

Yale University

EliScholar – A Digital Platform for Scholarly Publishing at Yale

Public Health Theses

School of Public Health

January 2022

Epidemiology Of Covid-19 Hospitalizations In New Haven And Middlesex Counties, Connecticut, July - September 2021

Caroline Mary McWilliams
caroline.mcwilliams@yale.edu

Follow this and additional works at: <https://elischolar.library.yale.edu/ysphtdl>

Recommended Citation

McWilliams, Caroline Mary, "Epidemiology Of Covid-19 Hospitalizations In New Haven And Middlesex Counties, Connecticut, July - September 2021" (2022). *Public Health Theses*. 2179.
<https://elischolar.library.yale.edu/ysphtdl/2179>

This Open Access Thesis is brought to you for free and open access by the School of Public Health at EliScholar – A Digital Platform for Scholarly Publishing at Yale. It has been accepted for inclusion in Public Health Theses by an authorized administrator of EliScholar – A Digital Platform for Scholarly Publishing at Yale. For more information, please contact elischolar@yale.edu.

**Epidemiology of COVID-19 Hospitalizations in New Haven and Middlesex Counties,
Connecticut, July - September 2021**

Thesis of Caroline McWilliams

Completed 2022, MPH 2022

Yale School of Public Health - Epidemiology of Microbial Disease

Advisor: Jim Hadler MD MPH

Committee Member: Laura Bothwell PhD

Abstract:

Background. This thesis explores the epidemiology of COVID-19 hospitalization among residents of New Haven County and Middlesex County, Connecticut from July - September 2021 with an emphasis on quantifying racial/ethnic and SES disparities. Two previous studies, the first conducted from March - May 2020 and the second conducted from July - December 2020, used COVID-NET Surveillance data from New Haven and Middlesex counties to explore the same questions. This thesis will compare findings with these previous studies to better understand how the epidemiology of COVID-19 hospitalization and racial/ethnic and SES disparities have changed in New Haven and Middlesex counties. Methods. Addresses of patients hospitalized with laboratory confirmed SARS-CoV-2, gathered by COVID-NET Surveillance, were geocoded and individuals were identified as either community- dwelling or institutionalized. Census tract measures of poverty and crowding were found for all community dwelling cases. Age adjusted incidence rates and age adjusted relative risks were calculated to determine the level of risk associated with race/ethnicity and census tract levels of poverty and crowding. Results. An individual's Black or Hispanic race/ethnicity was more strongly associated with hospitalization for COVID-19 than the levels of poverty or crowding in their census tract. Racial and ethnic disparities had declined since the March 2020 - May 2020 time period but increased for non-Hispanic Blacks compared to the July 2020 - December 2020 time period. Conclusion. Racial/ethnic disparities in hospitalization have fluctuated in magnitude but have persisted throughout the COVID-19 pandemic. Decreased racial/ethnic disparities compared to the March 2020 - May 2020 time period may reflect the increased diversity of individuals working out of the home post- lockdown. An increase in hospitalization of non-Hispanic Black individuals when compared to White individuals may be explained by decreased access to and acceptability of vaccination.

Table of Contents

<i>Abstract:</i>	2
<i>Introduction</i>	4
<i>Methods</i>	7
<i>Surveillance Data:</i>	7
<i>Study Population:</i>	8
<i>Census Data:</i>	8
<i>Statistical Analysis:</i>	9
<i>Results</i>	10
<i>Discussion</i>	13
<i>Conclusion</i>	16
<i>Tables:</i>	18
<i>References:</i>	25

Introduction

Coronavirus disease, or COVID-19, is an infectious disease caused by the SARS-CoV-2 virus. While many people infected with SARS-CoV-2 are asymptomatic or experience mild to moderate respiratory symptoms, others become seriously ill and require hospitalization. While individuals at any age can become seriously ill and die from COVID-19, older individuals and people with underlying health conditions such as cancer, cardiovascular disease, and diabetes are at greater risk for hospitalization and death from COVID-19.¹ Hospitalization is an important indicator of COVID-19 disease severity and more accurately reflects who within any age group is getting infected with COVID-19 than viral testing which is prone to testing biases.²

Early in the pandemic, it became clear that people of color in the United States were being infected, requiring hospitalization, and dying of COVID-19 at higher rates than White individuals. Coronavirus exposed and amplified already existing racial/ethnic health disparities in the United States which increased attention to and interest in health equity research. Researching and publishing racial and ethnic COVID-19 disparities is important, however, disseminating disparity figures without proper context can prompt erroneous biological explanations for disparities that are social in origin, behavioral explanations based on racial stereotypes, and explanations that reinforce “territorial stigma” of resource-deprived neighborhoods.³ To help minimize the risk of promoting these misconceptions, socioeconomic data should be collected and reported alongside racial and ethnic data.³ A 2005 paper by Krieger et al. demonstrated the feasibility and importance of using census tract level poverty data to illustrate socioeconomic gradients in health and the contribution of SES to racial and ethnic disparities in health.⁴ Exploring the population-based epidemiology of COVID-19 hospitalizations with emphasis on identifying and quantifying disparities by race/ethnicity and by

census tract-level measures of poverty and crowding is important in elucidating the most accurate understanding of racial/ethnic disparities in COVID-19 hospitalizations.

