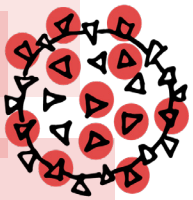
DENSITY & COVID-19 IN NEW YORK CITY



MAY 2020

CITIZENS HOUSING & PLANNING COUNCIL

EXECUTIVE SUMMARY

Since New York City emerged as a hotspot for COVID-19, government leaders and other prominent figures have implicated density as a reason for the growth of the pandemic in the city. Yet "density" is a catchall term that encapsulates many aspects of urban life.

Blaming New York City's density in this oversimplified manner is not helpful to the creation of virus mitigation strategies. Furthermore, residential population density, as it is measured by the number of residents per square mile, is not associated with higher rates of COVID-19 in New York City, the surrounding area, or the U.S.

We must dig deeper to understand and address the elements of our urban environment that have contributed to the spread of COVID-19. In the meantime, putting the blame on density risks contributing to an unfounded public fear of living in dense places. If cities are no longer seen as safe and attractive places to live, a full recovery from this crisis in New York City will be far more difficult to achieve.

CHPC NEW YORK CITY | CITIZENS HOUSING PLANNING COUNCIL

WE NEED TO STOP BLAMING DENSITY FOR NYC'S COVID-19 PANDEMIC.

New Yorkers come into contact with thousands of people a day, and there are many aspects of our urban environment that could have contributed to the spread of COVID-19. However, residential population density is not a key determinant of COVID-19's impacts.

Many dense global cities have seen exponentially fewer COVID-19 cases & deaths than NYC, while many rural areas have more cases per capita than NYC.

WITH 42,000 RESIDENTS PER SQ. MI., SEOUL HAS **1.5X** THE POP. DENSITY OF NYC.

THERE ARE **343X MORE** CASES PER CAPITA IN NYC THAN IN SEOUL.

1 IN 7 RESIDENTS OF TROUTSDALE COUNTY, TN HAS COVID-19, VS. **1 IN 44** NEW YORKERS.

The five counties surrounding NYC are far less dense, yet in terms of cases per capita have been hit harder by the pandemic than the city itself.

BROOKLYN IS **20X** AS DENSE AS ROCKLAND COUNTY, 40 MILES TO THE NORTH.

ROCKLAND COUNTY'S RATE OF COVID-19 IS **2X** THE RATE IN BROOKLYN.

MANHATTAN IS THE **DENSEST** OF THE FIVE BOROUGHS, YET HAS THE LOWEST RATE OF COVID-19.

Across NYC, population density and COVID-19 case rates are not only misaligned, but in many places appear almost opposite one another.

THE UPPER EAST SIDE IS **5X** AS DENSE AS ELMHURST/ CORONA, QUEENS.

ELMHURST/CORONA'S CASE RATE IS **4X** HIGHER THAN ON THE UPPER EAST SIDE.

THE BRONX HAS **400%** THE DENSITY OF STATEN ISLAND AND NEARLY THE SAME CASE RATE.

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INTRODUCTION

Many prominent figures and government leaders have blamed density for New York City's emergence as a hotspot of COVID-19. Yet "density" is a catchall term that captures many different aspects of the urban environment, each of which could have impacted the spread of COVID-19 in different ways. While it is difficult in the early stages of this crisis to draw definitive conclusions around why some places have been impacted more than others, there is a clear lack of association between population density, as it is commonly defined and measured in the policy and planning sectors, and rates of COVID-19 cases per capita across New York City, other virus hotspots in the U.S., and other large, global cities.

We must dig deeper to understand and address the elements of our dense, urban environment that could have contributed to the spread of COVID-19 in New York City. In the meantime, oversimplifying and blaming "density" for this crisis could have detrimental impacts on our ability to recover from it, by contributing to an unfounded public fear of living in dense places. New York is one of countless global cities that thrives from the best aspects of density, including those that are most beneficial during times of crisis: more services and amenities within walking distance and without leaving one's home, concentrations of medical facilities and talent that can increase capacity for care, and decreased risk of isolation for seniors and vulnerable individuals.

If cities are no longer seen as safe and attractive places to live, New Yorkers will be at risk of losing these benefits and countless others. Meanwhile, small businesses will face financial ruin, residents will struggle to regain their livelihood, and public services and infrastructure could be put at risk. An unfounded public fear of density could also make it more difficult for cities to achieve equitable growth, by exacerbating community opposition to new housing development in their neighborhoods.

In this report, CHPC parses out the different aspects of density; examines how each could have played a role in New York City's COVID-19 pandemic; highlights gaps in existing data and underscores data needs; and recommends next steps for the city's recovery towards a healthier and safer future.

KEY FINDINGS:

Residential population density is not a key determinant of the impacts of COVID-19.

Population density trends and rates of COVID-19 cases per capita diverge significantly across the New York City area, other virus hotspots in the U.S., and other large, global cities. In many instances, density patterns and COVID-19 trends in New York City even appear opposite to one another.

More information is needed on how housing conditions have played a role in this crisis.

Internal residential density, or overcrowding in housing, is somewhat positively correlated with higher rates of COVID-19 cases per capita in New York City. Yet more information is needed to understand how overcrowding and other housing conditions, versus overlapping issues of racial inequality and social determinants of health, might have made some New Yorkers more vulnerable to this crisis than others.

