

What the Data is Teaching Us About COVID-19: Insight into Three Key Areas Around the Novel Virus

New Jersey was one of the first COVID-19 hotspots in the United States. This state has helped pave the way for COVID-19 emergency preparedness and response, with its thousands of frontline clinical staff working around the clock to combat the spring surge. Having confronted the virus earlier, and on a large scale, New Jersey was able to collect valuable data about this never-before-seen virus. As the COVID-19 landscape continues to evolve, NJHA's Center for Health Analytics, Research and Transformation (CHART) takes a closer look at changes in the demographic and health make-up of 27,860 hospitalized COVID-19-positive inpatients admitted to an acute care New Jersey hospital between April 1 and Aug. 31, 2020.

A detailed look at New Jersey's first-wave experience with COVID-19 among its vulnerable hospitalized population provides important insight into three key facets of this novel virus:

- **Age** - While COVID-19 poses the greatest health risks to older individuals, younger age groups have by no means been immune to negative health outcomes. New Jersey experienced a substantial rise in the percentage of hospitalized COVID-19 patients under the age of 45, coupled with a decrease in the proportion of those age 60 and older. The proportion of hospitalized COVID-19 patients age 18 to 29, for example, increased from approximately 3 percent in April to 13 percent in July through August.
- **Comorbidities** - While earlier research emphasized the connection between COVID-19 and the lungs, New Jersey data shows

that hospitalized COVID-19 patients with kidney disease/impairment had the highest prevalence of mortality. Based on CHART's findings, comorbidities involving the heart and kidneys will likely remain important risk factors for poor health outcomes among hospitalized COVID-19 patients. As more and more information is collected, COVID-19's impact on other major organs is gradually becoming more clear.

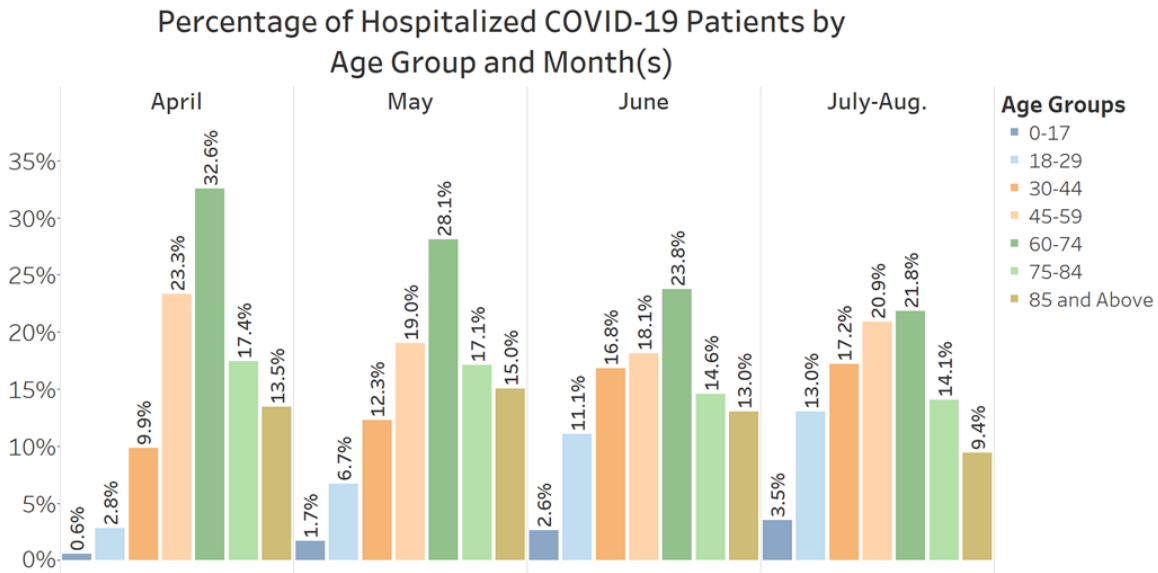
- **Treatment** - There were limited, if any, defined treatment protocols for COVID-19 when the virus first surged in New Jersey. Yet, within almost five months of being introduced to this novel virus, New Jersey experienced a decrease in hospitalized COVID-19 deaths, as well as reductions in severe forms of treatments and in average lengths of stays. Over a quarter of hospitalized COVID-19 patients (25.3 percent) died during April, more than four times the percentage in July through August (6 percent). Mortality among those with high-risk comorbidities has also decreased substantially from April through August. While the extent to which is unclear, improvements in the treatment and identification of COVID-19 patients have likely played an important role.

