changes, including rapid urbanization and a changing climate, which contribute to dual hazards to human health (McMichael 2000; Kjellstrom et al. 2007; Vardoulakis et al. 2016). Urban environmental health challenges and hazards include exposures to lead and toxic chemicals, indoor and outdoor air pollution, urban heat island effect, waste water and solid waste, and infectious disease agents that thrive in communities which lack provision for basic needs, such as water and sanitation services (WHO 1991; Kjellstrom et al. 2007). Other health challenges of urban environments include those linked to the built environment, including walkability and neighborhood design, which affects physical activity and access to healthy foods, and contributes to a myriad of chronic conditions, such as diabetes, weight-related problems (e.g. overweight and obesity), and cardiovascular diseases (Hilmers et al. 2012; Xu and Wang 2015). Furthermore, the urban built environment, coupled with social stressors, contributes to adverse maternal and infant health outcomes, such as pre-term and low-birthweight babies (Grady 2006; Grady and Ramirez 2008; Nowak and Guirguescu 2017).

Urban exposures are unevenly distributed among city populations, which in turn contributes to environmental health disparities across neighborhoods. In New York City, health disparities are well documented in the urban ecological landscape of the city’s five boroughs, where populations face multiple chronic conditions, which concentrate in a few neighborhoods (CUNY School of Public Health 2015). While policies since 2000 have improved the urban living conditions of residents, health disparities persist. According to the CUNY School of Public Health (2015), health inequalities disproportionately affect communities of color and low-income groups, and a baby born to a Black mother in New York City is three times more likely to die in the first year of life than a baby born to a white mother. Residents of the South Bronx and East Harlem have hospitalization rates for diabetes eight times higher than those living on the Upper East Side of Manhattan or in Soho.

(p. 3)

In this chapter, we focus on community engagement and action to address air quality risk in Los Sures, Williamsburg, Brooklyn, and concerns about asthma, which is a respiratory chronic condition that disproportionately affects urban minorities, particularly children, and women of color. Los Sures borders the eastern edge of north-central Brooklyn, which is one of three areas in NYC of “high need” for public health action. There, several neighborhoods have high rates of emergency room visits and hospitalizations for asthma, as well as the highest rates of asthma in children (SUNY Downstate Medical Center 2011). Of major concern to the community of Los Sures is the level of urban TRAPs that persist in their neighborhood, particularly along recreation spaces and parks adjacent to the Brooklyn–Queens Expressway. TRAPs are major contributors of fine particulate matter emissions, which have been linked to high rates of asthma, as well as cardiovascular disease and other respiratory-related illnesses, and are unevenly distributed in NYC (Kheirbek et al. 2016). The community members of Los Sures have been well aware of air quality and asthma issues since the 1990s, when action led by El Puente was taken to assess asthma in their neighborhood and implement their own health initiatives (see Ledogar et al. 1999; Corburn 2005). Therefore, the main motivation and objective of this pilot study were to build upon previous work and contribute to a community-engaged project that addresses the current needs of the Los Sures community, i.e. air quality concerns.
In the following section, we present the air pollution and asthma background necessary to understand the motivation of the project, followed by the approach and conceptual framework that underlie and guide the project and analysis of results. The chapter then discusses the methodology for data collection, which was co-designed by El Puente and TEDC. Finally, we discuss the results of the pilot study, including the composition and context of the population and conclusions, with a summary, and set out future directions for research and advocacy.

Air Pollution and Asthma Background

Global to Local Air Pollution

Ambient air pollution is the cause of an estimated 3 million premature deaths a year worldwide (WHO 2016), many of which are associated with cardiovascular diseases, lung cancer, and chronic and acute respiratory-related illnesses. According to a WHO (2016) assessment, urban areas experience the brunt of air pollution impacts. In world cities like New York, where the population exceeds 8.5 million, air pollution remains a significant challenge despite air quality improvements in the last few decades (Kheirbek et al. 2017). As Figure 31.1 shows, from 2009 to 2016 the five boroughs of NYC all indicate declines in fine particulate matter ($\text{PM}_{2.5} [\mu \text{g/m}^3]$), which is the most dangerous urban air pollutant (CDC 2017a). $\text{PM}_{2.5}$ is composed of fine particles, in either solid or liquid form, that measure at or under 2.5 micrometers. They may consist of dirt, soot, dust, or smoke, and either be emitted directly from various anthropogenic and natural sources, such as construction sites and fires, or be indirectly formed through chemical reactions with other air pollutants emitted into the atmosphere from industrial activities and vehicles (EPA n.d.). Of important concern is the geographic pattern of distribution. While concentrations have gone down, ambient $\text{PM}_{2.5}$ levels remain consistent in the same boroughs. The Manhattan and Bronx boroughs have the highest mean $\text{PM}_{2.5}$ concentrations, followed by Brooklyn and then Queens and Staten Island.

