Effects of the COVID-19 shutdown on air pollution in NYC: Implications for traffic policy

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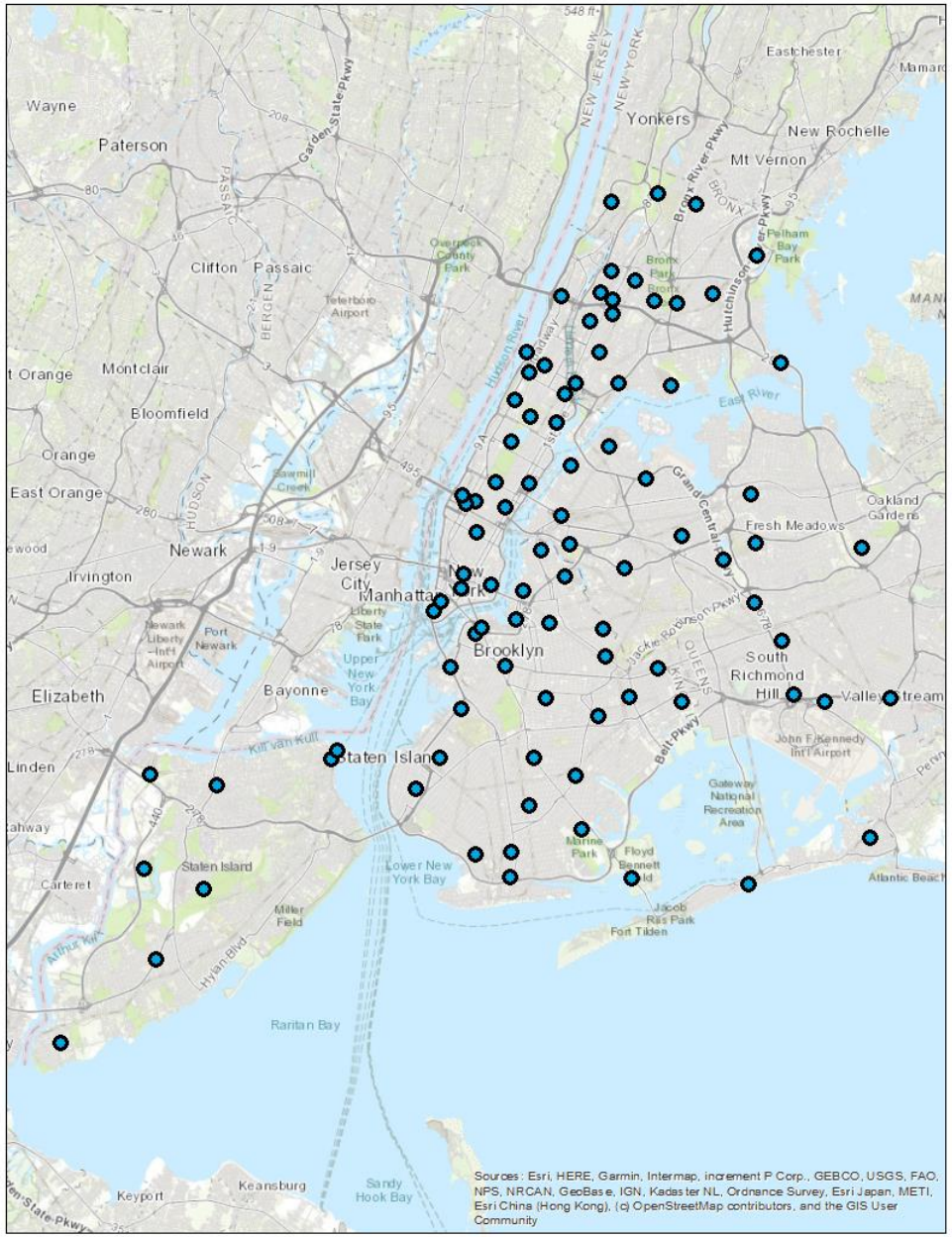
Background

- Many governments across the world implemented “lockdown” measures to reduce the spread of COVID-19
- A statewide executive order (NY Pause) shut down all non-essential business in New York (3/22/20 – 6/7/20 in NYC)
- The changes in economic activity resulting from NY Pause had effects that cascaded across numerous aspects of everyday life, including $PM_{2.5}$ and NO_2 pollution
- $PM_{2.5}$ and NO_2 exposures have been linked to adverse respiratory and cardiovascular health outcomes and premature death
- The abrupt changes in activity have allowed us to evaluate the potential for future regulations on major emission sources, such as traffic, to reduce air pollution

