Air Pollution and Community Health in Boyle Heights

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While overall air quality in California has improved in the last decade, parts of the state still have the worst pollution in the nation. Air pollution is a serious concern because exposure to pollutants is linked to a wide array of negative health effects including respiratory disease and symptoms, premature birth and birth defects, lung and heart conditions, even early death. Poor health due to air pollution also affects school attendance, academic and work performance, and is associated with a lower earnings potential. Vulnerable populations, including children, the elderly, those with chronic diseases, and low-income populations, are especially susceptible to air quality-related health problems.

This brief examines various air quality scenarios for fine particulate matter, or PM2.5, and the potential to improve health outcomes for Boyle Heights, one of 14 communities in The California Endowment’s 10-year Building Healthy Communities plan. Boyle Heights is located in the heart of Los Angeles’ urban area, and is a community disproportionately affected by high levels of PM2.5. This work is especially relevant for Boyle Heights due to the underlying high risk of poor health stemming from low income and many environmental hazards.¹

Using the UCLA-Health Forecasting Tool, we estimate the direct and indirect health-related benefits for Boyle Heights if levels of PM2.5 were reduced to the accepted federal clean air standard. Our analyses assess the impact of this reduction on direct health outcomes, including asthma-related emergency room visits, hospital admissions for asthma and chronic lung disease, years of life gained, and mortality, as well as days lost from work. Our forecasts, which cover a 20-year time horizon, predict that reducing PM2.5 could provide substantial health gains, reduce associated medical care expenditures, increase economic productivity, and improve quality of life for the residents of Boyle Heights.

Key Issues

- Boyle Heights, a small community in Los Angeles, is disproportionately affected by high levels of fine particulate matter pollution, called PM2.5. It is made up of toxic particles 1/30th the size of a human hair.
- Air pollution, including PM2.5, is linked to a wide array of negative health effects ranging from premature birth and birth defects to lung and heart conditions, even early death.
- In California, there are 9,200 premature deaths related to PM2.5 pollution every year. (California State Air Resources Board)
- Children, the elderly, those with chronic diseases, and low-income populations are all especially susceptible to air quality-related health problems.
- Poor health due to air pollution also affects school attendance, academic and work performance, and is associated with lower earnings potential.

Key Findings

By reducing PM2.5 levels to the accepted federal clean air standard, over the next 20 years the community of Boyle Heights would experience:

- 460 fewer deaths
- 120 fewer asthma-related ER visits among children
- 56,000 days of work gained that would have otherwise been lost
- 3,400 additional years of life for Boyle Heights residents.

Boyle Heights

Boyle Heights is located east of downtown Los Angeles and is home to over 90,000 residents, nearly 94% of whom are Hispanic. The median household income is just above half the median for Los Angeles County.² When compared to the rest of the county and state, income and education levels in Boyle Heights are considerably below average.
The socioeconomic challenges faced by members of the community also affect their health outcomes. Numerous studies have established a strong link between low socioeconomic status and an increased probability of poor health. People with lower income tend to have lower health literacy and have less access to high quality health care services. The physical environment also contributes to the likelihood of poor health. Boyle Heights lies at the intersection of heavily traveled freeways—the 10, 5, 60, and 101. Many commercial railroad and commuter lines also operate within its boundaries. The transportation hub is prone to frequent congestion and is subsequently afflicted with a higher concentration of PM2.5 than other parts of the state.

Why is it important to reduce PM2.5 levels?

Fine particulate matter or PM2.5 is made up of toxic particles \( \frac{1}{30} \) the size of an average human hair and are emitted from various sources, but primarily from industrial activities and the movement of motor vehicles. The dangers associated with PM2.5 are due to its small size, making it easily inhaled and able to settle deep into the lungs and become lodged there. Long-term exposure of PM2.5 above air quality standards is especially dangerous for children, weakening the development of the child’s respiratory system and placing them at higher risk for asthma. For adults, it can aggravate heart and lung diseases, respiratory illnesses and even increases the risk of premature death. Fine particulate matter is most harmful when a person engaging in physical activity is exposed to hazardous levels. The person exercising breathes in more air, thereby inhaling more PM2.5, inadvertently causing more damage to their lungs.

The findings of a 16-year follow-up study of exposure to fine particulate matter among adults age 30 years and older found that for each 10 µg/m\(^3\) (10 micrograms per cubic meter) increase in PM2.5, the risk of death from all causes increased by 4% and...
thus for every reduction of 10 µg/m³ PM2.5 in the general population there was an estimated increase in life expectancy of about half a year.\(^6\)

Because of the risks it poses, PM2.5 is regulated through ambient air quality standards established by the state and federal government. National standards limit set an acceptable level of PM2.5 to an annual mean averaged over three years of less than or equal to 15 µg/m³. State standards allow even less PM2.5 to be present in the air, at 12 µg/m³. The annual mean for PM2.5 in Boyle Heights decreased from a high of 25.5 µg/m³ in 2000, roughly double the acceptable state standard, to 17 µg/m³ in 2009, an average still above the national standard. Much of this 33% decline in PM2.5 over the course of these nine years was a result of a combination of stronger policies and programs enacted by the state and county to reduce emissions that lead to the formation of PM2.5. The economic recession has also contributed to a decrease in PM2.5.