At the sub-borough level, the uneven geography of $\text{PM}_{2.5}$ in NYC becomes even more apparent. Figure 31.2 is a map of the annual average concentration of $\text{PM}_{2.5}$ from 2009 to 2015 at the community district level (i.e. neighborhood). Generally, neighborhoods across Manhattan have the highest values, along with the south and west sections of the Bronx, central and northwest Brooklyn, and part of northwest Queens. Based on a recent study across the five boroughs, high concentrations of urban air pollutants such as $\text{PM}_{2.5}$ are strongly associated with high density of urban traffic, buildings, heat and hot water boilers, and industrial activity (Kheirbek et al. 2016, p. 12, 2017). Of major concern are TRAPs from on-road vehicles, which contributed 1,817 tons of $\text{PM}_{2.5}$ in NYC during this same time period (Kheirbek et al. 2016, p. 5). Among on-road vehicles the most significant are trucks and buses, which accounted for 12.8% of primary emissions. Figure 31.3 shows the relationship between $\text{PM}_{2.5}$ annual average (2015) and traffic density (2016)—annual vehicle miles traveled for trucks expressed as million miles per square kilometer—across neighborhoods in NYC. As the figure suggests, truck traffic in NYC appears to concentrate in and correlate with the neighborhoods that have high $\text{PM}_{2.5}$ levels. Such exposures to urban TRAPs contribute to significant public health problems in NYC. For example, Kheirbek et al. (2017, p. 23) estimated that there were approximately 870 hospitalizations, 320 premature deaths, and 5,850 years of life lost per year from 2009 to 2015 across NYC as a result of TRAPs exposures.

Asthma in New York City

Asthma is a significant urban health problem. In the U.S., the prevalence of asthma has been increasing (see Figure 31.4). It is a chronic disease that affects the lungs and when exacerbated may cause wheezing, making it difficult to breathe (CDC 2017b). Nationally, there were close to 25 million
people living with asthma in the U.S. as of 2015 (CDC 2017c). In NYC, asthma estimates show that 3.7% of adults (18 years and older) and 6.1% of children (under 12 years old) had reported asthma in the previous 12 months in 2014 and 2009, respectively (NYC Environment and Health Data Portal). For youths and adults (15 years and older), there were 115.7 emergency department visits per 10,000 residents (age adjusted) and 21.6 hospitalizations per 10,000 (age adjusted) in 2014. As with air pollution, the spatial distribution of asthma within the city is uneven among its residents. Figure 31.5 shows age-adjusted rates of asthma hospitalizations for youths and adults (15 years and older) in the five boroughs of NYC. Prevalence is highest in the borough of the Bronx (224.7), followed by Brooklyn (119.9) and Manhattan (110.3).

Within the city at a finer scale, the highest rates are found in areas known notoriously as “asthma alleys” (e.g. Goldstein and Arthur 1978; SUNY Downstate Medical Center 2011, p. 2; Yerman 2015). These areas of no coincidence are also located where Health Action Centers (formerly known as District Public Health Offices [DPOs]) have been established to address the urban health problems of residents in “high-need” neighborhoods in Manhattan, the Bronx, and Brooklyn (NYC Health n.d.a), where clusters of other chronic diseases exist and social and physical environmental neighborhood conditions are less than optimal. Like urban TRAPs, asthma prevalence is entrenched in certain neighborhoods in NYC.
Figure 31.2  Annual average PM$_{2.5}$ (2009–2015) in NYC by community district, based on quantile classification. Map by Jieun Lee. Data from NYC Environment and Health Data Portal.
Among boroughs, Brooklyn reportedly has some of the highest rates of asthma. According to a report in 2011 (SUNY Downstate Medical Center 2011, p. 2), three Brooklyn neighborhoods were identified as “asthma alleys” because of their higher rates of asthma in terms of emergency department visits and hospitalizations compared to other parts of NYC. These neighborhoods located in north and central Brooklyn are Bedford Stuyvesant–Crown Heights, East New York, and Williamsburg–Bushwick. Overall in Brooklyn, there are disparities among groups and neighborhoods. For example, adult women and non-Hispanic Blacks and Hispanics reported the highest asthma rates. Also, children younger than five and adults older than 65 are most susceptible in terms of emergency department visits (U.S. estimates for 2006 to 2008; see Moorman et al. 2011). In Williamsburg–Bushwick, 6.3% of the population reported asthma (2014 estimate), which is 2.1 and 1.7 times higher than in Brooklyn and NYC (NYC Environment and Health Data Portal). The outcomes are worse when examining emergency department visits and asthma hospitalizations for youth and adults. Emergency department rates in Williamsburg–Bushwick (259.3 per 10,000 residents) were 2.2 times higher than rates in Brooklyn and NYC, and this is similar to disparity ratios for asthma hospitalizations (2.1 times higher).

Figure 31.6 shows asthma prevalence in NYC, measured as percentage prevalence in 2015. Although the data are limited to adults (18 years and older), the figure does offer a glimpse of asthma
Figure 31.4  Asthma prevalence in the U.S. (all ages) from 2001 to 2016.

Data source: CDC (2017b).

Figure 31.5  Age-adjusted rates (per 10,000 residents) of asthma hospitalizations for youths and adults (15 years and older) in the five boroughs of NYC from 2005 to 2014.

Source: NYC Environment and Health Data Portal.
Figure 31.6  Asthma among adults (18 years and older) in 2015 measured as percentage prevalence across NYC’s five counties (census tract level), based on quantile classification.