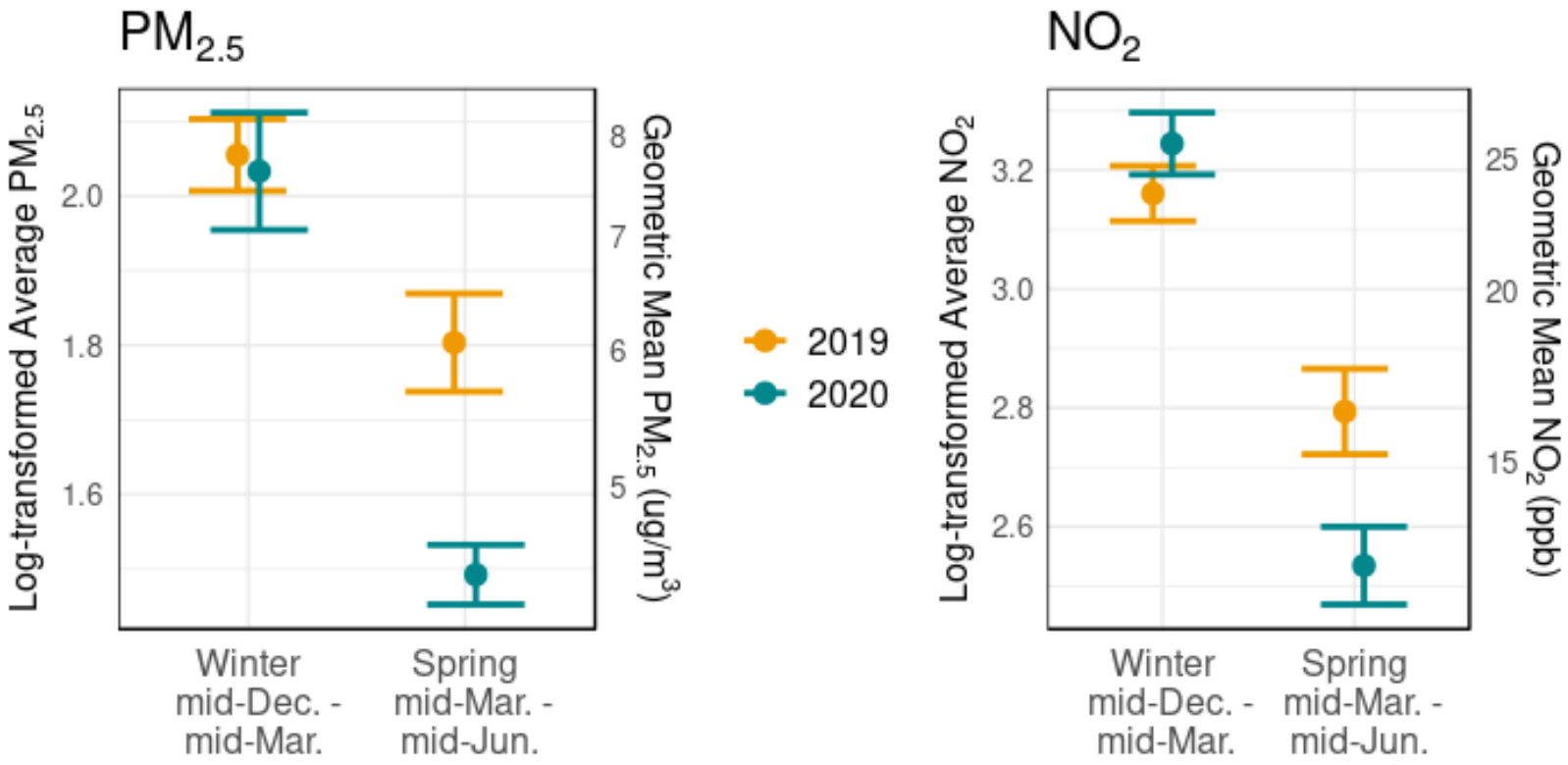


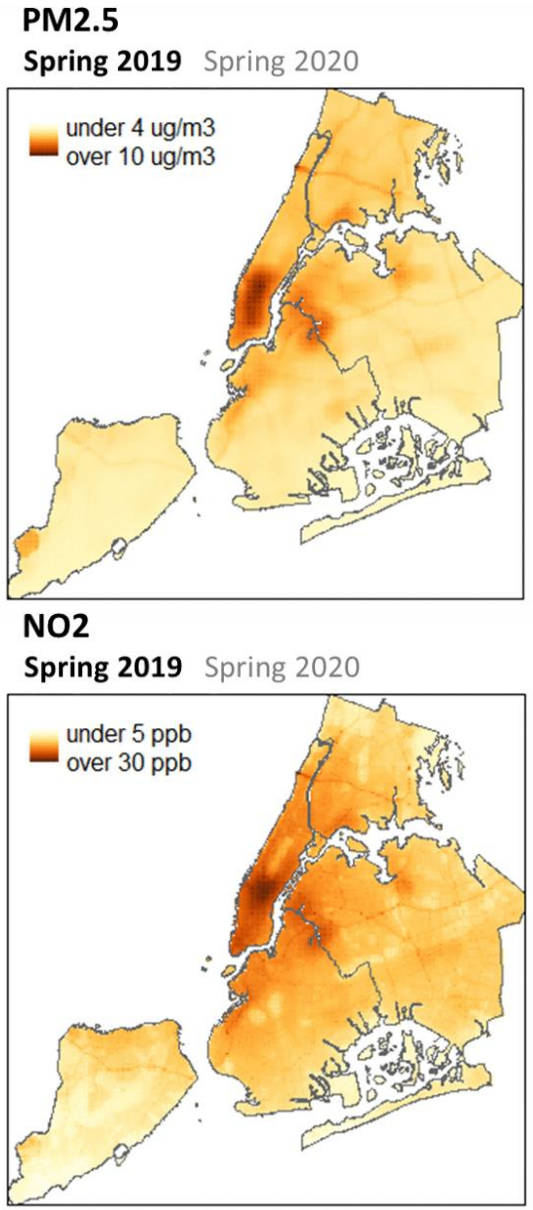
New York City Community Air Survey (NYCCAS)

- Started in 2008 by the Air Quality Program at DOHMH in partnership with CUNY Queens College
- Designed to capture the influence of diverse emissions sources distributed across the city
- Measurements of $PM_{2.5}$, NO_x, SO_2, O_3, BC, and elemental $PM_{2.5}$ constituents at about 100 sites
- Most sites are monitored once per season, and land-use regression models are used to predict seasonal averages of citywide pollutant concentrations