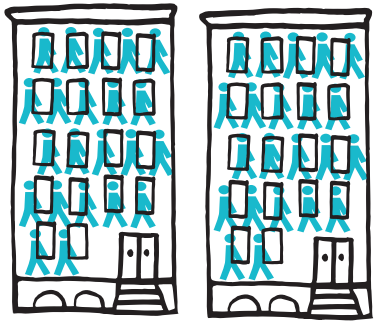
High numbers of people living in institutional settings and some types of workplaces and public spaces have emerged as major risk factors.

We desperately need to increase data around the role that institutional settings, workplaces, and public spaces have played in New York City's pandemic, and to develop targeted policy interventions to mitigate their impacts.

WHAT IS DENSITY?

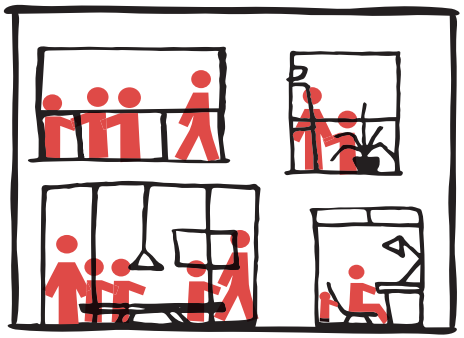
"Density" is a complex concept that encapsulates many aspects of urban life, each of which could have affected the COVID-19 pandemic in different ways. To recover from this crisis, New York City will require targeted policy interventions that both strengthen the elements of our dense environment that have helped New Yorkers weather this crisis, and mitigate any negative impacts that density has spurred.

Different aspects of density include:



Residential Population Density

For urban planning and policy purposes, density is commonly measured in terms of the average number of people living per square mile.

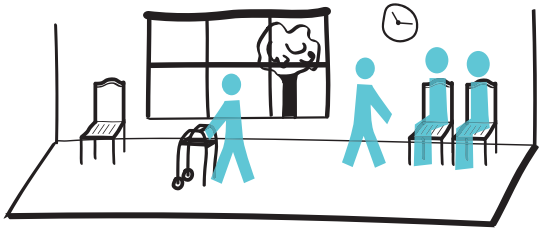


Internal Residential Density

Large numbers of people living together in housing units that were not designed to accomodate those numbers.

Institutional Settings Density

Large numbers of people sharing space and facilities in institutional settings with congregate living environments such as homeless shelters, prisons, and nursing homes.



Public Spaces & Workplace Density

Large numbers of people working in shared spaces, or sharing public spaces such as supermarkets, subway cars, gyms, and places of worship.

For further exploration of different aspects of density in New York City, see the Skyscraper Museum's online exhibit, "Housing Density: From Tenements to Towers," at [https://skyscraper.org/housing-density/.](https://skyscraper.org/housing-density/)

RESIDENTIAL POPULATION DENSITY + COVID-19

Density is typically defined in urban planning and policy as **residential population density**, or the average number of people living per square mile. By this measure, many other large, dense global cities have seen far lesser impacts from COVID-19. The disparities in how this pandemic has impacted different cities around the world, all with extremely high numbers of people living per square mile, immediately suggest that residential population density has not been a major factor in the spread of COVID-19. This conclusion is also supported by comparing the number of residents per square mile in New York City, the surrounding area, and other virus hotspots in the U.S. to the per capita rate of COVID-19 cases in the same locations.

In the nascent stage of a pandemic of unprecedented impact, it is difficult to make definitive conclusions about why some places have suffered more from COVID-19 than others.

However, there is a clear lack of association between virus case rates and the number of people living per square mile, indicating that residential population density is not a key determinant of COVID-19's impacts. There are many instances in New York City's trends where patterns of population density and case rates even appear opposite to one another.

If population density is not a major risk factor for COVID-19, then why has New York suffered from this pandemic to the degree that it has? This question will be crucial to answer in the weeks and months to come. In the context of a virus that is transmitted from person to person, too many people sharing a home, too many people sharing a public space, and congregate living environments in institutional settings could all plausibly increase the risk of spread. Yet we are currently faced with a paucity of data to understand how these issues played or did not play a role in the city's pandemic. In this moment, we can only gain a better sense of where the gaps in existing data lie, and where we desperately need to improve our knowledge.

This section reports findings from CHPC's comparative analysis of residential population density and COVID-19 case rates per capita.

At each level of comparison, between the most impacted counties in the nation, the counties in and around New York City, the five boroughs, and neighborhoods citywide, CHPC found COVID-19 case rates to diverge significantly from patterns of population density.

RESIDENTIAL POPULATION DENSITY | GLOBAL CITIES

With a population of 7.5 million, Hong Kong has around 18,000 people living per sq. mi. overall, and up to 147,000 residents per sq. mi. in the district of Kwun Tong, a population density similar to New York City's densest neighborhoods on the Upper East & West Sides of Manhattan.[3] Hong Kong reports 1,056 confirmed cases of COVID-19 and 4 deaths from the virus, giving it a case rate of only 13.9 cases per 100,000 people.[4]

San Francisco is the only U.S. city that comes even close to the population density of New York City. San Francisco has around 19,000 residents per sq. mi. and reports 258 cases of COVID-19 per 100,000 residents.[5] New York City is 1.5x as dense as San Francisco, yet has a virus case rate that is nearly 9x as high.

Seoul, South Korea reports only 736 confirmed cases of COVID-19, or 7.4 cases per 100,000 residents, and just 4 deaths from the virus.[1] With a population of nearly 10 million, Seoul has 1.5x the population density of New York City, with around 43,000 residents per sq. mi.[2] New York has 28,000 residents per sq. mi., and its rate of COVID-19 cases is exponentially higher, with 2,266 cases per 100,000 residents in the city overall, and as many as 4,300 cases per 100,000 residents in certain neighborhoods.