Map by Jieun Lee. Data from CDC (2017d).
disparities across the city at a finer scale (census tract level). The concentration of asthma is found in areas described earlier, including the “asthma alleys” and southeastern Queens. Also highlighted is the pilot study area, Los Sures, which borders the eastern part of the neighborhood Williamsburg–Bushwick, or the southern section of the neighborhood Greenpoint–Williamsburg, depending on which definition of neighborhood one chooses. In this study, for data and mapping purposes, we mainly utilize the community district Greenpoint–Williamsburg as the neighborhood associated with Los Sures.

**Fine Particulate Matter, Asthma, and Social Context**

Air pollutants such as PM$_{2.5}$ penetrate the lungs and bloodstream, which means they can cause great harm, particularly among vulnerable groups. PM$_{2.5}$ can cause inflammation of airways, which can exacerbate asthma (NY Department of Health 2018) and even contribute to the onset and incidence of this chronic disease (Guarnieri and Balmes 2015). The most vulnerable populations to PM$_{2.5}$ exposure are infants, children, seniors, and persons with preexisting chronic conditions such as heart and lung disease and asthma (CDC 2017a). Children with allergic sensitization are most susceptible (Mann et al. 2010). Long-term exposure can even lead to a decrease in lung function (Paulin and Hansel 2016). In NYC, fine particulate matter contributes to significant morbidity and mortality of asthma. Based on 2009 to 2011 estimates, ambient PM$_{2.5}$ annual concentrations and subsequent human exposure contributed to 2,400 and 3,600 emergency department visits associated with children (under 18 years) and adults (18 years and older) suffering from asthma in NYC (Kheirbek et al. 2013, pp. 22–23). Trucks and buses and their contributions to urban TRAPs are most connected with adverse health outcomes (Kheirbek et al. 2016). In terms of asthma, researchers have shown that rates may increase with the proximity of residents to urban traffic (Lindgren et al. 2016).

As noted earlier, the geography of urban TRAPs is uneven and concentrated in certain neighborhoods. Patterns of PM$_{2.5}$ and asthma are no coincidence and tend to overlap with neighborhood social disparity, for example as measured by income poverty. Figure 31.7 is a map of neighborhood poverty for 2011–2015 at the sub-neighborhood scale in NYC. Generally, areas with a large segment of the population living on annual income that falls below 100% of the federal poverty level are places within the catchment of the NYC’s Health Action Centers. Figure 31.8 shows the relationships between neighborhood poverty, traffic density (million miles traveled per square kilometer), and asthma rates of hospitalizations (youth and adults) in NYC. As the figure suggests, traffic density (top panel) and asthma (bottom panel) both increase with neighborhood poverty (for 2009–2013), and these relationships are persistent across time (asthma shown only for 2001, 2008, and 2014). For example, the medians of traffic density and age-adjusted asthma rates were 1.4 and 4.1 times higher in high-poverty neighborhoods compared to low-poverty neighborhoods. More recently, Kheirbek et al. (2016) showed that PM$_{2.5}$ concentrations associated with TRAPs were strongly associated with high-poverty neighborhoods (approximately 70% higher than for low-poverty neighborhoods), supporting previous observations that socioeconomically poorer places of residence experience greater concentrations of higher traffic air pollution. Consequently, these harmful exposures in high-poverty neighborhoods were attributed to disproportionate asthma morbidity. For example, emergency department visits were 8.3 times higher relative to low-poverty neighborhoods (Kheirbek et al. 2016, p. 6).

According to public health officials, the reasons for higher asthma rates in Brooklyn, for example, are associated with the management of the disease and/or air pollution (SUNY Downstate Medical Center 2011). Furthermore, although the specific causes of asthma are not well understood, it is clear that the prevalence of this chronic respiratory disease is multifactorial (WHO n.d.; see Subbarao et al. 2009 for a review). Therefore air pollution is only one of several factors associated with asthma risk that must be considered. Moreover, PM$_{2.5}$ is one among many outdoor
pollutants, for example ozone, nitrogen dioxide, sulfur dioxide, and black carbon, that contribute to hospitalizations for respiratory conditions like asthma (Kheirbek et al. 2017). Other known risk factors include genetic predisposition, environmental exposures outside the home (e.g. pollen) and inside the home (e.g. tobacco smoke, mold, mice, cockroaches, and dust mites [Kanchongkittiphon et al. 2014]), immune responses (i.e. hygiene hypothesis), diet, stress, gender, and socioeconomic status (Subbarao et al. 2009). The latter factor more broadly relates to the inequality of social determinants of health (Williams et al. 2009). Such factors may reflect characteristics of population vulnerability linked to neighborhood social, physical, and service environments that affect where one lives (e.g. housing), how one lives (e.g. housing, heat, and food), and access to healthcare and other social services.

**Approach and Conceptual Framework**

This pilot study, conducted through a collaborative partnership between TEDC, The New School, and El Puente, was guided by principles of global and environmental justice and a community-based participatory approach.
Figure 31.8  Relationships between (a) traffic density (million miles traveled per square kilometer) in 2016 and neighborhood poverty and (b) age-adjusted rate of asthma hospitalizations (youth and adults) per 10,000 residents in 2001, 2008, and 2014 and neighborhood poverty. The neighborhood poverty estimate is based on ranks of three equal groupings. Neighborhood is defined according to administrative boundaries set forth by the United Hospital Fund definition.