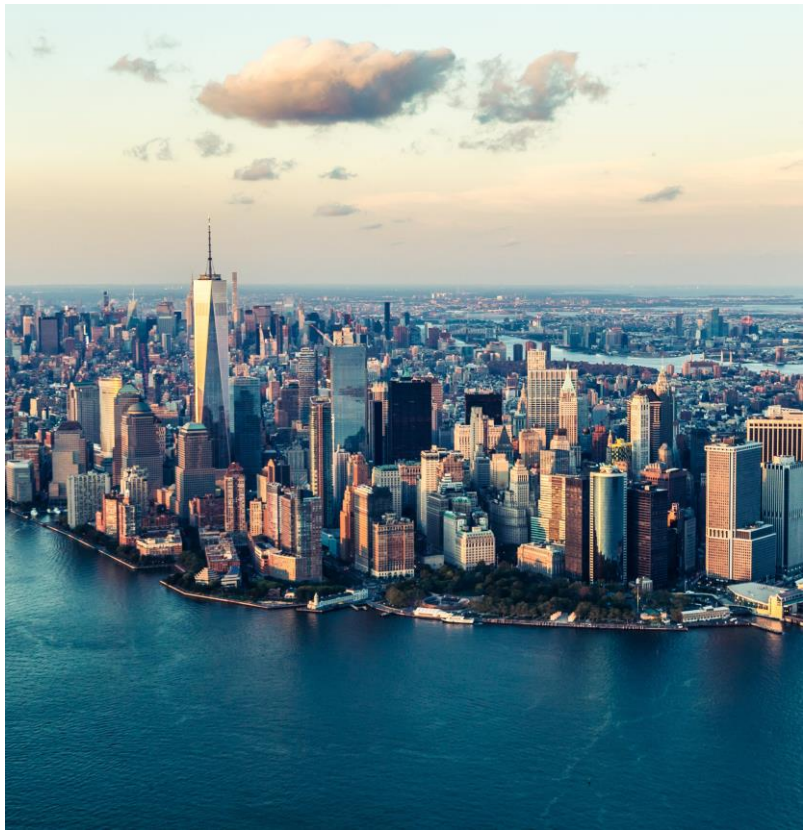
NYC Health

Air pollution fell during the shutdown



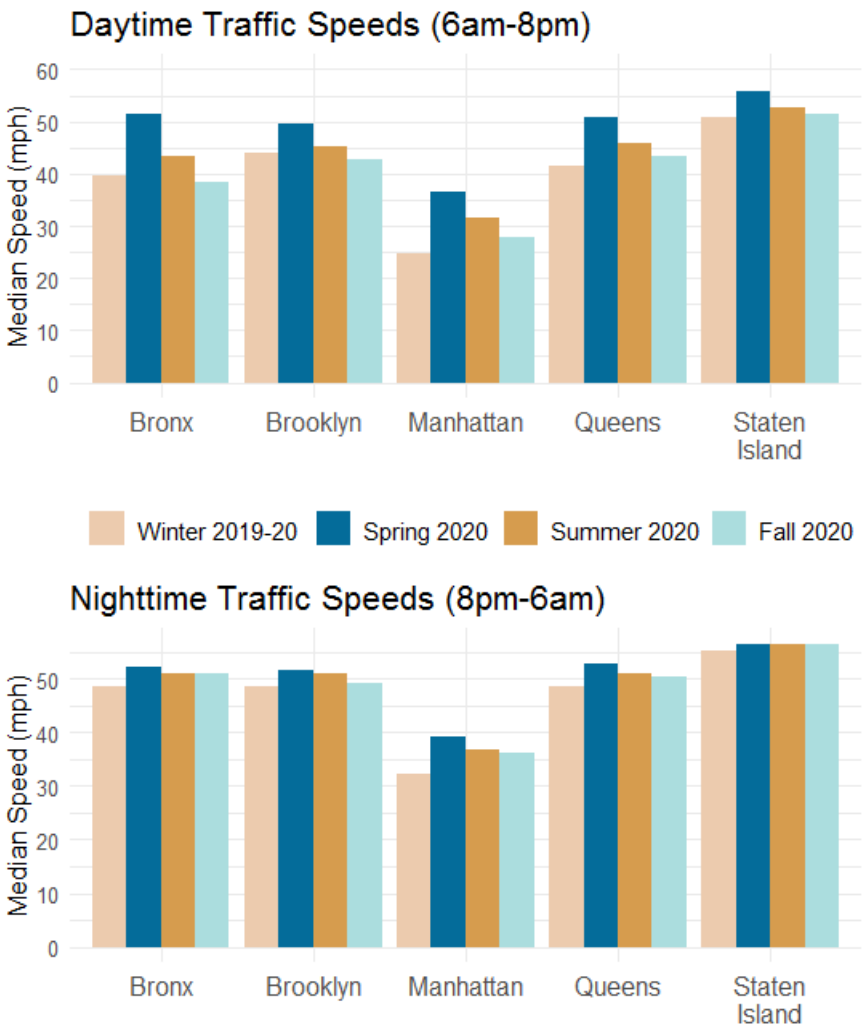


Pitiranggon et al. (2022) “Effects of the COVID-19 shutdown on spatial and temporal patterns of air pollution in New York City." *Environmental Advances*