Prior to this study, two previous studies were conducted using the COVID-19-Associated Hospitalization Surveillance Network (COVID-NET) surveillance data in Connecticut. The first study explored the racial/ethnic and SES disparities in COVID-19 hospitalizations during the first “lockdown” wave of the pandemic (March 2020 - May 2020) in New Haven County and Middlesex County.⁵ The second study was conducted during the first half of the second wave prior to vaccine availability (July 2020 - December 2020) and included data from the entire state of Connecticut.⁶ Both studies found significant racial and ethnic disparities in COVID-19 hospitalizations.^{5,6}

During the “lockdown” wave, higher incidence of hospitalization was associated with increasing age, increasing levels of census tract poverty and crowding, and non-Hispanic Black and Hispanic/Latinx race\ethnicity.⁵ Furthermore, the study found that non-Hispanic black race and Hispanic/Latinx ethnicity were more strongly and independently associated with higher incidence of hospitalization regardless of poverty or crowding status.⁵ Previous studies of influenza hospitalization data in New Haven County found that census tract poverty and crowding levels were more strongly associated with hospitalization than race/ethnicity.^{7,8} The researchers purported that the epidemiology of SARS-CoV-2 hospitalization was greatly impacted by the “stay at home” orders which protected the majority of the population from exposure, with the exception of “essential workers”⁵. However, “essential workers” encountered varied access to PPE as well as testing and social support.⁵ Essential workers with decreased access to these resources disproportionately included people of color, which may account for the racial/ethnic disparities of hospitalization incidence demonstrated in this study.⁵

The study conducted with statewide data from July 2020 - December 2020 also found that race and ethnicity were more strongly associated with higher incidence of hospitalization compared to census tract levels of poverty and crowding.⁶ However, the racial/ethnic disparities in hospitalization were smaller than the disparities found during the “lockdown” time period covered in the previous study.⁶ The researchers attribute this reduction in hospitalization to increased accessibility of PPE and the lifting of restrictions on non-essential businesses, gatherings, and activities outside the home which led to exposures across a wider diversity of ages, SES, and racial/ethnic groups.⁶

The objective of this analysis is to determine the population-based epidemiology of COVID-19 hospitalization in July - September 2021 in Middlesex and New Haven counties and to quantify disparities by race/ethnicity and by census tract level SES measures of poverty and crowding. It also seeks to determine trends in race/ethnic and SES hospitalization incidence disparities by comparing these results with the two previous time periods: March - May 2020 and July - December 2020.

As the pandemic continued, the FDA issued an Emergency Use Authorization (EUA) on December 11, 2020 for the Pfizer-BioNTech COVID-19 Vaccine among individuals over the age of 16.¹⁰ By July 2021, not only was the Pfizer-BioNTech COVID-19 Vaccine approved for individuals 12 years and older, but the Moderna COVID-19 Vaccine was authorized under EUA as a two dose primary series for individuals 18 years and older and the recommended pause of the Johnson & Johnson Vaccine was lifted, reinstating the FDA’s EUA for the single-dose COVID-19 vaccine in individuals 18 years and older.^{10,11,12} By September 30st, 2021, an estimated 69% of Connecticut’s population was fully vaccinated and 76% had received at least one dose.¹³ By late July 2021, the Delta variant (B.1.617.2) accounted for the vast majority (94 -

100%) of sequenced samples in New England.¹⁴ Its dominance compared to Alpha, the main variant in early 2021, immediately suggested Delta's increased transmissibility which may be attributable to it causing a higher viral load.¹⁴ Essentially Delta, the dominant variant during this time period, spread more easily and caused more severe cases of COVID, which could significantly impact hospitalization rates.⁹ Delta circulation and COVID-19 vaccination surely impacted the population-based epidemiology of hospitalizations for COVID-19 disease in New Haven and Middlesex counties. Regarding the impact of this era on the racial/ethnic disparities found in the previous studies, the availability of vaccines, potential for natural immunity in communities infected earlier in the pandemic, and a larger proportion of individuals having the opportunity for exposure to the virus, the degree of racial and socioeconomic status disparities may be decreased compared to the earlier time periods studied. On the other hand, given disparities in vaccination, racial and SES disparities could also be increased.²⁰

Methods

Surveillance Data:

This study used the Coronavirus Disease 2019 Associated Hospitalization Surveillance Network (COVID-NET) data gathered by the Connecticut Emerging Infections Program. Cases of first-time hospitalizations of residents of New Haven and Middlesex Counties with laboratory confirmed COVID-19 during July - September 2021 were identified through hospital, laboratory, and admission databases as well as infection control logs to identify patients hospitalized with COVID-19. Demographic information including age, race/ethnicity, gender, and residential address were collected for each case and confirmed via electronic medical records. Then case addresses were geocoded and assigned the appropriate census tract as well as a description of address type including residential, correctional facility, skilled nursing facility, homeless,

hospice, hospitalized since birth, substance use treatment facilities, residential care, group home, and psychiatric facility.

Study Population:

The study population included non-institutionalized residents of New Haven County and Middlesex County who were hospitalized for the first time with laboratory confirmed COVID-19 during the time period of July to September 2021. Non-institutionalized, or community dwelling individuals, were defined as people living at a residential address at the time of their hospitalization which excluded people admitted to the hospital from a skilled nursing facility, correctional facility, rehabilitation facility, homeless shelter, etc. The population included individuals of any age.

Census Data:

To compare our results with those of the two studies conducted at earlier time periods in the pandemic, we used the 2010 census tracts and the American Community Survey (ACS) 5-year estimates of poverty and crowding from the years 2014-2018. Census data were collected and downloaded from censusdata.gov. The ACS data for poverty levels gave the percent of individuals in each census tract in New Haven County and Middlesex County who were living in poverty. The ACS data for crowding gave the number of households where the ratio of people per room was greater than one for each census tract in New Haven County and Middlesex County. We then divided this number by the total number of people living in each individual census tract to determine the prevalence of crowding. Poverty and crowding data were categorized into four categories. Census tracts with 0 - 4.9% of residents living below the federal poverty line were categorized as *very low levels of poverty*, census tracts with 5 - 9.9% of residents living below the federal poverty line were categorized as *low levels of poverty*, census

tracts with 10-20% of residents living below the federal poverty line were categorized as *moderate levels of poverty*, and tracts with greater than 20% of residents living below the federal poverty line were categorized as *high levels of poverty*. Census tracts with 0 - 0.009% of residents living with more than one person per room were categorized as *very low levels of crowding*, census tracts with 0.01 - 0.25% of residents living with more than one person per room were categorized as *low levels of crowding*, census tracts with 0.026 - 0.05% of residents living with more than one person per room were categorized as *moderate levels of crowding*, and census tracts with 0.05 - 4% of residents living with more than one person per room as *high levels of crowding*.