Data source: NYC Environment and Health Data Portal.
Principles of Justice

El Puente’s fundamental principles of creative justice and transformative community building were key guides to this project, and they included: creating community, holism, unity through diversity, creativity, and collective self-help (El Puente 2017). The latter principle highlights the fact that communities such as those residing in Los Sures, Williamsburg are seeking self-determination and community capacity building that will enhance and positively transform community resilience within their neighborhood. For example, rather than have solely researchers or students from The New School conduct the study (as experts), El Puente argues that community members should be the principal participants and citizen scientists conducting the study with collaboration from external partners like TEDC to assist with but not be limited to the scientific and technical aspects. In doing so, El Puente asserts what founder Luis Acosta strongly believes, that “science should be used as an instrument for collective self-help” (Ledogar et al. 1999, p. 1796).

The second key set of principles for the project was the Jemez Principles for Democratic Organizing (Southwest Network for Environmental and Economic Justice 1996). These principles emphasize the importance of working in solidarity and mutuality, letting communities speak for themselves, inclusivity, self-transformation, and building just relationships. Such principles ground the environmental justice and community academic partnerships fostered by TEDC, and are strongly aligned with El Puente’s creative and transformative justice philosophy and practice. In the process, TEDC modeled an approach to academic and community partnerships that can produce pedagogical and research benefits for all participants. The foundation of the model is a co-production framework popularized as “citizen science” and pioneered by environmental justice groups like El Puente in the 1990s. Co-production implies several benefits for participants, including epistemological contributions that improve environmental policy and produce practical solutions as well as improving procedural and distributive justice overall. Furthermore, by integrating environmental and social justice with spatial thinking, this pilot study adopts a practice of community-engaged geography (see Reynolds and Cohen 2016 for an excellent critical analysis on urban agriculture and food justice).

In adopting such principles of justice, the project undertaken contributes to a practice of community engagement and equity that works towards a collaborative process of scholarship that is cross-cutting, reciprocal, and mutually beneficial (Fitzgerald et al. 2005). “Cross-cutting” refers to the notion that engagement contributes to and is part of teaching, research, and service. “Reciprocal and mutually beneficial” refers to a bi-directional relationship of information and benefits. It suggests that knowledge is generated with partners and that this process is transformational for society.

Community-Engaged Approach

The collaborative partnership between El Puente and TEDC and their underlying principles called for a scholarly approach that would engage and bridge community members with academics, facilitate a just participation, and emphasize and value local community knowledge. Thus, a community-based participatory action research approach was employed. This research philosophy stems from the Latin American tradition of community participatory action research pioneered by Chambers (1994), which emphasizes research as a process of education and pedagogy that should encourage social transformation (Corburn 2005). In particular, the approach to community-based participatory action research that influenced this study was the “street science” lens to urban environmental health justice. Developed by Corburn (2005), and influenced by Freire (1970), it emphasizes the importance of local community knowledge and action and was employed to document and frame community efforts for environmental health justice by El Puente and other organizations in Brooklyn, NYC (Corburn 2005). Street science asserts that local participation is meaningful and critically valuable not only to understand vulnerability and health but also to provide actionable solutions led by the
residents who are most affected by inner-city problems. In alignment with El Puente and TEDC’s principles of justice, the street science approach asserts that communities are experts too (in addition to public health practitioners and epidemiologists), since they experience and observe firsthand disease burdens in their communities. Thus, community members participate as equal partners, contributing to study design, information collection, and data analysis (Corburn 2002), and importantly better affect decision-making that can potentially benefit the Los Sures community.

**Conceptual Framework**

This pilot study, guided by principles of justice and a community-engaged approach, was set within a broader analytical framework that integrates urban health (Galea et al. 2005) with the human ecology of disease (Meade and Emch 2010) to understand urban environmental health vulnerability of air quality and asthma. Figure 31.9 shows a preliminary conceptualization of the framework. From this lens, urban environmental health consists of intersecting components that include the urban physical,

![Figure 31.9 Preliminary conceptualization of urban environmental health.](image)

*Note: The illustration is for heuristic purposes only.*
social, and service environments influenced by ecological interactions between population, their behavior and culture, and the habitat ("place") in which people live, work, and play.

The urban physical environment describes physical ("natural") and built environment characteristics of cities composed of “community-level” and “proximal” factors (Klitzman et al. 2006). “Community-level” refers to indirect urban exposures such as the built environment including infrastructure (e.g. water, sanitation, and transportation systems) and buildings, land-use patterns (how cities are planned, zoned, and designed), and density of the population (growth and population change, which have implications for all previous subcomponents). Proximal factors are conceived as direct urban exposures such as the air, water, weather and climate, pollutants, and noise which many residents encounter in city environments. Proximal community-level factors mediate the impacts of community-level factors on the urban health of populations (Klitzman et al. 2006).