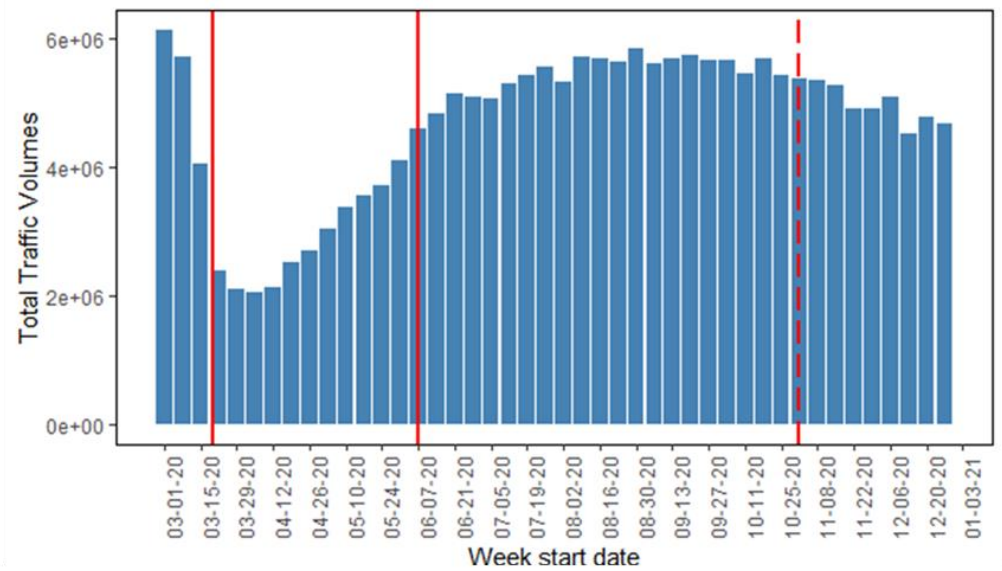
Major sources of air pollution in NYC

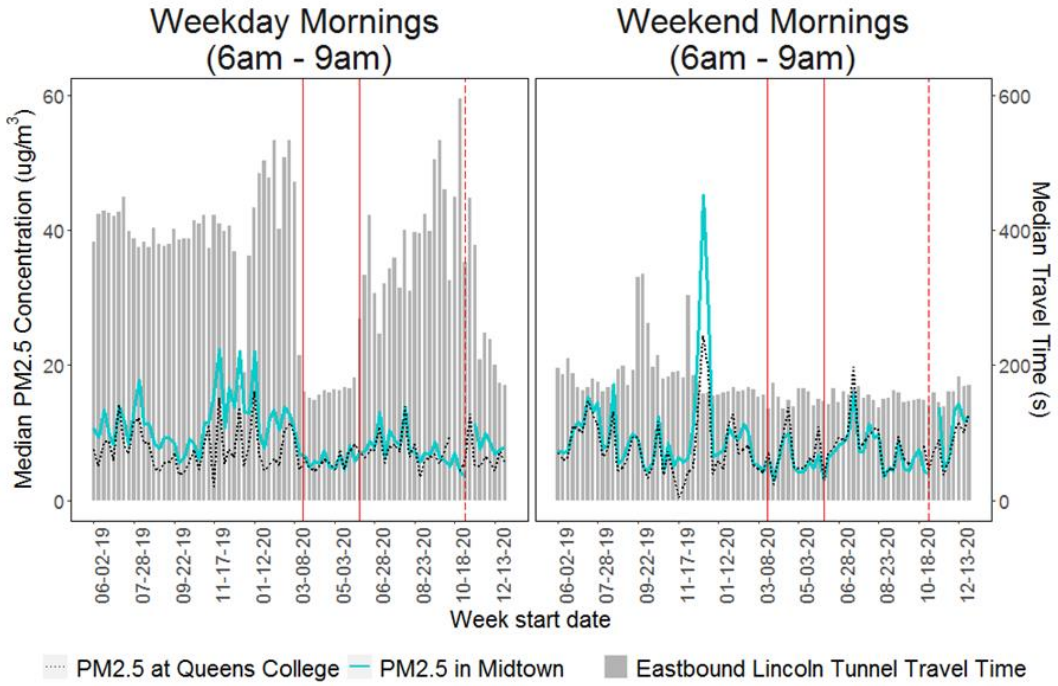
There was less traffic during the shutdown



NYC DOT Real-Time Traffic Speed Data

Shearston et al. (2021) "Social-distancing fatigue: evidence from real-time Crowd-sourced traffic data." *Science of the total environment*