Figure 1: Residential Population Density and COVID-19 Case Rates in NYC vs. Other Global Cities (as of May 18th)

City	Total Pop.	Average No. Residents/ mi.²	COVID-19 Cases	COVID-19 Cases/ 100k Ppl	Share of Pop. w/ COVID-19
NYC	8.4 million	28,000	190,314	2,266	1 in 44
Seoul	10 million	43,000	736	7.4	1 in 13,500
Hong Kong	7.5 million	18,000	1,056	13.9	1 in 7,100
San Francisco	882,000	19,000	2,272	258	1 in 388

RESIDENTIAL POPULATION DENSITY | THE 5 BOROUGHS

Despite being the densest borough, Manhattan has the lowest rates of COVID-19 in the NYC area.*

Manhattan is by far the densest borough, and New York County is the densest county in the U.S., with around 72,000 residents per square mile. However, compared to the five counties within New York City and the five counties surrounding it (Nassau, Orange, Rockland, Suffolk, and Westchester), New York County/Manhattan has the lowest rate of COVID-19.

Despite the New York City region being a major hotspot for COVID-19, there are 70 counties in the U.S. that have higher virus case rates than Manhattan, many of which are located in rural areas and have extremely low levels of population density.

The Bronx & Staten Island have similarly high rates of COVID-19, yet are very different in terms of population density.

The Bronx has the highest rate of COVID-19 cases among the five boroughs, despite being half as dense as Manhattan and slightly less dense than Brooklyn.

Staten Island is New York City's least dense borough, with only 8,300 residents per square mile (or one third the population density of Manhattan), yet has the 2nd highest virus case rate in the city.

Although the Bronx is 4x as dense as Staten Island, its case rate is only 12% higher.

The areas of NYC with the highest rates of COVID-19 cases are much less dense than many other neighborhoods that have fared comparatively well.

The zip code with the highest rate of COVID-19 in the city (4,379 cases per 100,000 people), located in Elmhurst/Corona, has 5x fewer residents per square mile as the city's densest zip code on the Upper East Side, and 4x as many cases per capita.

Of the top 10 zip code areas with the highest case rates in New York City (located in several areas of northern Queens and the north Bronx, along with Glen Oaks, Queens and East New York, Brooklyn), 6 are less dense than the city overall, and only 2 are significantly denser.

The city's densest neighborhoods have some of the lowest rates of COVID-19.

The 10 densest zip codes in New York City are located predominantly in Upper Manhattan, with parts of the Financial District and Long Island City also included. These areas report some of the lowest rates of COVID-19 cases in the city, with an average of 1,217 cases per 100,000 people.

The city's 3 densest zip codes, located in Manhattan on the Upper East and West Sides and in Yorkville, are between 4x and 5x as dense as the city overall. Each of these zip codes has seen fewer than half as many COVID-19 cases per capita, relative to the citywide average.

** It is important to note that some areas in Manhattan have decreased in residential population density since the onset of New York City's COVID-19 pandemic, due to large numbers of residents temporarily leaving the city. The New York Times reports that an estimated 12.9% to 18.6% of Manhattan residents have left the city during this pandemic, compared to an estimated 4% to 5.2% of New Yorkers overall.[6] Yet even with 18.6% of its residents gone, Manhattan would still contain an average of 59,000 residents per square mile, far exceeding the population density of any other borough.*