Statistical Analysis:

Even though our study focused on the epidemiology of hospitalizations for COVID-19 disease in individuals residing in the community, our first step was to take all the reported cases and characterize them as “community dwelling” or “institutionalized.” We then calculated odds ratios to determine if certain demographics were more likely to be hospitalized from the community as compared to an institution. Then crude and age adjusted incidence rates were calculated for cases that were characterized as “community dwelling.” The age adjusted rates were calculated using the 2000 U.S. standard population proportions. Chi-square tests were used to compare hospitalization incidence between demographic and SES groups. Chi-square for trend was used to determine whether there was a significant trend association between increasing poverty and crowding levels with age-adjusted incidence. Chi-square tests were used to compare the case characteristics of community dwelling patients hospitalized due to COVID - 19 for this study and the study conducted from July - December 2021. All statistical analyses were performed using SAS version 9.4 and Epi Info.

Results

There were 757 cases of hospitalization with laboratory confirmed SARS CoV-2 residents of Middlesex County and New Haven County from July - September 2021. Of these 757 cases, 712 were hospitalized from a residential address and 45 were hospitalized from an institution with the majority of those being from long-term care facilities (Table 1). More than 98% of the hospitalized cases were adults and the majority were male with 46.2% of the cases occurring in females; 55.4% of the hospitalized cases were non-Hispanic White with 22.7% and 16.5% of the cases being, respectively, non-Hispanic Black and Hispanic/Latino. The majority of cases were 18-64 years old with a little less than 25% of the cases occurring in people older than 75 years. By month of hospitalization, only a small percentage (16.6) of the cases were hospitalized in July, 48.1% of the cases were hospitalized in August, and 35.3% were hospitalized in September.

When comparing the likelihood of individuals being hospitalized from the community as opposed to an institution, Hispanic/Latino individuals were 4.49 times as likely to be hospitalized from the community whereas White individuals were only 0.33 times as likely to be hospitalized from the community (Table 2). Interestingly, non-Hispanic Black individuals were 2.45 times as likely to be hospitalized from the community. Individuals ages 18-49 were 3.2 times as likely to be hospitalized from the community compared to individuals older than 85 years of age who were only 0.31 times as likely to be hospitalized from the community. There was no significant difference between males & females, individuals hospitalized in July, August, or September, or adults & children as far as being hospitalized from the community vs an institution.

When looking at the age adjusted relative risks of hospitalized cases in community dwelling individuals, non-Hispanic Black individuals were 4.07 times more likely than White individuals to be hospitalized and Hispanic/Latinx individuals were 3.44 times more likely to be hospitalized than White individuals (Table 3). Relative risk also increased with age, for example, individuals 50 -64 years of age were 1.68 times more likely than individuals 18-49 years of age to be hospitalized for COVID-19 whereas individuals older than 85 were 4.65 times more likely than individuals 18-49 years of age. Individuals living in census tracts with high levels of poverty were 2.28 times more likely than individuals living in census tracts with very low levels of poverty. Similarly, individuals living in census tracts with high levels of crowding were 2.03 times more likely than individuals living in very low levels of crowding. However, when census tract poverty and crowding levels were stratified by race/ethnicity, the increase in age adjusted relative risk for individuals residing in very low to high levels of poverty and individuals from very low to high levels of crowding disappeared (Table 4a): White individuals living in census tracts with high levels of poverty were only 1.11 times more likely to be hospitalized compared to White individuals living in census tracts with very low levels of poverty; the age adjusted relative risk for individuals living in high poverty census tracts compared to low poverty census tracts for non-Hispanic Black individuals was 1.16 and for Hispanic/Latinx individuals was 0.95. For crowding, the age adjusted relative risk of individuals residing in census tracts with high levels of crowding compared to individuals residing in census tracts with very low levels of crowding for White individuals was 1.57, for non-Hispanic Black individuals was 1.04, and for Hispanic/Latinx individuals was 1.47. In contrast, when race/ethnicity was stratified by census tract poverty and crowding levels there remained a stark difference in the age adjusted relative risks of non-Hispanic Black and Hispanic/Latinx individuals compared to White individuals in

each level of poverty and crowding (Table 4b). Compared to White individuals who resided in census tracts with very low levels of poverty, both non-Hispanic Black and Hispanic/Latinx individuals who also resided in census tracts with very low levels of poverty were 3.8 times more likely to be hospitalized with COVID-19. For each level of poverty and crowding, non-Hispanic Black and Hispanic/Latinx individuals were anywhere from 2.4 to 6.0 times more likely than White individuals to be hospitalized with COVID-19. Therefore, an individual's race/ethnicity was more strongly associated with hospitalization than either census tract level of poverty or crowding.

As the pandemic progressed in Connecticut, a smaller percentage of COVID-19 hospitalizations occurred in institutionalized populations. In March - June 2020, "*the lockdown period*", 30.4% of the patients residing in New Haven and Middlesex Counties who were hospitalized for COVID-19 were from institutions compared to 14.6% in July - December 2020, "*the post-lockdown pre-vaccine period*" and 5.96% in July - September 2021, "*the vaccine period*" (Table 5b). Additionally, there was a significant increase in the incidence of hospitalization for individuals aged 18 - 49 years old in "*the vaccine period*" compared to "*the post-lockdown pre-vaccine period*". Also, there was a significant decrease in the incidence of hospitalization for individuals aged 65+ years or older in "*the vaccine period*" compared July - December 2020. Furthermore, during the current period of study, July - September 2021, there was a statistically significant increase in the incidence of hospitalization for non-Hispanic Black individuals compared to the "*post-lockdown pre-vaccine period*". The relative risk of non-Hispanic Black individuals compared to White individuals increased from 3.20 to 4.07 whereas the relative risk of Hispanic/Latinx individuals compared to White individuals decreased from 4.73 to 3.44. However, the high, medium, low vs very low relative risks in both levels of poverty

and crowding remained relatively stable between the July - December 2021 and July - September 2020time periods.