The urban social environment encompasses the social processes that affect health at the neighborhood and individual levels, and includes much more than socioeconomics or income poverty. Urban social environments are made up of pathogenic (negative) and salutogenic (positive) pathways that may contribute to population behavior, norms, and interactions that promote healthy and unhealthy outcomes in cities (Coutts and Kawachi 2006). Such pathways include “social networks, social capital, segregation, and the social support that interpersonal interactions provide” (Galea et al. 2005, p. 1026), which may aggravate vulnerability conditions of communities or build their resiliency. The social environment is intricately linked to the physical environment, and therefore the impacts of social processes are not only seen in urban health outcomes but also manifested in the urban landscape, for example urban blight, which serves as an indicator of neighborhood conditions and potentially the type of health outcomes observed in a community. The service environment covers health and social services, including public health efforts that address HIV and tuberculosis prevention, asthma management, family planning, and food insecurity. Many services serve residents without health insurance (e.g. safety-net hospitals and clinics) (Galea et al. 2005). The service environment also includes the Health Action Centers described earlier, which address health disparities in high-need neighborhoods in NYC.

Set within the human ecology of disease (Meade and Emch 2010), which is complementary to the urban health concept of Galea et al. (2005), urban environmental health considers: the biological and individual-level composition of a population, including age, gender, genes, and health status and history; the behavior and culture of populations, or how communities socially interact and are organized, which may be influenced by politics and economics; the habitat of populations, where physical, social, and built environments converge; and the interactions of all three in a “place” at multiple scales. At the center of this framework is the vulnerability of populations to urban hazard exposures in their communities, how sensitive populations are to hazard exposures, and how resilient those populations are to hazard exposures, including population recovery and public health responses, adjustments, and adaptations (based on Ebi et al.’s 2006 components of health vulnerability).

**Study Design**

Initially we proposed conducting focus groups to understand local community health needs and perceptions. The aim was to collect some initial feedback from the community on air quality, asthma, and other health issues with the longer-term goal of writing a grant proposal with the community for a comprehensive study. However, after discussions with El Puente, we realized the community need was to document air quality in the neighborhood for the purpose of evidence-based advocacy that would support an ongoing campaign for cleaner and safer recreation spaces and parks. Hence, the research team decided to collect measurements, with the community (El Puente) leading the investigation, and technical and conceptual guidance from TEDC and a partner at Farmingdale State College of SUNY.

Several community-level methodologies were reviewed to meet the objectives of this study (e.g. Kinney et al. 1999; Maantay 2007). For example, the work of Northridge et al. (1999) and Kinney
et al. (1999) and nonprofit organization WE ACT for Environmental Justice (WE ACT n.d.) was inspiring because it was among the first studies to conduct community-based epidemiological investigations of TRAPs. Through collaboration with WE ACT, Kinney and authors implemented a pilot study that examined temporal and spatial variations in sidewalk concentrations of \( \text{PM}_{2.5} \) in West Harlem, located in northern Manhattan. Using mobile air quality monitors and traffic counters at four intersections, a team composed primarily of community members and one scientist collected data over five days within a period of 13 days. These studies discovered that the main sources of \( \text{PM}_{2.5} \) were diesel exhaust. However, because of funding, resources, and time constraints, this (our) pilot study took a practical approach to design and implementation. It was therefore co-designed and coordinated so that the study could support the ongoing efforts of an El Puente community survey of recreation spaces and parks (i.e. open/green spaces).

**Study Area**

This pilot study was situated in Los Sures, which is a sub-area located in the south of the neighborhood known as Williamsburg, Brooklyn (see Figure 31.10). It consists of nine census tracts and a population of 40,616 across 1.84 square kilometers. It is a gentrifying neighborhood undergoing rapid social changes with a strong history of Puerto Rican and Dominican Republic culture and heritage (Elizalde 2013, 2017; Haas 2016).

Four neighborhood parks were selected by El Puente based on proximity to the Brooklyn–Queens Expressway, neighbor traffic, and cultural relevance. These were: 1) LaGuardia Playground; 2) Marcy Green; 3) Rodney Park; and 4) Jaime Campiz Playground. All of these parks are important recreation spaces, particularly for youth, mothers, and their children (see Figures 31.11 and 31.12 for corresponding roadways and park). Hence, many young children, who are a population of concern when it comes to asthma, are potentially exposed on a daily basis to air pollutants emitted from the high traffic density in the area.

![Figure 31.10 Map of study area including park sites.](Map by Jieun Lee.)
Figure 31.11  Images of study site neighborhood parks with corresponding roadways associated with the Brooklyn–Queens Expressway. LaGuardia Playground (left panels), which is south of El Puente and adjacent to the Brooklyn–Queens Expressway; and Marcy Green (right panels), which is located between S. 4th St. and S. 5th St. on Marcy Ave.

Photos by Andreah Santos and Milagros De Hoz (bottom right panel).
Objectives and Methods

The objectives of this pilot study were: 1) to collect environmental data including PM$_{2.5}$ (µg/m$^3$), ambient temperature (°F), relative humidity (%), and noise (decibels) using mobile air quality monitors called Airbeams (Figure 31.13); 2) to count trucks using an online app; 3) to use GIS to map the study area composition and context; and 4) to calculate summary statistics and ratios comparing the Airbeam mobile data with publicly available data from the NY State Department of Environmental Conservation (NY DEC). The last objective is particularly important, because it not only provides some preliminary scientific evidence for advocacy but also compares the Airbeam mobile data with hourly measurements from the local NY DEC monitor (Figure 31.14), which informs an air quality index that advises the public of air pollution conditions and potential risks to public health. The NY DEC monitor is some distance (3.4–3.9 km) from the study area and therefore may not accurately characterize air quality conditions for local residents in Los Sures. For the purpose of this chapter, we present only the PM$_{2.5}$ results.\footnote{5}
Figure 31.13  Airbeam mobile monitors and app for air quality and other environmental variables.  
Source: HabitatMap (n.d.).