Figure 2: Residential Population Density in NYC by Zip Code Tabulation Area

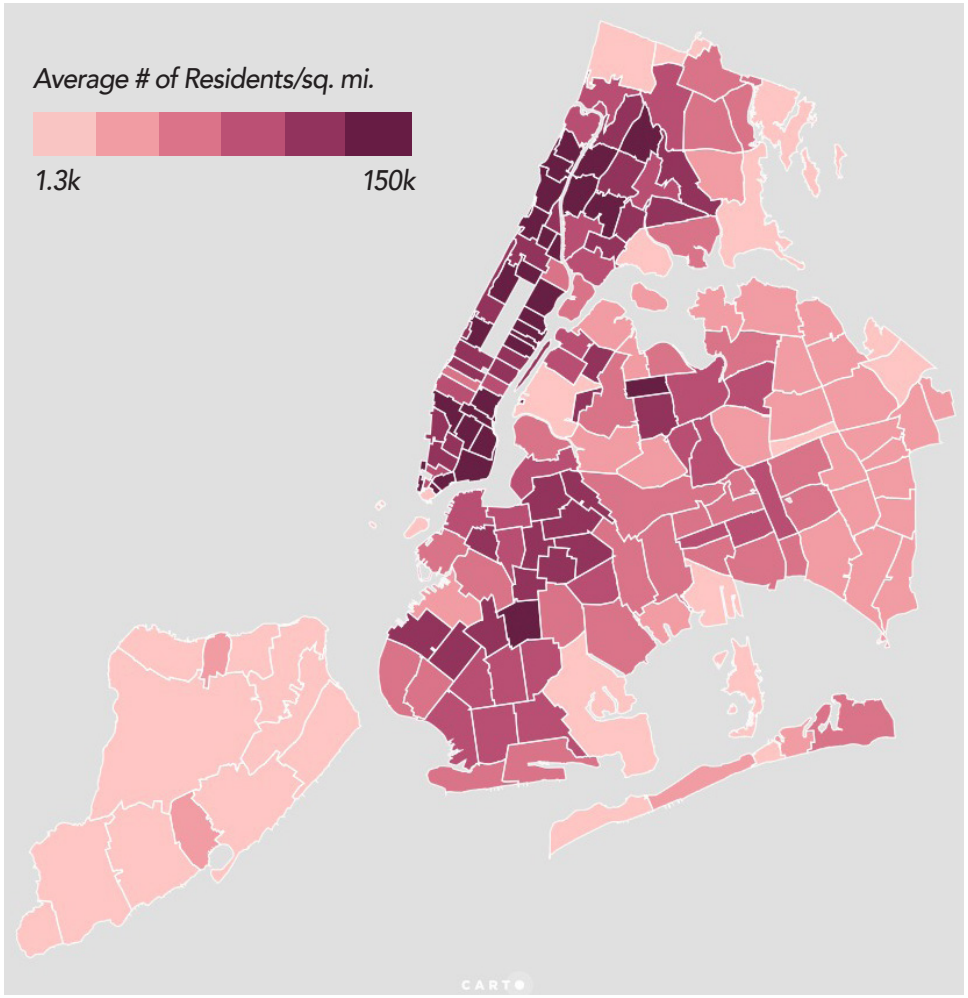
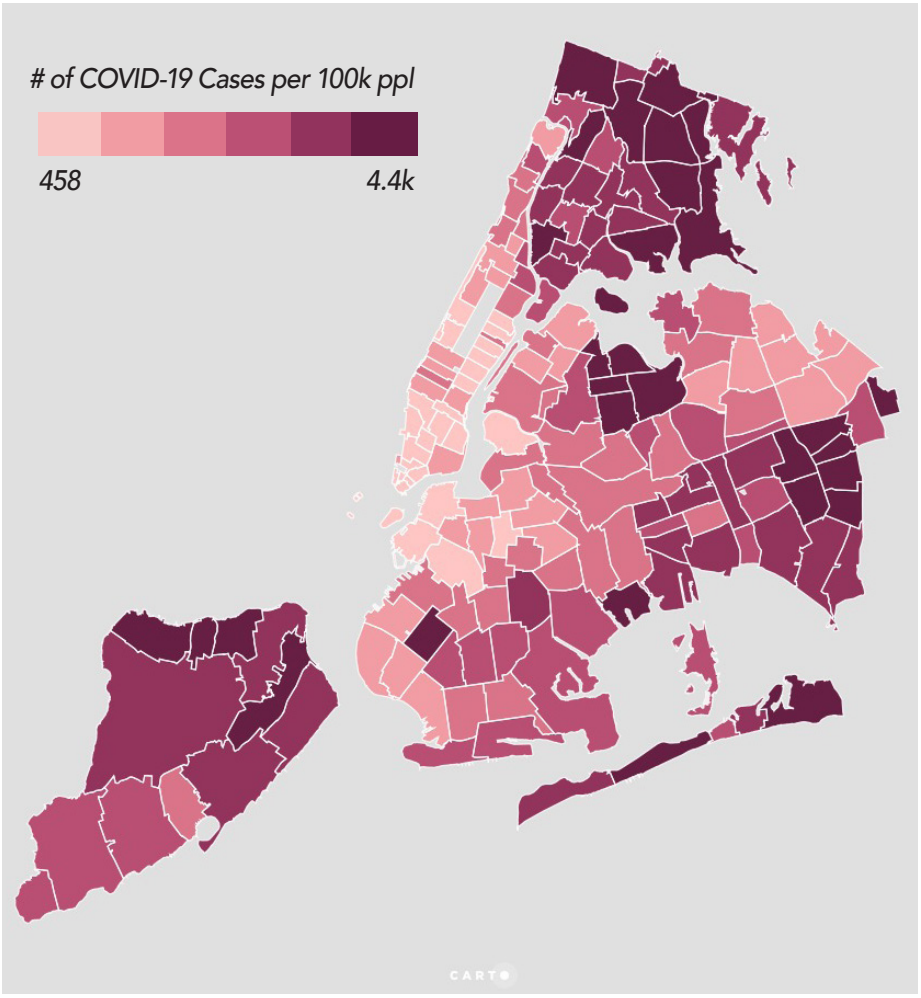


Figure 3: COVID-19 Case Rates in NYC by Zip Code Tabulation Area (as of May 18th)



Figures 2 and 3 demonstrate that, rather than seeing higher rates of COVID-19 in denser neighborhoods and lower rates of the virus in less dense neighborhoods, lower density areas have some of the highest case rates in the city. Some of the lowest rates, meanwhile, are present in the city's densest neighborhoods in Manhattan.

RESIDENTIAL POPULATION DENSITY | NEW YORK CITY SUBURBS

The suburban counties around NYC have been bit harder by COVID-19 than the five boroughs.

Rockland County has the highest rate of COVID-19 cases in the New York City area and statewide. Rockland County has nearly twice as many cases per capita as Brooklyn, which is 20x as dense, and 1.6x as many cases per capita as Queens, which is 11x as dense.

Westchester County has the state's 2nd highest case rate, reporting around 3 cases per 100,000 people for every 2 in New York City, although the city is 12x as dense.

Orange County is home to only 474 residents per square mile, making New York City 59x as dense. Orange County has more cases per capita than each Brooklyn, Manhattan, and Suffolk counties.

Manhattan and Brooklyn each have lower rates of COVID-19 than the five counties surrounding New York City.