Discussion

One of the most important findings from this study is the persistence of racial/ethnic disparities in COVID-19 hospitalizations seen in community dwelling individuals in New Haven and Middlesex Counties from July 2021 - September 2021. Additionally, race/ethnicity remains more strongly associated with hospitalization than measures of SES.

Inequalities in access to and acceptability of the COVID - 19 vaccine have affected the disparities seen specifically in the “*the vaccine period*”. Recent abuses, such as the water crisis in Flint, Black maternal mortality rates, and coerced sterilizations in ICE detention centers, provide people of color with many reasons to distrust medical and public health institutions.¹⁵ Lower rates of self-reported of vaccine acceptability in racial and ethnic minorities in the United States reflects this very justified mistrust. Compared to white individuals, non-Hispanic Black individuals had 3.84 times the odds of reporting vaccine hesitancy and Hispanic/Latinx individuals had 1.69 times the odds of reporting vaccine hesitancy when compared to White individuals.²² Additionally, disinvestment due to racialized practices and policies, has left many communities of color without adequate access to medical care and health-promoting resources such as vaccines.¹⁵ Structural barriers to COVID-19 vaccination for non-Hispanic Black and Hispanic/Latinx individuals include but are not limited to increased geographic distance from vaccination sites, less flexibility in work and childcare schedules to travel to vaccination sites when appointments open up, decreased access to an adequate internet connection, and lack of affordable transportation that allows for social distancing to vaccine appointments.²¹

Whether due to mistrust, lack of access, or both, at the end of September 2021, Connecticut's non-Hispanic Black and Hispanic/Latinx populations were vaccinated at lower rates compared to the non-Hispanic White population.¹⁹ With an estimated 59 - 64% of the COVID-NET catchment area's population fully vaccinated for COVID-19 between August 1 and September 29, 2021, 67 - 71% of Connecticut's non-Hispanic White population was fully vaccinated whereas only 46 - 54% of the non-Hispanic Black population and 57 - 67% of the Hispanic/Latinx population was fully vaccinated.¹⁹ Racial/ethnic differences in vaccination rates likely explain why the age adjusted relative risk for non-Hispanic Black individuals compared to non-Hispanic White individuals increased from 3.20 in "*the post-lockdown pre-vaccine period*" to 4.07 in "*the vaccine period*".

Remarkably, the gap in vaccination rates between Connecticut's non-Hispanic White population and Hispanic/Latinx population is less pronounced than the disparity between the non-Hispanic White and non-Hispanic Black populations. Additionally, disparities in vaccination rates between the Hispanic/Latinx population and the non-Hispanic White population decreased as age increased. However, this was not the case for the non-Hispanic Black population. For example, non-Hispanic White individuals aged 25 - 34 years old were 64 - 67% vaccinated while only 30 - 38% of non-Hispanic Black and 47 - 56% of Hispanic/Latinx individuals in this age group were vaccinated¹⁹. In comparison, non-Hispanic White individuals aged 65 years and older were 77 - 79% vaccinated while Hispanic/Latinx individuals were 75-90% vaccinated and non-Hispanic Black individuals were only 69-72% vaccinated in this age group.¹⁹ As age increased the Hispanic/Latinx population caught up to and surpassed the non-Hispanic White population, while the non-Hispanic Black population always had a lower vaccination rate than the non-Hispanic White population. Since increased age is associated with a higher likelihood of

COVID-19 hospitalization, the magnitude of disparities seen in racial/ethnic vaccination rates in older age groups has a greater impact on disparities in hospitalization. This most likely explains why the age adjusted relative risk for Hispanic/Latinx individuals compared to non-Hispanic White individuals decreased from 4.73 in “*the post-lockdown pre-vaccine period*” to 3.44 in “*the vaccine period*”.

More broadly, the racial/ethnic disparities in hospitalizations for COVID-19 in this time period and the two previous time periods of study, reflect the enduring effects of racism on the health of racial/ethnic minorities in the United States.¹⁸ Racism adversely effects health through three main mechanisms: experience of discrimination creating psychosocial stress, internalized racism, and the creation of racial/ethnic differences in residential environments, SES, and access to goods and services through institutional discrimination.²³ While racial/ethnic disparities in vaccination rates are attributed to decreased access to and acceptability of the COVID-19 vaccines, it’s important to acknowledge racism as a root cause of gaps in access and acceptability.

Another important finding from this study is the decrease in the percentage of hospitalized cases in institutionalized individuals. Institutionalized individuals accounted for approximately 30% of all hospitalized cases in March - June 2020, 15% in July - December 2020, and only 6% in July - September 2021. This trend reflects increased prevention of COVID-19 outbreaks (first versus second time period) that was furthered due to vaccination of persons residing in nursing homes, prisons, and shelters. In early July 2021, approximately 88% of residents in long term care facilities located in Connecticut were fully vaccinated and by the end of September this percentage increased to 92%.¹⁷ It appears as though vaccination in institutionalized settings greatly affected this group’s risk of hospitalization for COVID-19.

Another notable finding is that individuals ages 18 - 49 years old in the “*vaccine period*” accounted for a significantly greater percentage of cases than during the “*post-lockdown pre-vaccine period*”. Furthermore, individuals aged 65 years and older accounted for a significantly lower percentage of cases in the “*vaccine period*” compared to the “*post-lockdown pre-vaccine period*”. Vaccination may have contributed to this finding because the rate of vaccination increased for each progressively advanced age group. However, older individuals may also have been more likely to continue avoiding COVID-19 exposure and wear masks as they were more concerned about getting the virus compared to younger age groups.

Limitations of our findings include using vaccination rates for the entire state of Connecticut to explain patterns in New Haven and Middlesex counties and using census tract levels of poverty and crowding to determine an individual’s SES. Instead of using vaccination information for the entire state of Connecticut to evaluate differences in COVID-19 hospitalization epidemiology in New Haven County and Middlesex County, our explanations in the discussion section would be stronger if we used vaccination information specific to New Haven and Middlesex Counties. However, county specific data were not available to us. Additionally, deducing a case’s SES from their census tract measures of poverty and crowding may not accurately reflect their individual SES as they could have very different levels of crowding and poverty compared to the other individuals living in their census tract.