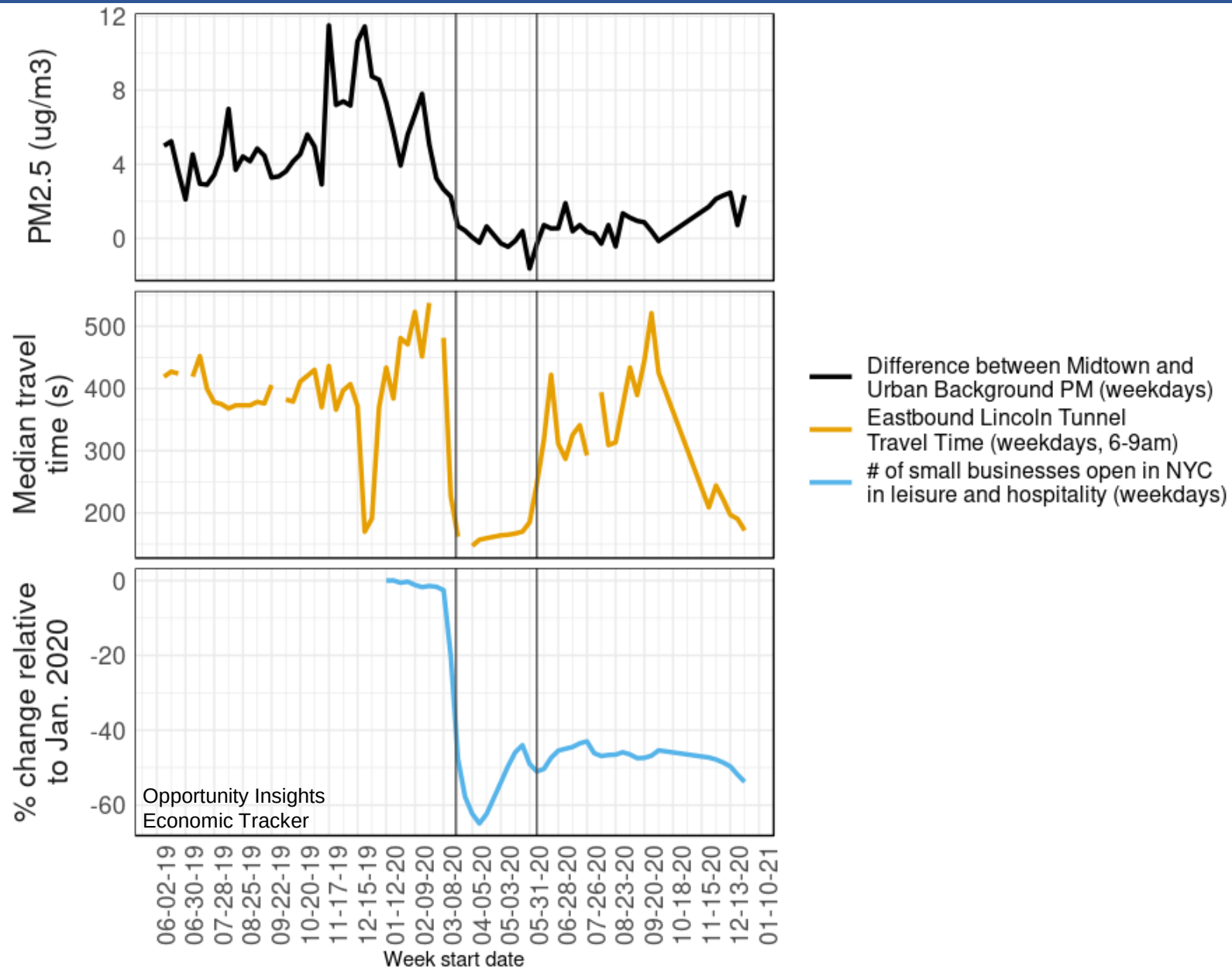




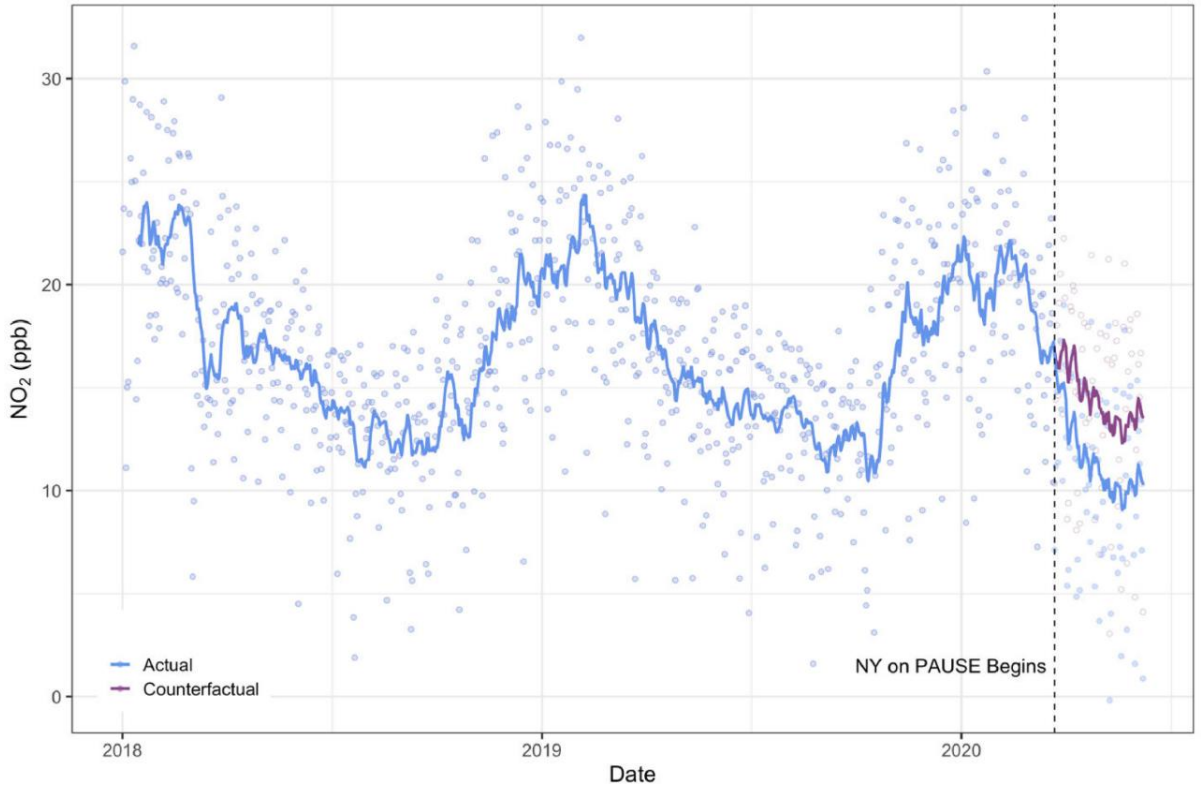
Convergence of $PM_{2.5}$ pollution in Midtown with urban background site coincided with drop in traffic observed during the shutdown.