Figure 4: Residential Population Density & COVID-19 Rates in the NYC Area by County (as of May 18th)

County/ Borough	Case Rate Rank	Total Pop.	Avg. No. Residents/ mi.^{2}	COVID-19 Cases	COVID-19 Cases/ 100k Ppl	Share of Pop. w/ COVID-19
Rockland	1	326,000	1,900	12,758	3,916	1 in 26
Westchester	2	968,000	2,250	32,224	3,331	1 in 30
Bronx	3	1.4 million	33,700	43,352	3,050	1 in 33
Nassau	4	1.4 million	4,800	39,136	2,884	1 in 35
Staten Island	5	476,000	8,300	12,937	2,717	1 in 37
Queens	6	2.3 million	20,700	58,574	2,599	1 in 38
Orange	7	385,000	470	9,943	2,583	1 in 39
Suffolk	8	1.5 million	1,600	38,117	2,581	1 in 39
Kings	9	2.6 million	36,900	51,931	2,029	1 in 49
Manhattan	10	1.6 million	72,000	23,620	1,447	1 in 69

RESIDENTIAL POPULATION DENSITY | VIRUS HOTSPOTS ACROSS THE U.S.

Many of the areas in the U.S. that have suffered the most from COVID-19 are rural.

Except for New York's Rockland County, the top 15 counties in the nation with the highest rates of COVID-19 have less than 200 people living per square mile.

The top 5 counties nationwide with the highest rates of COVID-19 are located in rural parts of Tennessee, Arkansas, Nebraska, and Minnesota, and have fewer than 100 residents per square mile.

NYC is exponentially more dense than many of the hardest-hit areas in the nation.

Compared to other counties in the U.S., the five counties in New York City combined have the 38th highest rate of COVID-19 cases per capita. The Bronx has the 18th highest rate and Staten Island has the 25th highest rate in the country. Many U.S. counties with higher rates of COVID-19 than New York City are located in low-density, rural areas.

18 of the country's top 25 counties with the highest case rates have a population density of less than 1,000 people per square mile. New York City by comparison has 27,000 residents per square mile.

Figure 5: Residential Population Density & COVID-19 Rates in the Top 10 U.S. Counties w/ the Highest Rates of Cases per Capita (as of May 18th)

County	Case Rate Rank	Total Pop.	Avg. No. Residents/ mi.^{2}	COVID-19 Cases	COVID-19 Cases/ 100k Ppl	Share of Pop. w/ COVID-19
Trousdale, TN	1	11,284	99	1,383	12,256	1 in 8
Lincoln, AK	2	13,024	23	955	7,333	1 in 14
Dakota, NE	3	20,026	76	1,458	7,281	1 in 14
Nobles, MN	4	21,629	30	1,361	6,292	1 in 16
Lake, TN	5	7,016	12	404	5,758	1 in 17
Colfax, NE	6	10,881	41	516	4,742	1 in 2`
Cass, IN	7	37,955	37	1,555	4,097	1 in 24
Bledsoe, TN	8	15,064	1,878	607	4,029	1 in 25
Rockland, NY	9	325,789	31	12,758	3,916	1 in 26
Ford, KS	10	33,619	161	1,311	3,900	1 in 26

INTERNAL RESIDENTIAL DENSITY (OVERCROWDING) + COVID-19

Internal residential density is often measured in terms of **overcrowding**, based on the number of occupants per room in a household. Households with between 1 and 1.5 occupants per room, including every room except for the kitchen and bathroom, are considered **overcrowded,** while households with more than 1.5 occupants per room are defined as **severely overcrowded.**

Across NYC neighborhoods, overcrowding is somewhat positively correlated with higher rates of COVID-19, meaning that neighborhoods with a greater share of overcrowded households are more likely to have a higher per capita case rate.

Yet overcrowding also disproportionately affects low-income households, New Yorkers of color, and immigrants – communities we know to be suffering from outsized impacts of COVID-19. New Yorkers of color have accounted for a greater share of virus cases and deaths and, along with immigrant New Yorkers, a greater share of essential workers, who bear increased risk of exposure as the majority of residents shelter in place.[7] Low-income neighborhooods and communities of color, meanwhile, have suffered from higher case rates overall, relative to higher-income and predominantly White neighborhoods.[8]

Meanwhile, severe overcrowding is not correlated with higher rates of COVID-19 across New York City zip codes. While internal residential density could have played a role in the city's pandemic, further information is needed to draw conclusions.

Moving forward, it will be critical to reconcile how environmental factors, including housing conditions and overcrowding in households, versus overlapping issues of racial inequality and social determinants of health, helped make some communities more vulnerable to this crisis than others. COVID-19 has highlighted and exacerbated many aspects of racial inequality that have long been embedded in New York City's housing stock and urban fabric. To ensure that equity is positioned as a core pillarof recovery, we must fill the gaps in existing data and take a closer look at how different elements of inequality have played a role.