Conclusion

In summary, the key finding from this study is that non-Hispanic Black and Hispanic/Latinx race/ethnicity were associated with lower vaccination rates which led to higher incidence of hospitalization compared to non-Hispanic White individuals in New Haven and Middlesex counties in July - September 2021. Furthermore, in the “*vaccine period*” of study the

hospitalization rate for non-Hispanic Black individuals compared to non-Hispanic White individuals increased from those in the “*post-lockdown pre-vaccine period*”.

In conclusion, the COVID -19 vaccination era of July - September 2021 did not result in more racial/ethnic equality in hospitalization in New Haven and Middlesex counties. In fact, it appears that lower COVID-19 vaccination rates in non-Hispanic Black individuals increased inequities in hospitalization. I suggest conducting community based participatory research with this demographic to better understand barriers to vaccination and ultimately focus attention and funding towards overcoming the identified obstacles.

Tables:

Table 1. Characteristics of laboratory confirmed SARS CoV- 2 hospitalized cases in Middlesex and New Haven County, CT from July - September 2021

	N (N = 757)	%
Address Type		
Residential	712	94.1
Long - Term Care Facility	39	5.2
Corrections	1	0.1
Homeless	4	0.5
Other	1	0.1
Pathogen Type		
SARS CoV-2	757	100
Case Type		
Pediatric	11	1.5
Adult	746	98.5
Gender		
Male	407	53.8
Female	350	46.2
Race		
White Non-Hispanic/Latinx	419	55.4
Black Non-Hispanic/Latinx	172	22.7
Hispanic/Latinx	125	16.5
Asian/Pacific Islander	12	1.6
Other	29	3.8
Age Group		
0 - 17	11	1.5
18 - 49	241	31.8
50 - 64	194	25.6
65 - 74	127	16.8
75-84	108	14.3
85 +	76	10.0
Month of Hospitalization		
July	126	16.6
August	364	48.1
September	267	35.3

Table 2. Characteristics of laboratory confirmed SARS-CoV-2 hospitalized cases in community dwelling individuals vs institutionalized individuals in Middlesex and New Haven County, CT from July - September 2021

	Community dwelling		Institutionalized		OR (95% CI)	Overall chi-square p-value
	N (N = 712)	%	N (N = 45)	%		
Pathogen Type						
SARS CoV-2	712	100	45	100	-	-
Case Type						
Pediatric	10	1.4	1	2.2	0.63 (0.08 - 5.01)	0.66
Adult	702	98.6	44	97.8	1.60 (0.20 - 12.75)	
Gender						
Male	385	54.1	22	48.9	1.23 (0.67 - 2.25)	0.50
Female	327	45.9	23	51.1	0.81 (0.44 - 1.49)	
Race						
White Non-Hispanic/Latinx	384	53.9	35	77.8	0.33 (0.16 - 0.69)	0.007
Black Non-Hispanic/Latinx	167	23.5	5	11.1	2.45 (0.95 - 6.31)	
Hispanic/Latinx	123	17.3	2	4.4	4.49 (1.07 - 18.78)	
Asian/Pacific Islander	10	1.4	2	4.4	0.31 (0.07 - 1.44)	
Other	28	3.9	1	2.2	1.80 (0.24 - 13.55)	
Age Group						
0 - 17	10	1.4	1	2.2	0.63 (0.08 - 5.01)	<0.0002
18 - 49	235	33.0	6	13.3	3.20 (1.34 - 7.67)	
50 - 64	187	26.3	7	15.6	1.93 (0.85 - 4.40)	
65 - 74	120	16.9	7	15.6	1.10 (0.48 - 2.52)	
75-84	95	13.3	13	28.9	0.38 (0.19 - 0.75)	
85 +	65	9.1	11	24.4	0.31 (0.15 - 0.64)	
Month of Hospitalization						
July	119	16.7	7	15.6	1.09 (0.48 - 2.50)	0.60
August	345	48.5	19	42.2	1.29 (0.70 - 2.37)	
September	248	34.8	19	42.2	0.73 (0.40 - 1.35)	

Table 3. Crude & age-adjusted incidence and relative crude & age adjusted incidence of community-dwelling individuals hospitalized with COVID in New Haven and Middlesex counties, CT, July - September 2021

	N (%)	Total Population	Crude IR/100,000	Crude RR	Adj IR/100,000 population	Adj RR	95% CI
Total Hospitalized Patients	712	1,028,153	69.3	--	62.5	--	--
Gender							
Male	385 (54.1)	495,998	77.6	1.26	74.1	1.38	1.18-1.61
Female	327 (45.9)	532,155	61.5	ref	53.7	ref	ref
Race							
NH White	384 (53.9)	725,528	52.9	ref	40.5	ref	--
NH Black	167 (23.5)	109,019	153.2	2.89	164.8	4.07	3.39 - 4.90
Hispanic/Latinx	123 (17.3)	137,577	89.4	1.69	139.9	3.44	2.87 - 4.13
Asian/Pacific Islander	10 (1.4)	34,140	29.3	0.55	51.3	1.23	0.76 - 2.01
Other	28 (3.9)	21,889	127.9	2.42	--	--	--
Age Group							
0 - 17	10 (1.4)	228,072	4.4	0.08	4.4	0.08	0.04 - 0.16
18 - 49	235 (33.0)	441,329	53.3	ref	53.3	ref	--
50 - 64	187 (26.3)	209,159	89.4	1.68	89.4	1.68	1.39 - 2.03
65 - 74	120 (16.9)	74,130	161.9	3.04	161.9	3.04	2.44 - 3.79
75-84	95 (13.3)	49,238	192.9	3.62	192.9	3.62	2.86 - 4.60
85 +	65 (9.1)	26,225	247.9	4.65	247.9	4.65	3.54 - 6.12
Month of Hospitalization							
July	119	1,028,153	11.6	--	10.7	--	--
August	345	1,028,153	33.6	--	30.0	--	--
September	248	1,028,153	24.12	--	21.8	--	--
Community Poverty Levels							
Very low	193 (27.6)	366,844	52.6	ref	44.3	ref	--
Low	157 (22.4)	270,104	58.1	1.10	48.6	1.09	0.87 - 1.37
Moderate	164 (23.4)	197,588	83.0	1.58	78.2	1.77	1.42 - 2.20
High	186 (26.1)	193,617	96.1	1.83	101.3	2.28	1.85 - 2.80
Community Crowding Levels							
Very Low	270 (38.6)	508,471	53.1	ref	45.2	ref	--
Low	208 (29.7)	274,286	75.8	1.43	67.9	1.50	1.24 - 1.82
Moderate	134 (19.1)	144,042	93.0	1.75	87.8	1.95	1.58 - 2.41
High	88 (12.6)	101,354	86.8	1.64	92.4	2.03	1.59 - 2.58