Figure 31.14  Map of NY State DEC monitoring sites.  
Data collection was principally undertaken by high school students associated with El Puente’s afterschool program and supervised by El Puente staff and undergraduate and graduate students from the New School’s Eugene Lang College and Milano School of International Affairs. Prior to data collection, all staff and students were trained to use the monitors with assistance from HabitatMap. Data collection was done by a team of two people across four parks over a period of five weeks (nine days total) on Mondays and Wednesdays for usually at least one hour in the late afternoon in October and November of 2016. The schedule with total minutes and number of observations is given in Table 31.1 (example from LaGuardia Park is shown). In addition, mobile air quality data (not shown in this report) were collected by several volunteers from a nonprofit called Mothers Out Front.

Demographic, social, and health data datasets at the census tract scale were downloaded from the U.S. Census (2017), 500 Cities (CDC 2017d), and the Social Vulnerability Index (CDC 2017e), and hourly PM$_{2.5}$ data from the NY DEC (2017). All variables except for particulate matter were visualized as choropleth maps generated in ArcGIS (version 10.5; ESRI 2017). Data averages and ratios for PM$_{2.5}$ were calculated in Microsoft Excel. Comparison ratios were calculated by dividing the park average for each day by the NY DEC average local monitor of PM$_{2.5}$ from the average of measurements between 4 and 5 p.m.

### Preliminary Results

Figures 31.15 and 31.16 show several variables that represent the demographic composition and socioeconomic context of Los Sures within Greenpoint–Williamsburg in Brooklyn (Kings County). According to the 2010 U.S. Census, Los Sures is predominantly composed of non-White Hispanics (Figure 31.15 [a]) and non-Hispanic Whites (Figure 31.15 [c]). The Hispanic population is concentrated in the southern section of the study area and increases in percentage as one moves east towards the area of high need in north-central Brooklyn. For reference, this concentration of Hispanics is also in proximity to recreation spaces along the Brooklyn–Queens Expressway, where we collected air quality data. Non–Hispanic Blacks (Figure 31.15 [b]) tend to live outside the study area, concentrating in eastern southeast Greenpoint–Williamsburg, whereas residents of Asian descent (Figure 31.15 [d]) are living in the northwest of the study area, but mainly outside in north Greenpoint–Williamsburg and just east of Los Sures. Regarding socioeconomic context, disparities are clearly evident in the southeast of Los Sures and in general in the south of Greenpoint–Williamsburg. Generally, the percentage of the population living in poverty (Figure 31.16 [a]) is highest there compared to the north. Furthermore, many residents are without health insurance (Figure 31.16 [b]) in the south and far east of Greenpoint–Williamsburg. Both variables suggest a limit of capacity to adequately respond to public health concerns.

### Table 31.1 Data collection schedule with total minutes and number of observations (LaGuardia example)

<table>
<thead>
<tr>
<th>Week</th>
<th>Day</th>
<th>Date</th>
<th>Time begun</th>
<th>Time ended</th>
<th>Total minutes</th>
<th>No. of observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>10/24/2016</td>
<td>4:11:18</td>
<td>5:13:10</td>
<td>62</td>
<td>3,180</td>
</tr>
<tr>
<td>2</td>
<td>M</td>
<td>10/31/2016</td>
<td>4:31:27</td>
<td>5:19:27</td>
<td>48</td>
<td>2,467</td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>11/2/2016</td>
<td>4:08:30</td>
<td>5:11:58</td>
<td>63</td>
<td>3,251</td>
</tr>
<tr>
<td>3</td>
<td>M</td>
<td>11/7/2016</td>
<td>4:19:22</td>
<td>5:08:08</td>
<td>49</td>
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Figure 31.15  Maps of the demographic composition as a percentage of population in Greenpoint–Williamsburg (census tract level) in 2010: (a) Hispanic, (b) Black, (c) White, and (d) Asian, based on quantile classification.
Maps by Jieun Lee. Data from U.S. Census.
Maps by Jieun Lee. Data from U.S. Census; and CDC (2017d).
In terms of asthma (Figure 31.17), prevalence among adults (18 years and older) in 2015 was highest in the south compared to the north part of Greenpoint–Williamsburg. For example, asthma prevalence was approximately between 9.7% and 11.5% in the southeast census tracts (n=2) of the study area, which border the study site parks. These prevalence estimates among adults are approximately 3.2, 2.6, and 1.3 times higher than asthma estimates for Brooklyn, NYC, and the U.S. (based on estimates from 2014 data in NYC Environment and Health Data Portal; and national estimates for 2015 from CDC 2017c). Although difficult to compare because of the time difference (about 20 years), scale (census tract versus block), and measurement (adults defined as 15 to 34 years), these estimates for 2014–2015 relative to an El Puente survey taken in 1999 highlight the fact that asthma remains a potential health problem in the community. In 1999, the organization found that 9.3% of residents aged 15 to 34 (n=1011) reported asthma, defined as having symptoms, taking medication, or visiting the emergency room in the previous 12 months. In this older survey, it was also found that 73.0% of residents (all ages) relied on Medicaid and 45.0% did not have health insurance. Furthermore, it was observed that, within the Hispanic population, residents of Puerto Rican descent were at higher risk (2.5 times higher) than those of Dominican Republic descent, and that women who were 25 years and older (Puerto Rican and Dominican) had a higher prevalence than younger women (estimates were reported by Corburn 2005, pp. 130, 133). Sadly, these 1999 survey estimates reflect more recent national estimates of asthma disparities which note that, among the Latino population, Puerto Ricans are disproportionately affected by asthma and so too are women in general (Moorman et al. 2011; CDC 2017c).