Figure 6: Share (%) of Overcrowded Households vs. COVID-19 Case Rates in NYC, by Zip Code (as of May 18th)

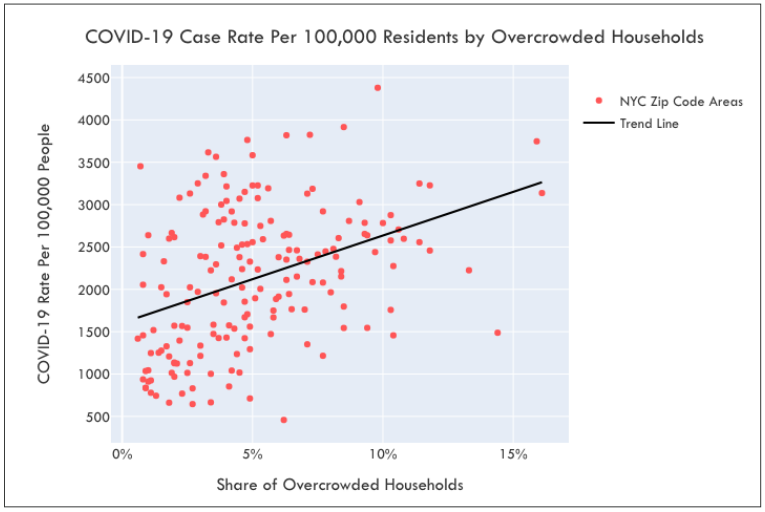
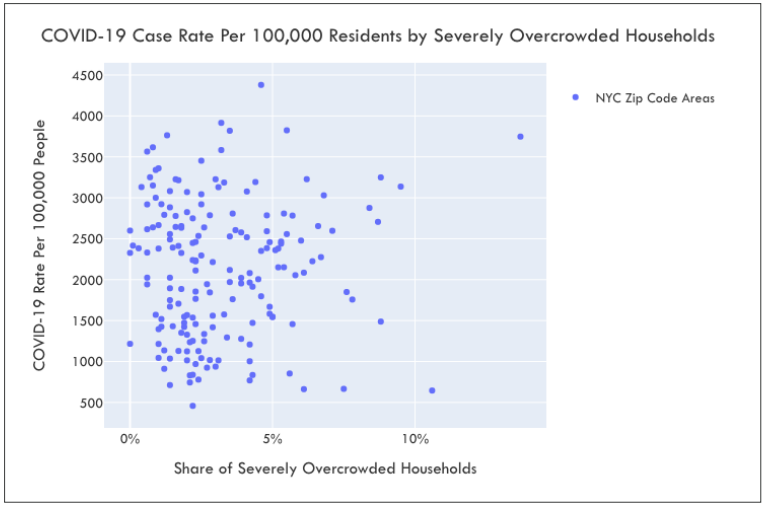


Figure 7: Share (%) of Severely Overcrowded Households vs. COVID-19 Case Rates in NYC, by Zip Code (as of May 18th)



INSTITUTIONAL SETTINGS DENSITY + COVID-19

Institutional settings, such as nursing homes, homeless shelters, and jails, create an extreme version of internal residential density in which more occupants are sharing facilities and spaces. Our institutional residential facilities also house some of the populations most vulnerable to COVID-19, which has disproportionately affected senior residents and those with underlying health conditions. With facility staff traveling between work and home on a daily basis, these settings greatly increase the risk of exposure for occupants, workers, and their household members, creating an urgent need for targeted interventions to mitigate virus transmission within them.

Unlike residential population density, density in institutional settings has been a major risk factor for COVID-19 nationwide.

We desperately need to improve data around COVID-19 in New York City's residential facilities, so that we can gain a clear understanding of their role in this crisis and develop targeted strategies to mitigate virus transmission within them. How many nursing home residents, New Yorkers experiencing homelessness, and inmates of New York City jails contracted COVID-19 in institutional settings? How many staff members at these facilities fell ill at work and/or subsequently exposed a family member? These questions are vital for protecting the health and safety of the most vulnerable New Yorkers, yet remain unanswered.

Figure 8: Available Data & Data Needs on COVID-19 in Institutional Settings w/ Residential Facilities in NYC (as of May 18th)

Population	COVID-19 Cases	COVID-19 Deaths	COVID-19 Tests Performed
Nursing Home Residents	Unavailable	At least 3,029 (excluding resident deaths that occurred in hospitals)	Unavailable
Nursing Homes Staff	Unavailable	Unavailable	Unavailable
DHS Shelter Residents	At least 900	At least 75	Unavailable
DHS Shelter Staff	At least 87 (peace officers excludes other staff)	Unavailable	Unavailable
DOC/CHS Inmates	At least 364 (currently incarcerated only)	At least 3 (only fatalities that have occurred while in custody)	Unavailable
DOC/CHS Staff	At least 1,531 (185 CHS staff and 1,346 DOC staff)	Unavailable	Unavailable

INSTITUTIONAL DENSITY | NURSING HOMES

Of the 20,720 fatalities that have occurred in New York City from COVID-19, at least 15% (3,029) were nursing home residents.[9]

The true figures are likely much higher, as these numbers only account for deaths that occurred within nursing home facilities, excluding any residents who fell ill at a nursing home, were then transferred to and passed away in a hospital. Meanwhile, many more cases and deaths could be associated with nursing home staff or members of their own households. Even with incomplete data, it is clear that nursing homes in New York City have suffered tremendously from COVID-19.

With around 47,000 total beds, the city's nursing homes have seen at least 6.5% of its residents lose their lives to COVID-19 between March 1st and May 17th.

This tragic number is even more staggering when compared to the citywide rate of COVID-19 deaths: 0.2% of the population.

INSTITUTIONAL DENSITY | HOMELESS SHELTERS

The Department of Homeless Services reports that at least 900 positive cases and 75 fatalities have occurred among New Yorkers experiencing homelessness.

These figures have not been regularly updated and could be incomplete. Of 450 active peace officers employed by DHS to enforce laws within the city's homeless shelters, 87 are confirmed to have contracted COVID-19.[10] Data around other shelter staff members is unavailable.

We must improve data on the impacts of COVID-19 on New Yorkers experiencing homelessness, yet current estimates suggest that the city's homeless shelters have not fared nearly as poorly as its nursing homes. Even assuming incomplete data, rates of COVID-19 cases and deaths among New Yorkers experiencing homelessness could be somewhat commensurate with citywide averages.