Table 4a. Crude, age-adjusted and relative crude and age-adjusted incidence of laboratory confirmed SARS-CoV-2 hospitalizations for community dwelling individuals in New Haven and Middlesex counties by Census Tract Poverty and Crowding Levels stratified by Race/Ethnicity

	N (%)	Total Population	Crude IR/100,000	Crude RR	Adj IR/100,000	Adj RR	95% CI
Total Hospitalized Patients	712	1,028,153	69.3	--	62.5	--	
Census Tract Poverty Levels							
NH White							
Very low	157	32,6428	48.1	ref	37.8	ref	--
Low	107	22,0483	48.5	1.01	36.6	0.97	(0.73 - 1.28)
Moderate	78	117,083	66.6	1.39	51.1	1.35	(0.99 - 1.84)
High	36	61,534	58.5	1.22	42.9	1.11	(0.73 - 1.70)
NH Black							
Very low	10	8,207	121.8	ref	141.9	ref	--
Low	23	14,091	163.2	1.34	172.0	1.16	(0.58 - 2.33)
Moderate	45	31,708	141.9	1.16	151.4	1.04	(0.55 - 1.95)
High	86	55,013	156.3	1.28	169.2	1.16	(0.63 - 2.11)
Hispanic/Latinx							
Very Low	14	16,014	87.4	ref	141.6	ref	--
Low	19	21,023	90.4	1.03	149.1	1.03	(0.60 - 1.76)
Moderate	28	35,174	79.6	0.91	136.7	0.95	(0.58 - 1.56)
High	59	65,366	90.26	1.03	135.4	0.95	(0.60 - 1.50)
Census Tract Crowding Levels							
NH White							
Very low	199	420,923	47.3	ref	36.7	ref	--
Low	104	193,657	53.7	1.14	39.8	1.08	(0.82 - 1.42)
Moderate	48	74,601	64.3	1.36	48.4	1.31	(0.91 - 1.88)
High	27	36,347	74.3	1.57	59.0	1.57	(0.99 - 2.47)
NH Black							
Very low	31	24,856	124.7	ref	129.8	ref	--
Low	62	28,902	214.5	1.72	233.6	1.83	(1.20 - 2.79)
Moderate	43	31,445	136.7	1.10	143.1	1.11	(0.71 - 1.75)
High	28	23,816	117.6	0.94	135.6	1.04	(0.64 - 1.70)
Hispanic/Latinx							
Very low	25	36,853	67.8	ref	89.6	ref	--
Low	30	31,274	95.9	1.41	203.2	2.29	(1.50 - 3.48)
Moderate	34	35,218	96.5	1.42	147.5	1.65	(1.07 - 2.55)
High	31	34,231	90.6	1.34	130.8	1.47	(0.94 - 2.30)

Table 4b. Age-adjusted and relative age-adjusted incidence of laboratory confirmed SARS-CoV-2 hospitalizations for community dwelling individuals in New Haven and Middlesex counties by race/ethnicity stratified by Census Tract Poverty and Crowding Levels

	Adj IR/100,000	Adj RR	95% CI
Census Tract Levels of Poverty			
Very Low			
NH White	37.8	--	--
NH Black	141.9	3.8	(2.13 - 6.96)
Hispanic/Latinx	141.6	3.8	(2.42 - 5.90)
Low			
NH White	36.6	--	--
NH Black	172.0	4.6	(2.94 - 7.31)
Hispanic/Latinx	149.1	4.0	(2.65 - 6.07)
Moderate			
NH White	51.1	--	--
NH Black	151.4	3.0	(2.02 - 4.32)
Hispanic/Latinx	136.7	2.7	(1.83 - 3.90)
High			
NH White	42.9	--	--
NH Black	169.2	4.0	(2.59 - 6.18)
Hispanic/Latinx	135.4	3.2	(2.08 - 4.99)
Census Tract Level of Crowding			
Very low			
NH White	36.7	--	--
NH Black	129.8	3.5	(2.40 - 5.13)
Hispanic/Latinx	89.6	2.4	(1.67 - 3.54)
Low			
NH White	39.8	--	--
NH Black	233.6	6.0	(4.30 - 8.24)
Hispanic/Latinx	203.2	5.1	(3.70 - 7.17)
Moderate			
NH White	48.4	--	--
NH Black	143.1	3.0	(1.92 - 4.61)
Hispanic/Latinx	147.5	3.0	(2.00 - 4.68)
High			
NH White	59.0	--	--
NH Black	135.6	2.3	(1.35 - 4.05)
Hispanic/Latinx	130.8	2.3	(1.36 - 3.82)

Table 5a. Comparison of community patients hospitalized due to COVID-19 between March 1 - June 30, 2020*, July 1 - December 31, 2020, and July 1 – September 30, 2021 residing in New Haven and Middlesex counties in CT