Figure 31.17 Map of asthma among adults (18 years and older) in 2015 measured as prevalence percentage in Greenpoint–Williamsburg (census tract level), based on quantile classification.
Maps by Jieun Lee. Data from CDC (2017d).
Fine particulate matter (PM$_{2.5}$) was the main focus of this pilot study. Figure 31.18 shows the average, maximum, and minimum values for PM$_{2.5}$ for each of the study site parks. Preliminary results suggest that the highest PM$_{2.5}$ values (average and maximum) were observed in the LaGuardia Playground (a) and Marcy Green (c), which El Puente identified in an initial report (Traverso-Krejcarek and Galvez 2017). In these parks, PM$_{2.5}$ values exceeded the National Ambient Air Quality Standard (35 µg/m$^3$) for a 24-hour period on four separate days (considering the maximum) in each park. At Rodney Park (d), PM$_{1.5}$ values exceeded the National Ambient Air Quality Standard on three separate days. Jamie Campiz (b) data were incomplete, and values appear to be lower. Given the limited observations without taking into account other variables such as air temperature, wind direction, and relative humidity, it is uncertain what the broader pattern of air quality is in these neighborhood parks. Still, given the time of day (late afternoon) and year (fall), it is possible to speculate that PM$_{2.5}$ values are even higher in the morning during rush hour and vary by season.

Table 31.2 compares the mobile PM$_{2.5}$ measurements at the study site parks with data from the local NY DEC monitoring site, which assigns one value to several neighborhoods (e.g. Greenpoint–Williamsburg and Bushwick). As the ratios suggest, in many instances (shaded in the table), neighborhood park data were much higher, sometimes twice as much, compared to the NY DEC monitor. For example, the greatest differences were observed at LaGuardia Playground (two times higher on four days), which was noted earlier. Marcy Green and Rodney Park also recorded great differences relative to the NY DEC data. It was observed that three days stood out in terms of differences relative to the NY DEC monitor: November 2, 9, and 28. Although the NY DEC average measurement was within the National Ambient Air Quality Standard, the data collected by the research team...
suggest that the publicly available data by NY DEC may underestimate the true air quality conditions faced by local residents in Los Sures and likely neighboring areas.

**Summary and Conclusions**

Using a community-engaged approach and principles of justice, TEDC and El Puente embarked on a pilot project that focused on research examining local air quality (TRAPs) in four neighborhood parks adjacent to the Brooklyn–Queens Expressway in Los Sures, which is an area located in the Southside of Williamsburg, Brooklyn in NYC. Pilot study results indicate that air quality (based on PM$_{2.5}$) in three of the four neighborhood parks exceeded levels set by the National Ambient Air Quality Standard as harmful. Furthermore, it was observed that PM$_{2.5}$ estimates varied from park to park, even though the parks are relatively close to one another within the neighborhood. One reason for the variability may be the proximity of sources of air pollution to each park. For example, the LaGuardia Playground had the highest estimates, which could be explained by its location, as it is closest among the parks to a bus depot, the Brooklyn–Queens Expressway, and the Williamsburg Bridge. In addition, the neighborhood park data of PM$_{2.5}$ estimates were at least two times greater on several days during the study period when compared to the local NY DEC monitor. Further analysis (e.g. more days for observation comparing seasons; and more times of the day, including mornings, which may have heavier traffic) is needed to examine and support these patterns of air quality observed, in part because of instrumentation differences. Furthermore, it will be necessary to examine the ambient pollution measurements with actual exposure of residents to PM$_{2.5}$ and subsequent health effects (e.g. asthma prevalence). Nevertheless, these preliminary findings suggest some evidence to support the advocacy campaign. Moreover, it highlights the limits of publicly available data of NY State, which cannot capture local conditions and spatial variability accurately, and may underestimate the air quality risk in communities such as Los Sures. In addition, the composition and context of the study area population highlight that asthma is a potential health problem set within a wider social and health context, which requires further study. Thus researchers, practitioners, and community organizers should consider for investigative and advocacy purposes that air quality risk is part of a broader urban health problem, where environment, health, and social problems intersect.