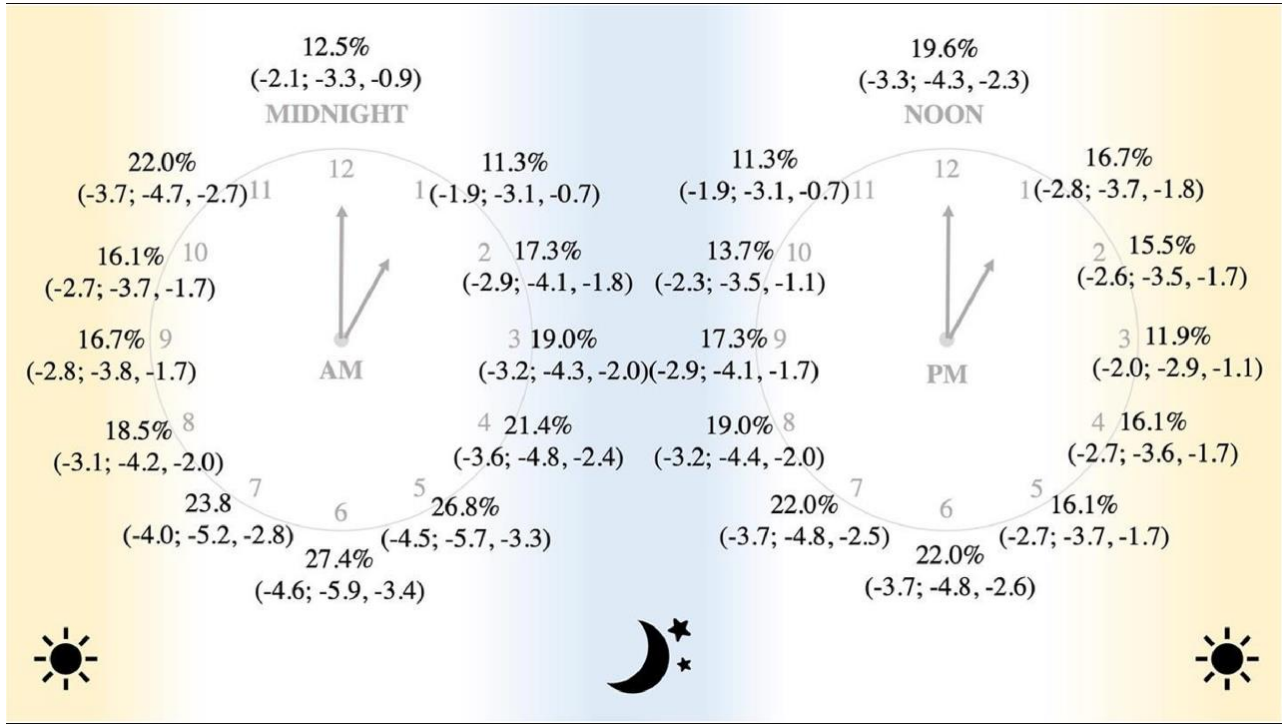
…but $PM_{2.5}$ remained suppressed in Midtown even after traffic rebounded.

Reduced commercial cooking activity is a likely driver of $PM_{2.5}$ decreases during and after the shutdown.



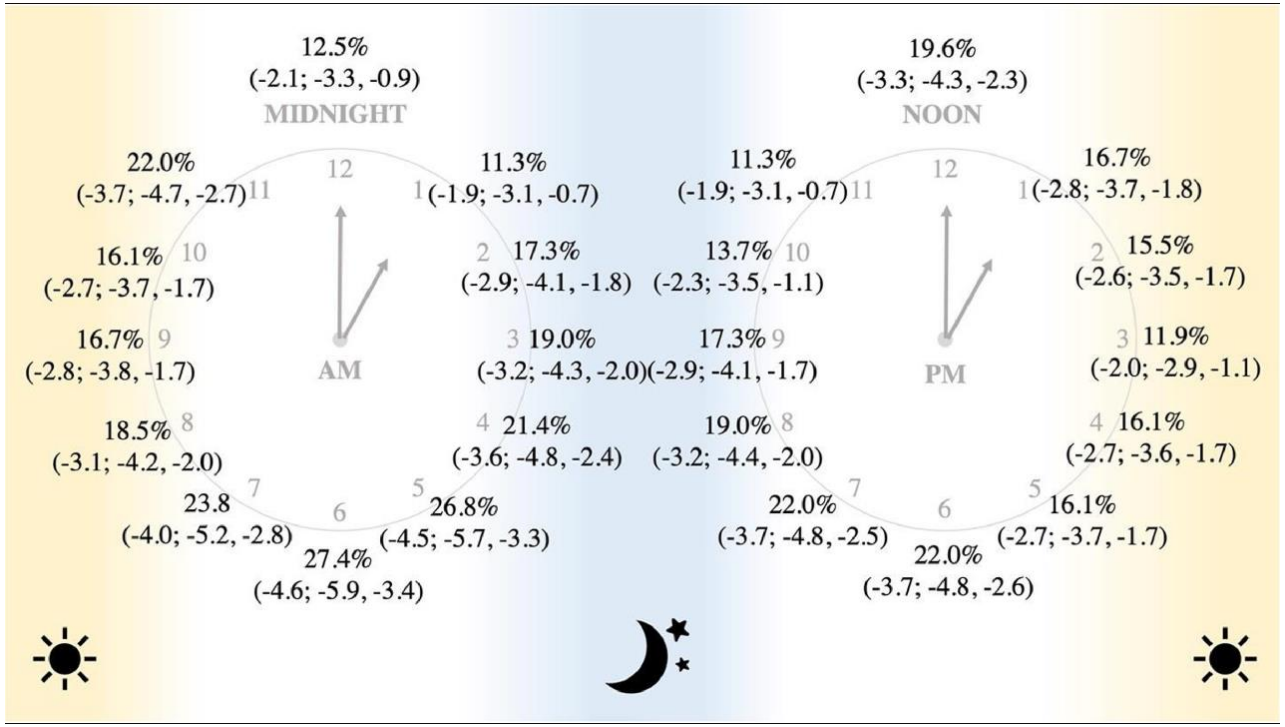
Traffic is the city's main source of NO_2, which fell the most during morning and evening rush hours





Shearston et al. (2022) "Quantifying diurnal changes in NO2 due to COVID-19 stay-at-home orders in New York City." *Hygiene and Environmental Health Advances*

Larger decreases during rush hour peaks suggests that shutdown had a greater impact on commuter vehicles than trucks or freight vehicles



Supplemental Table 1. Monthly traffic counts at Port Authority New York New Jersey bridge and tunnel crossings, disaggregated by vehicle type, 2020.