*Figure 9: COVID-19 Cases, Deaths, Case and Fatality Rates in NYC vs. NYC Homeless Population (as of May 14th, 2020)***

	Total Population	COVID-19 Cases	COVID-19 Cases/1k Residents	Share of Residents w/ COVID-19	Deaths	% Fatality Rate
NYC	8.4 million	186,923	22.2	1 in 45	20,720	0.25%
Homeless NYers	60,049	At least 900	15.0	1 in 66	75	0.15%

*** COVID-19 data in Figure 9 reflects reporting as of May 14th, to align with the most recently updated figures provided for COVID-19 cases and deaths among New Yorkers experiencing homelessness.*

INSTITUTIONAL DENSITY | CORRECTIONAL FACILITIES

364 inmates currently in custody at NYC correctional facilities have tested positive for COVID-19, in addition to over 1,500 facility staff members.

The Board of Correction (BOC) also reports 3 deaths from the virus among inmates while in custody. Based on these numbers, 1 in 11 current inmates have tested positive for COVID-19, compared to 1 in 44 New Yorkers overall. This figure is particularly alarming given the incomplete nature of existing BOC data, which excludes cases and deaths among any former inmates who fell ill while in custody and have since been released. As the city's inmate population has decreased by 29% since March 16th, or by over 1,600 individuals, a significant number of cases and deaths associated with correctional facilities are likely unaccounted for. Meanwhile, an additional 35% of current inmates have been classified as "Likely Exposed but Asymptomatic."[11]

Correctional facilities have seen immense impacts from COVID-19 nationwide, with some of the worst virus hotspots in the U.S. attributing the majority of cases to local jails and prisons. Trousdale County, TN has the nation's highest rate of COVID-19 cases per capita, yet 1,299 of its 1,383 cases have occurred among inmates at the Trousdale County Correctional Facility.[12] Similarly, Lincoln County, Arkansas ranks 3rd among U.S. counties with the highest rates of cases per capita, largely due to the county's 1,800-bed Cummins Unit prison, where at least half of inmates have tested positive.[13]

Although we lack sufficient data to draw definitive conclusions, preliminary trends in New York City indicate that the city's correctional facilities could be having a similar impact on case rates at the neighborhood level. The zip code with the 2nd highest rate of COVID-19 cases per capita contains the primary municipal jail complex at Rikers Island. The adjacent zip code, encompassing parts of East Elmhurst and North Corona, has the city's highest rate of cases per capita.

PUBLIC SPACES & WORKPLACE DENSITY + COVID-19

In regard to COVID-19, the aspect of density where we know the least is in New York City's essential **public spaces**. New Yorkers come into contact with thousands of other people each day - on the sidewalk, in the subway, in the supermarket, etc. - creating risk of exposure. Yet many other large, global cities that rely on mass transit and public spaces have fared far better in this pandemic. Have New York's public spaces somehow made the city more vulnerable to COVID-19? And if so, how?

Data on how public spaces have impacted the spread of COVID-19 in New York City is largely unavailable. However, it is clear that public spaces have played a key role in shaping this crisis across the U.S. Many hotspots of the virus have emerged due to widespread transmission in industrial workplaces with high numbers of employees and public congregations for religious and recreational purposes.

Like institutional settings, certain types of workplaces with high numbers of employees and other congregate settings in public spaces have emerged as major risk factors for the spread of COVID-19.

The neighboring counties of Dakota and Colfax in Nebraska are suffering from the nation's 3rd and 5th highest rates of cases per capita, after hundreds of workers at Tyson Foods' largest meatpacking plant tested positive.[14] Meanwhile, at least 1 in 4 cases in Minnesota's Nobles County can be attributed to employees at a local pork processing plant.[15]

Public congregations for cultural, recreational, religious, and educational purposes have also contributed to the spread of COVID-19. After the pandemic began in China, cruise ships played a major role in enabling the spread of the virus to other places worldwide.[16] Initial outbreaks of the virus in the New York City area, meanwhile, emerged in Westchester County, where religious congregations exposed hundreds to the state's first reportedly infected individual.[17] Clusters of cases worldwide have been tied to public congregations in spaces ranging from music venues, to nightclubs, to Zumba classes.[18]

We must examine the impacts that New York City's public spaces have had on this pandemic, especially as they are unique from or comparable to the types of shared spaces and congregate settings that have influenced the spread of COVID-19 globally and nationwide.

NEXT STEPS

There are clearly certain aspects of density, such as high numbers of people sharing residential facilities, or high numbers of workers coming into contact in the workplace, that have played a role in the spread of COVID-19. However, population density, as it is measured by the average number of residents per square mile, is not associated with per capita rates of COVID-19, and many other global cities that rely on mass transit and public spaces have fared far better than New York during this crisis.

We must dig deeper to understand why New York City has suffered more from COVID-19 than some other dense, global cities, and to identify which aspects of the city's urban and built environment have and have not played a role. In the meantime, oversimplifying and blaming "density" for this pandemic will only inhibit our ability to recover from it, and to prevent more tragedy of this kind from occurring, moving forward. Dense, urban areas can offer significant benefits in times of crisis: more services and amenities within walking distance and without leaving one's home, concentrations of medical facilities and talent that can increase capacity for care, and decreased risk of isolation for seniors and vulnerable individuals.