This study followed a co-production model for the identification of research questions, project design, implementation, and data collection. The broader aim of the study was to enhance existing capacities and build alliances for social, health, and environmental justice in the spirit of community.
engagement and principles of justice. El Puente has a long history of fighting for urban environmental health justice and fostering community cohesion and capacities in Los Sures; this includes supporting a high school and middle school, maintaining community gardens, and sponsoring and creating art for activism (see Figures 31.19 and 31.20). Thus we emphasize that El Puente and its community and its partnerships with organizations such as TEDC are important for empowering youth and local residents who have felt the effects of dramatic social and economic changes (i.e. gentrification) in their neighborhood. By using public health and environmental science, as well as

Figure 31.19  Earth Spirit Community Garden on 2nd St. located between Roebling St. and Driggs Ave. This is an El Puente partnership site.
Photos by Jieun Lee.
spatial thinking, along with political organizing skills, community residents advocate for themselves and their neighborhood. High school students and mother volunteers played a vital role in this pilot study, because they collected the air quality data, in addition to conducting park surveys. This work is often very personal for the students and community, as many suffer from air quality (e.g. asthma) or have family members who do. By participating in community work such as this study, they are reclaiming some power over their health and the well-being of the neighborhood.

This collaboration between El Puente and TEDC produced learning outcomes for students, faculty, and community participants. The efforts revealed some of the opportunities and challenges of academic community partnerships grounded in the Jemez Principles. Some of the key lessons important for establishing authentic partnerships with communities include: 1) training faculty and students on environmental justice and the Jemez Principles to familiarize academic partners about the expectations and commitments required before embarking on collaborative projects; 2) taking care to be transparent about the terms of any collaboration using tools like memorandums of understanding or principles of collaboration; and 3) building trusting relationships based on an ethic of care rather than purely transactional partnerships. These are lessons organizations such as TEDC are building upon to deepen engagement with communities and learning how to be good allies in efforts to promote urban environmental justice. Additionally, the results led El Puente to come to several conclusions about the state of its community parks. The data collected will be used to help advocate for the construction of BQGreen, a park that would deck over the existing Marcy and Rodney Parks.
The next steps for this project include developing grant proposals to support community-engaged research with El Puente, creating a space for digital documentation of the study, and designing a GIS study that examines air quality and asthma within a wider context of urban health vulnerability. In conclusion, El Puente hopes that this ongoing work will call for more greenery and tree canopy to buffer high-pollution areas, as well as community involvement when making decisions regarding park locations and amenities. El Puente hopes to continue studying the air quality in its community in order to further improve well-being and health outcomes in Los Sures, Williamsburg.

Acknowledgements

First and foremost we acknowledge the community members of El Puente, including Ana Traverso-Krejcarek (now at The Highline Organization), Virginia Ribot, Luis Garden Acosta, and Frances Lucerna (founders), and Clara Parker, and especially their students and mother volunteers ( Mothers Out Front) who dedicated their time to the study. The legacy of El Puente is celebrated here. This project was funded by TEDC and the Provost Office at The New School and in-kind support from the Milano School of International Affairs. Additional funds awarded by the Eugene Lang Civic Engagement and Social Justice Office and the Eugene Lang Opportunity Award enabled Andreah Santos to attend and present at the AAG conference. We also thank the Interdisciplinary Science Program (Department of Natural Sciences and Math) at Eugene Lang College for their support and encouragement of the project. Special thanks are given to Andreah Santos, Milagros de Hoz, and Jose Galvez Contreras for their hard work on the project as research assistants who worked closely with El Puente. Lastly, we thank Michael Heimbinder at HabitatMap for his assistance and support with the Airbeam monitors, the NYC Environmental Justice Alliance for lending study monitors, and Dr. Sam Myers at the Planetary Health Alliance for helping to organize an advisory committee for future work.

Notes

1 Between 1995 and 2000, El Puente conducted a series of community surveys to estimate asthma prevalence in the community, and was successful in creating asthma awareness and advocating change in policy (Corburn 2005).

2 Traffic density as annual vehicle miles traveled is a measure used in New York City estimated by summing the daily vehicle miles across geographic units and then multiplying by 365 (days). This measure is then expressed as million miles (distance) per square kilometer (area). For more details, please see http://a816-dohbsp.nyc.gov/IndicatorPublic/VisualizationData.aspx?id=2112,719b87,114,Summarize.

3 NYC’s Department of Health and Mental Hygiene has many data figures and reports which utilize two definitions of neighborhood, meaning two sets of boundaries for neighborhoods, and their names. The first is the United Hospital Fund (NYC Health n.d.b). According to this definition, part of Los Sures falls within the boundaries of the neighborhood of Williamsburg–Bushwick. The second is the Community Health District, which was recently adopted by NYC Health (n.d.c). In this configuration of boundaries, Los Sures falls entirely within the community district called Greenpoint–Williamsburg.

4 We used air quality mobile monitors called Airbeams which we purchased from the nonprofit HabitatMap and also borrowed from the New York City Environmental Justice Alliance.

5 We lacked the resources to complete the evaluation of other environment variables as well as PM2.5 measurements collected by volunteers from the organization Mothers Out Front.

References


CDC (Centers for Disease Control and Prevention). 2017c. Most recent asthma data. Retrieved from www.cdc.gov/asthma/most_recent_data.htm