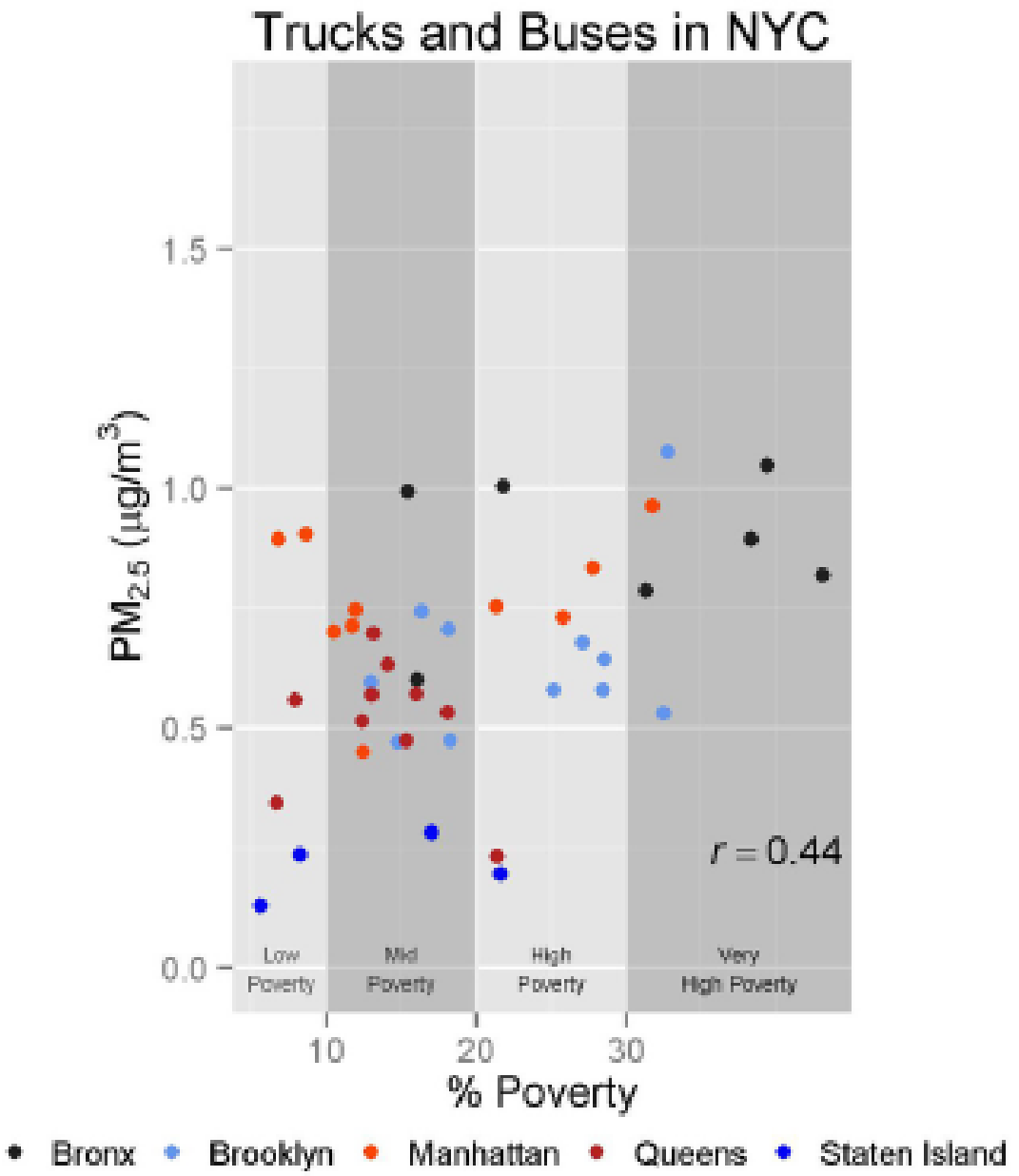
		N (%)[a]		
Month	Total Vehicles	Automobiles	Buses	Trucks
All Sites				
January	9,577,274	8,719,766 (91%)	233,267 (2%)	624,241 (7%)
February	9,284,312	8,492,197 (91%)	218,995 (2%)	573,120 (6%)
March	7,235,171	6,456,792 (89%)	181,665 (3%)	596,714 (8%)
April	3,964,954	3,445,043 (87%)	74,809 (2%)	444,102 (11%)
May	6,156,299	5,548,460 (90%)	90,819 (1%)	517,020 (8%)
June	7,825,245	7,096,906 (91%)	128,822 (2%)	599,518 (8%)
G. W. Bridge				
January	4,063,426	3,720,343 (92%)	32,881 (1%)	310,202 (8%)
February	3,939,733	3,619,349 (92%)	31,788 (1%)	288,596 (7%)
March	3,121,055	2,788,888 (89%)	22,374 (1%)	309,793 (10%)
April	1,788,278	1,529,569 (86%)	9,862 (1%)	248,847 (14%)
May	2,822,993	2,529,460 (90%)	13,160 (0%)	280,373 (10%)
June	3,538,604	3,200,525 (90%)	17,312 (0%)	320,767 (9%)

Data Source: Port Authority New York New Jersey, Traffic & Volume, 2020 Monthly Traffic and Percent of E-ZPass Usage