To ensure that New York City can continue to thrive from the best aspects of density, and to advance our recovery from this crisis towards a healthier and safer future, we need to stop blaming density and focus on implementing targeted policy solutions that mitigate specific areas of risk. CHPC recommends:

Improve data collection at the local and institutional level.

All COVID-19 data must be made uniformly available at the citywide, borough, and neighborhood level. Institutional data needs to include, at a minimum, numbers of cases, tests, and deaths, case rates per capita, and demographic indicators of affected individuals, by facility and aggregated at the citywide, borough, and neighborhood levels. Reporting should include all individuals who have resided at a facility since the onset of New York City's pandemic, and contact tracing should be used to expand data to include cases that have occurred through transmission by facility workers and staff. Contact tracing should also be used to examine the role that different elements of the city's housing stock, household configurations, living conditions, workplaces and schools, public transit, and shared public spaces have contributed to the spread of COVID-19. Such information will allow us to parse out how different aspects of density have or have not played a role in this pandemic, and craft policy measures accordingly.

Look to large, global cities with lower rates of COVID-19 to develop best practices for pandemic mitigation in dense, urban environments.

New York City is more similar in its urban fabric to cities such as Tokyo, Seoul, and Hong Kong than most other places in the U.S. We cannot let New York's exceptionalism obscure the important lessons that peer cities worldwide have to offer. A network of dense, global cities working together can parse out why some places have been impacted by COVID-19 more than others, and develop best practices for preventing the transmission of contagious diseases in a city of millions.

Develop partnerships between the epidemiology, virology, and housing and planning industries in NYC to inform new practices in housing design and management.

As more knowledge around COVID-19 emerges, partnerships between health science and public health experts, housing policymakers and practitioners, and urban planners can help New York City evolve its built environment to promote public health and safety in a post-pandemic era. Innovation and new practices in the design and management of housing and public space will prove essential as we strive to rebuild New York City to ensure a healthier and safer future.

SOURCES & METHODOLOGY

Residential Population Density

Population density of global cities (Seoul, Hong Kong, San Francisco) was calculated using estimates of residential population and total land area, retrieved from sources as noted. All COVID-19 data for global cities was retrieved from government sources and reflects reporting as of May 18th.

All data on the five boroughs of New York City reflects county-level data for Bronx, Kings, New York, Richmond, and Queens counties. All citywide data for New York City reflects combined county-level data for those five counties. Discussion of the population density of zip codes in New York City refers to Zip Code Tabulation Areas used by the U.S. Census, some of which are not entirely coterminous with zip codes.

Figures 2 & 3 were created using CARTO.

Residential population density in New York City Zip Code Tabulation Areas (as presented in Figure 2) was calculated using Zip Code Tabulation Area population and land area estimates, retrieved from the U.S. Census Bureau's *TIGERweb 2010 Census Zip Code Tabulation Areas - 2019 ACS file*. Data is available for download at: https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_nation_based_files.html.

Total numbers of COVID-19 cases and COVID-19 per capita incidence rates in New York City Zip Code Tabulation Areas (as presented in Figure 3) reflect reporting as of May 18th, 2020 by the New York City Department of Health and Mental Hygiene (NYC DOHMH). Data was retrieved from the *NYC Coronavirus Disease (2019) Data Repository* by DOHMH and is available for download at: https://github.com/nychealth/coronavirus-data.

Population estimates, total numbers of COVID-19 cases, and COVID-19 incidence rates per capita for U.S. counties, including counties in New York City, (as presented in Figures 4 & 5) reflect reporting by the Johns Hopkins University Coronavirus Resource Center on May 18th, 2020. Data was retrieved from the *COVID-19 Data Repository* by The Center for Systems Science and Engineering (CSSE) at Johns Hopkins University and is available for download at: https://github.com/CSSEGISandData/COVID-19.

Residential population density of U.S. counties, including counties in New York City, (as presented in Figures 4 & 5) was calculated using county land area estimates, retrieved from the U.S. Census Bureau's *2019 National Counties Gazetteer File*. Data is available for download at: https://www.census.gov/geographies/reference-files/time-series/geo/gazetteer-files.html.

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Internal Residential Density

Data on overcrowded and severely overcrowded households in New York City zip codes (as presented in Figures 6 and 7) reflects the U.S. Census Bureau's 2019 American Community Survey estimates, aggregated by Zip Code Tabulation Area. Data was retrieved from data.census.gov.

Total numbers of COVID-19 cases and COVID-19 incidence rates per capita in New York City zip codes (as presented in Figures 6 and 7) reflect reporting from May 18th, 2020 by NYC DOHMH. Data was retrieved from the *NYC Coronavirus Disease (2019) Data Repository* by DOHMH and is available for download at: https://github.com/nychealth/coronavirus-data.

Figures 6 and 7 are subject to minor inaccuracies, due to comparison of COVID-19 data at the zip code level to overcrowding data by Zip Code Tabulation Area. Some tabulation areas are not entirely coterminous with zip codes.

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Institutional Settings Density

COVID-19 case and death rates among residents of institutional facilities in New York City were estimated using total numbers of cases and deaths, as retrieved from noted sources.

Total COVID-19 fatalities in New York City (as presented in Figure 9) includes confirmed and presumed deaths, as reported by NYC DOHMH on May 18th.

Population estimate of New Yorkers experiencing homelessness (as presented in Figure 9) is not exact. Estimate includes 56,641 reportedly served by New York City Department of Homeless Services (DHS) shelters on May 18th, 2020, and 3,588 New Yorkers estimated to be unsheltered, based on the 2019 New York City HOPE count.

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Public Spaces & Workplace Density

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