Our Work

We developed a quantitative model to assess the health impacts of poor air quality due to PM2.5 in Boyle Heights and examined how a reduction scenario would affect health outcomes over a 20-year time frame. For this, we used the UCLA Health Forecasting Tool, a micro-simulation model that incorporates specific demographic profiles, risk factor information, and the epidemiologic information that links the risk profile to outcomes over a simulated time horizon.\(^7\) Data inputs for the model are drawn from various sources. Demographic data is pulled from the U.S. Census, and population estimates are from the Demographic Research Unit of the California Department of Finance. Air quality data is obtained from the California Air Resources Board, using all available data for air quality monitoring stations throughout Los Angeles County to calculate levels of ambient PM2.5 in Boyle Heights.

We found that annual averages for ambient PM2.5 in Boyle Heights have been on the decline for the past decade, but were still above both state and national standards (Figure 1). The number of days per year during which ambient PM2.5 exceeded the federally-
established daily limit of 35 µg/m³ (considered hazardous in our Health Forecasting Tool) decreased over the past decade, from a high of 87 in 2001 to 11 in 2009.

To our model we applied health risk functions of the effect of PM2.5 on health published by the Environmental Benefits Mapping and Analysis Program (BenMAP), which was developed by the U.S. Environmental Protection Agency (U.S. EPA), and provides information on the relationship between air pollution levels and a number of health outcomes. These BenMAP health functions were derived from reviews of the published research literature.

**Scenarios**

The Health Forecasting Tool compares two “What would happen in Boyle Heights if” scenarios using historical data11 to forecast trends in the future.

**Scenario 1:**

*What if levels of PM2.5 pollution remain the same?*

Boyle Heights has experienced a decline in PM2.5 by 33% over the past decade. Some of this decline may be attributed to pollution control measures, such as a diesel truck replacement program which requires new commercial vehicles to meet more stringent emission standards, while the economic recession has also played a role, reducing commercial and personal vehicle use as the price of gas rose, jobs were lost, and a decline in income influenced driving behavior. For Scenario 1, we assume that PM2.5 levels will stabilize assuming that growing economic activity will counteract the impact of past pollution control efforts. We thus use the average ambient level of PM2.5 from 2007 to 2009, which averages to 18.5 µg/m³. This level, 18.5 µg/m³, is extended beginning in the year 2010 through 2030.

**Scenario 2:**

*What if levels of PM2.5 pollution continue to decline by 33%?*

Within the past few decades, government agencies have made significant progress improving PM2.5 air quality through numerous programs and policies. Most recently, the California Air Resources Board and the local air pollution control agency10 submitted a State Implementation Plan10, approved by the U.S. EPA, which specifically outlines comprehensive and extensive measures to reduce PM2.5 to the federal clean air standard.

For Scenario 2, the Health Forecasting Tool simulates a continued decrease in PM2.5 pollution of approximately 33% from our baseline of 18.5 µg/m³ (average of 2007-2009) through 2030. This reduction follows a similar trend in PM2.5 for the year 2000 through 2009. A continued reduction of ambient PM2.5 by 33% would bring the annual average PM2.5 level below the federal clean air standard of 15 µg/m³ by 2018.

**Summary of Results**

Our results are summarized in Figure 2. We project significant improvements on health and work-related outcomes over the 20 years following a reduction of PM2.5 in Boyle Heights. Further reductions in ambient levels of PM2.5 and reaching the federal clean air standard by 2018 (Scenario 2) would provide substantial health gains. These health gains translate into reduced associated medical care expenditures, improved quality of life, and higher economic productivity for residents of Boyle Heights. We also find an impressive reduction in the number of days lost from work, which has important economic benefits to households and the community as a whole.

Our findings can be used to mobilize community members to find solutions to promote cleaner air. While improving air quality is the primary goal of federal and state air quality agencies in charge of setting standards for pollutants such as PM2.5, community members can play an important role in meeting or exceeding the decline in particulate matter to improve air quality. Community-wide approaches to air quality improvement involves decreasing auto emissions, expanding public transportation, improving and maintaining road infrastructure, and encouraging walking and biking to destinations.

Results of this analysis and more information regarding the UCLA Health Forecasting Tool are available on our website: [http://www.health-forecasting.org](http://www.health-forecasting.org).

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7. UCLA Fielding School of Public Health, Health Forecasting Tool [www.health-forecasting.org](http://www.health-forecasting.org)
8. California Air Resources Board
9. South Coast Air Quality Management District
10. Approval of air quality implementation plans: California; South Coast; Attainment Plan for 1997 PM2.5, 76 Fed. Reg. 69928 (2011) (to be codified at 40 C.F.R. pt. 52)

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