[a]Percentages may not add to 100% due to rounding

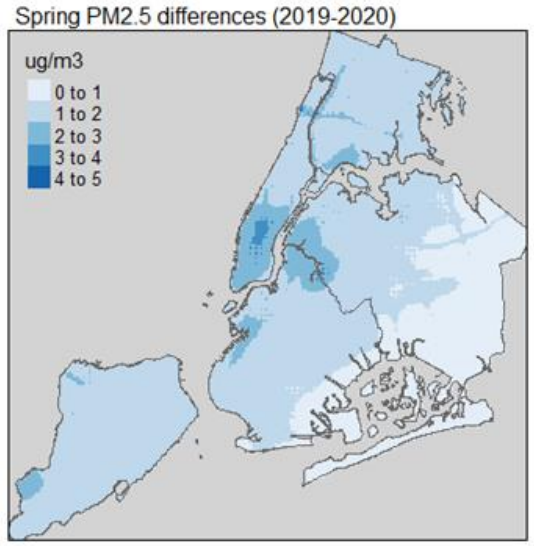
Shearston et al. (2022) "Quantifying diurnal changes in NO2 due to COVID-19 stay-at-home orders in New York City." *Hygiene and Environmental Health Advances*

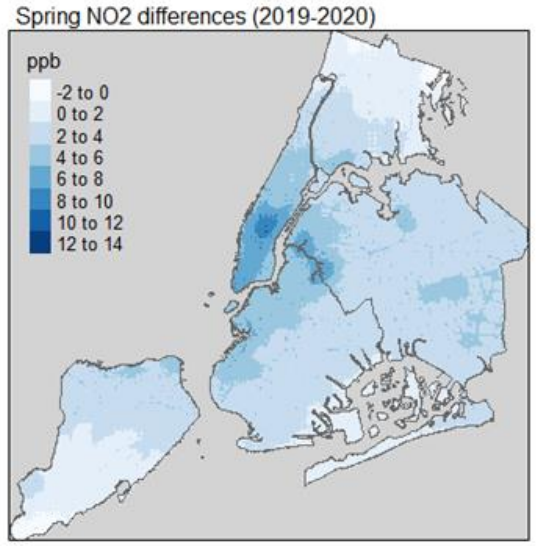
Truck traffic disproportionately impacts high-poverty communities

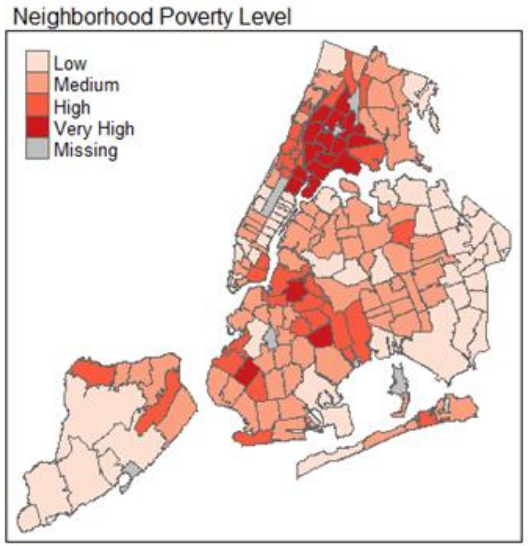


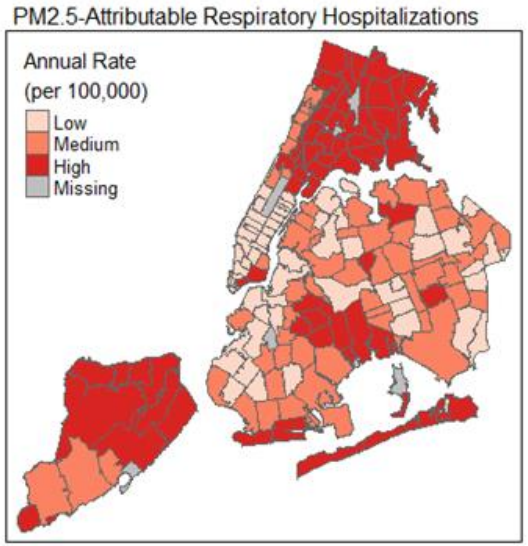
Kheirbek et al. (2016) "The contribution of motor vehicle emissions to ambient fine particulate matter public health impacts in New York City: a health burden assessment." *Environmental Health*

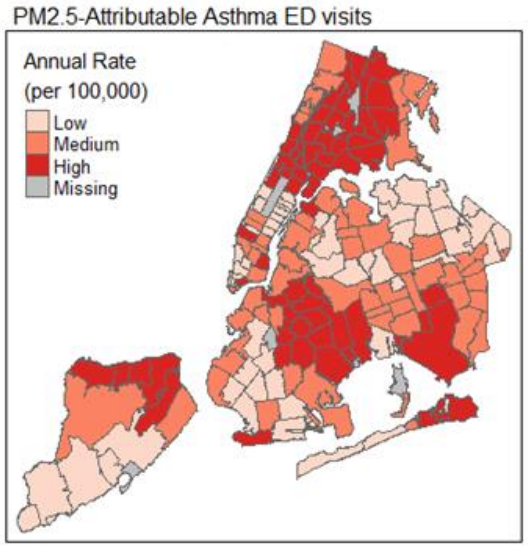
$PM_{2.5}$ and NO_2 decreased disproportionately in the CBD











Conclusions

- NY Pause resulted in a 25% drop in $PM_{2.5}$ and a 29% drop in NO_2, citywide
- Our findings give a sense of what can be expected from policies regulating traffic in NYC, such as congestion pricing
- Blanket regulation of citywide traffic is likely to affect NO_2 more than $PM_{2.5}$ and commuter traffic more than freight traffic
- Because congestion pricing targets traffic going into the CBD, we can expect pollution reductions to be mostly focused on areas immediately surrounding the CBD
- These findings emphasize the need to target pollution sources in communities that suffer the greatest from pollution exposure in the design of equitable environmental health policy