Case Characteristics	Mar – Jun 2020	Jul – Dec 2020	Jul – Sep 2021	Jul-Dec 2020 vs Jul-Sep 2021
	N Cases (%)	N Cases (%)	N Cases (%)	P-value* (Chi-square)
Total Hospitalized Cases	2,733	6,967	757	-
Institutionalized Cases	832 (30.4)	1,018 (14.6)	45 (5.96)	<0.001
Total Community COVIDNET Cases	1,901 (69.6)	2,035 (29.2)	712 (94.1)	<0.001
Sex				
Male	989 (52.0)	1040 (51.1)	385 (54.1)	NS**
Female	912 (48.0)	995 (48.9)	327 (45.9)	NS
Age Group				
0-17	16 (0.8)	18 (0.9)	10 (1.4)	NS
18-49	433 (22.8)	406 (22.0)	235 (33.0)	<0.001
50-64	561 (29.5)	556 (27.3)	187 (26.3)	NS
65+	891 (46.9)	1055 (51.8)	280 (39.3)	<0.001
Race/ethnicity				
Non-Hispanic White	778 (40.9)	1148 (56.4)	384 (53.9)	NS
Non-Hispanic Black	536 (28.2)	350 (17.2)	167 (23.5)	<0.001
Hispanic/Latinx	419 (22.0)	406 (22.0)	123 (17.3)	NS
Asian/Pacific Islander	33 (1.7)	18 (0.9)	10 (1.4)	NS
Other	---	113 (5.6)	28 (3.9)	NS
Census Tract Levels of Poverty				
Very low	381 (20.0)	567 (27.9)	193 (27.6)	NS
Low	410 (21.6)	513 (25.2)	157 (22.4)	NS
Medium	468 (24.6)	427 (21.0)	164 (23.4)	NS
High	642 (33.8)	528 (26.0)	186 (26.1)	NS
Census Tract Levels of Crowding				
Very low	699 (36.8)	865 (42.5)	270 (38.6)	NS
Low	496 (26.1)	553 (27.2)	208 (29.7)	NS
Medium	359 (18.9)	359 (17.6)	134 (19.1)	NS
High	347 (18.3)	258 (12.7)	88 (12.6)	NS

* Chi-square comparing statistically significant difference in characteristics of the community dwelling individuals hospitalized for COVID-19 in Jul-Dec 2020 and Jul - Sep 2021

** NS = not statistically significant, p>0.05

Table 5b. Time period comparisons of age adjusted relative risks by race/ethnicity and SES of residents of New Haven and Middlesex Counties in March - May 2020, July-December 2020, and July - September 2022.

	Mar – Jun 2020 aRR (95% CI)	Jul – Dec 2020 aRR (95% CI)	Jul – Sep 2021 aRR (95% CI)
Race/Ethnicity			
Non-H Black vs Non-H White	7.51 (6.71-8.41)	3.20 (2.84-3.60)	4.07 (3.39 - 4.90)
Hispanic vs Non-H White	6.57 (5.88-7.35)	4.73 (4.29-5.22)	3.44 (2.87 - 4.13)
Poverty			
High vs Very Low	4.36 (3.82-4.99)	2.48 (2.20-2.81)	2.28 (1.85 - 2.80)
Med vs Very Low	2.68 (2.32-3.10)	1.69 (1.48-1.94)	1.77 (1.42 - 2.20)
Low vs Very Low	1.41 (1.21-1.60)	1.21 (1.06-1.39)	1.09 (0.87 - 1.37)
Crowding			
High vs Very Low	3.40 (2.99-3.87)	2.06 (1.79-2.36)	2.03 (1.59 - 2.58)
Med vs Very Low	2.11 (1.84-2.41)	1.75 (1.53-1.98)	1.95 (1.58 - 2.41)
Low vs Very Low	1.42 (1.25-1.60)	1.27 (1.13-1.43)	1.50 (1.24 - 1.82)

Table 6. Age-specific Incidence Rates of hospitalization with laboratory confirmed SARS-CoV-2 by race/ethnicity and by SES measures for community dwelling individuals in Middlesex County and New Haven County from July - September 2021.

			Incidence Rate / 100,000 population					
	N (%)	Total Population	0 - 17	18 - 49	50 - 64	65 - 74	75 - 84	85 +
Race/ Ethnicity								
NH - White	384 (53.9)	725,528	3.8	25.4	59.2	128.8	149.8	231.7
NH - Black	167 (23.5)	109,019	10.0	146.0	292.3	403.9	437.0	323.6
Hispanic/Latinx	123 (17.3)	137,577	4.1	100.1	173.8	298.2	736.2	864.0
Asian	10 (1.4)	34,140	0	20.4	22.9	155.4	627.6	0
Poverty Levels								
Very Low	193 (27.6)	366,844	3.7	29.8	49.0	140.8	187.4	287.1
Low	157 (22.4)	270,104	5.5	39.7	79.8	120.4	139.4	159.3
Moderate	164 (23.4)	197,588	2.3	67.2	128.3	222.6	172.2	299.5
High	186 (26.1)	193,617	6.1	84.8	173.8	225.9	327.0	299.1
Crowding Levels								
Very Low	270 (38.6)	508,471	3.7	35.0	62.9	143.5	126.8	219.0
Low	208 (29.7)	274,286	3.5	55.1	93.7	178.5	235.4	320.0
Moderate	134 (19.1)	144,042	2.7	83.5	149.9	131.1	298.1	238.4
High	88 (12.6)	101,354	11.5	75.4	150.4	464.2	253.5	196.5

References:

- 1) Centers for Disease Control and Prevention. (n.d.). *Underlying medical conditions associated with higher risk for severe COVID-19: Information for Healthcare professionals*. Centers for Disease Control and Prevention. Retrieved April 4, 2022, from <https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/underlyingconditions.html>
- 2) Fox, S. J., Lachmann, M., Tec, M., Pasco, R., Woody, S., Du, Z., Wang, X., Ingle, T. A., Javan, E., Dahan, M., Gaither, K., Escott, M. E., Adler, S. I., Johnston, S. C., Scott, J. G., & Meyers, L. A. (2022). Real-time pandemic surveillance using hospital admissions and Mobility Data. *Proceedings of the National Academy of Sciences*, 119(7). <https://doi.org/10.1073/pnas.2111870119>
- 3) Chowkwanyun, M. and A. L. Reed (2020). "Racial Health Disparities and Covid-19 — Caution and Context." *New England Journal of Medicine* **383**(3): 201-203.
- 4) Krieger, N., et al. (2005). "Painting a truer picture of US socioeconomic and racial/ethnic health inequalities: the Public Health Disparities Geocoding Project." *Am J Public Health* **95**(2): 312-323.
- 5) Hadler, Edmunson, Yousey-Hindes (2020). "Race/Ethnic Disparities in COVID-19 Hospitalizations Stronger Than Socioeconomic Ones During Stay Safe, Stay Home, New Haven and Middlesex Counties, March 1 - May 8, 2020." *Connecticut Epidemiologist* **40**: 13-15.
- 6) Chiumento, G., Yousey-Hindes, K., & Hadler, J. L. (2021). *Persistence of Racial/Ethnic and Socioeconomic Status Disparities Among Non-Institutionalized Patients Hospitalized with Covid-19 in Connecticut, July - December 2020* (thesis).
- 7) Yousey-Hindes, K. M., & Hadler, J. L. (2011). Neighborhood socioeconomic status and influenza hospitalizations among children: New Haven County, Connecticut, 2003–2010. *American Journal of Public Health*, 101(9), 1785–1789. <https://doi.org/10.2105/ajph.2011.300224>
- 8) Tam, K., Yousey-Hindes, K., & Hadler, J. L. (2014). Influenza-related hospitalization of adults associated with low census tract socioeconomic status and female sex in New Haven County, Connecticut, 2007-2011. *Influenza and Other Respiratory Viruses*, 8(3), 274–281. <https://doi.org/10.1111/irv.12231>
- 9) Centers for Disease Control and Prevention. (n.d.). *Variants of the virus*. Centers for Disease Control and Prevention. Retrieved April 4, 2022, from <https://www.cdc.gov/coronavirus/2019-ncov/variants/>

- 10) FDA. (n.d.). *FDA approves first COVID-19 vaccine*. U.S. Food and Drug Administration. Retrieved April 4, 2022, from <https://www.fda.gov/news-events/press-announcements/fda-approves-first-covid-19-vaccine>.
- 11) FDA. (n.d.). *Spikevax and Moderna Covid-19 vaccine*. U.S. Food and Drug Administration. Retrieved April 4, 2022, from <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/spikevax-and-moderna-covid-19-vaccine>.
- 12) FDA. (n.d.). *FDA and CDC Lift recommended pause on Johnson & Johnson (janssen) COVID-19 vaccine use following thorough safety review*. U.S. Food and Drug Administration. Retrieved April 4, 2022, from <https://www.fda.gov/news-events/press-announcements/fda-and-cdc-lift-recommended-pause-johnson-johnson-janssen-covid-19-vaccine-use-following-thorough>
- 13) *Connecticut Coronavirus Vaccination Progress*. USAFacts.org. (2022, March 14). Retrieved April 4, 2022, from <https://usafacts.org/visualizations/covid-vaccine-tracker-states/state/connecticut>
- 14) Earnest, R., Uddin, R., Matluk, N., Renzette, N., Siddle, K. J., Loreth, C., Adams, G., Tomkins-Tinch, C. H., Petrone, M. E., Rothman, J. E., Breban, M. I., Koch, R. T., Billig, K., Fauver, J. R., Vogels, C., Turbett, S., Bilguvar, K., De Kumar, B., Landry, M. L., Peaper, D. R., ... Grubaugh, N. D. (2021). Comparative transmissibility of SARS-CoV-2 variants Delta and Alpha in New England, USA. *medRxiv: the preprint server for health sciences*, 2021.10.06.21264641. <https://doi.org/10.1101/2021.10.06.21264641>
- 15) Hyacinthe, M.-F. W., Shannon. (2021). Vaccine Hesitance and Medical Mistrust: What Did We Learn. Retrieved from <https://iaphs.org/vaccine-hesitancy-and-medical-mistrust-what-did-we-learn/>
- 16) Geronimus, A. T., Hicken, M., Keene, D., & Bound, J. (2006). "Weathering" and age patterns of allostatic load scores among blacks and whites in the United States. *American journal of public health*, 96(5), 826-833. doi:10.2105/AJPH.2004.060749
- 17) Centers for Disease Control and Prevention. (n.d.). *CDC Covid Data tracker*. Centers for Disease Control and Prevention. Retrieved April 14, 2022, from <https://covid.cdc.gov/covid-data-tracker/#vaccinations-nursing-homes>
- 18) Centers for Disease Control and Prevention. (2021, November 24). *Racism and health*. Centers for Disease Control and Prevention. Retrieved April 14, 2022, from <https://www.cdc.gov/healthequity/racism-disparities/index.html>
- 19) *Connecticut COVID-19 vaccine coverage*. State of Connecticut - Open Data. (n.d.). Retrieved April 14, 2022, from <https://data.ct.gov/stories/s/Connecticut-COVID-19-Vaccine-Coverage/bhcd-4mnv>

- 20) Harvard Gazette. (2022, February 2). *Study examines racial, ethnic disparities in COVID vaccine rate*. Harvard Gazette. Retrieved April 25, 2022, from <https://news.harvard.edu/gazette/story/2022/02/study-examines-racial-ethnic-disparities-in-covid-vaccine-rate/>
- 21) Njoku, A., Joseph, M., & Felix, R. (2021). Changing the Narrative: Structural Barriers and Racial and Ethnic Inequities in COVID-19 Vaccination. *International journal of environmental research and public health*, 18(18), 9904. Retrieved from <https://www.mdpi.com/1660-4601/18/18/9904>
- 22) Nguyen, L.H., Joshi, A.D., Drew, D.A. *et al.* Self-reported COVID-19 vaccine hesitancy and uptake among participants from different racial and ethnic groups in the United States and United Kingdom. *Nat Commun* **13**, 636 (2022). <https://doi.org/10.1038/s41467-022-28200-3>
- 23) Williams, D. (2004). Chapter 6: Racism and Health. In *Closing the Gap: Improving the Health of Minority Elders in the New Millennium* (pp. 69–80). essay, Gerontological Society of America.