Age and Gender

In June, an uptick in coronavirus cases among 18- to 29-year-olds in New Jersey gained the public's attention. That month, 18- to 29-year-olds accounted for approximately 22 percent of all COVID-19 hospitalized cases, up from 12 percent in April¹.

There was also a notable rise in the percentage of COVID-19 patients under the age of 45 in New Jersey’s hospitalized population, coupled with a decrease in the proportion of those age 60 and older. The proportion of hospitalized COVID-19 patients age 18 to 29 was 4.6 times higher in the months of July and August than in April (13 percent vs. 3 percent, respectfully). When comparing the same monthly periods, the proportion of patients age 30 to 44 was 1.7 times higher (17 percent vs. 10 percent). The largest decrease between April and July/August was among those age 60 to 74 (from 33 percent to 22 percent). The spread of COVID-19 in younger age groups can be attributed to a combination of factors: the reopening of colleges and universities (even in limited capacities); the tendency of younger individuals to work in frontline or public-facing occupations; higher rates of asymptomatic transmission; reduced adherence to social distancing; and a variety of other influences.²

Figure 1



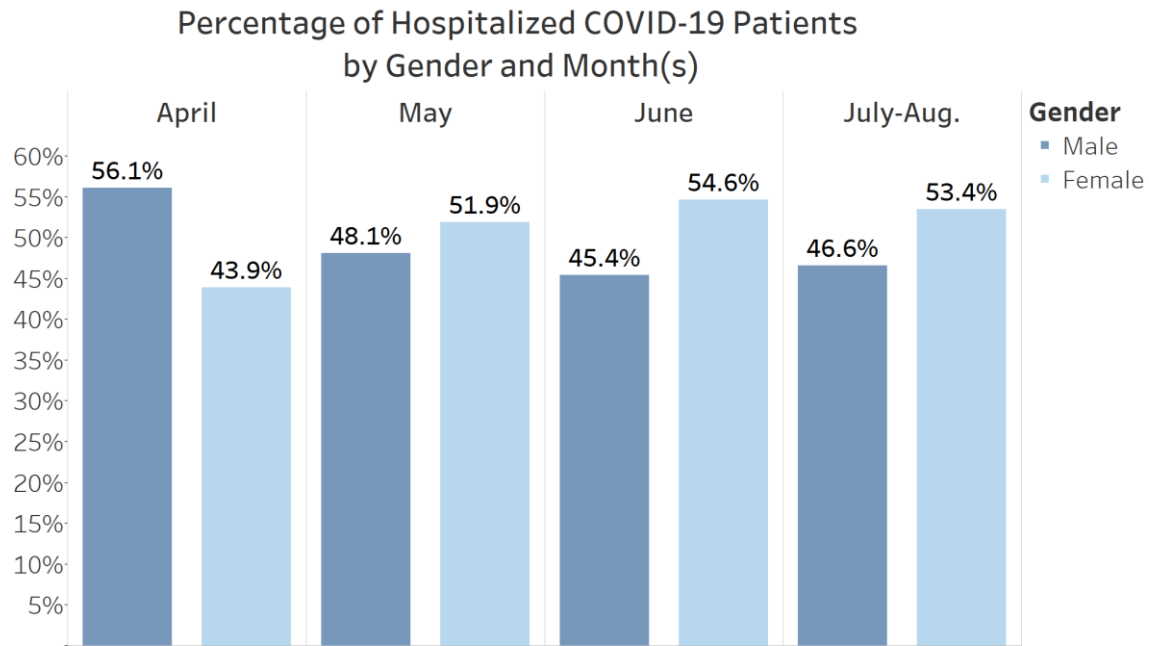
Month	Mean Age (COVID-19 Positive)		
	Not Expired	Expired	All
April	62	73	64
May	60	75	62
June	57	72	58
July-Aug.	54	75	55

In light of these overall trends, the mean age of hospitalized COVID-19 patients who died was consistently higher compared to those who survived, fluctuating to some extent but remaining above 70 years. Those in older age groups, therefore, continued to be at an increased risk for death.

Gender also has been shown to be an important risk factor for COVID-19-related mortality. Per the Centers for Disease Control and Prevention (CDC), male’s physiological characteristics (such as weaker immune systems) and their behavioral and lifestyle factors (a greater propensity toward higher-risk behaviors such as tobacco use and alcohol consumption; higher rates of preexisting conditions; and decreased adherence to preventive health measures) are believed to contribute to higher rates of both COVID-19 infections and deaths.³ New Jersey discharge data shows a shift in the proportion of male hospitalized COVID-19 patients after April. While males accounted for approximately 56 percent of hospitalized COVID-19 patients in April, this proportion decreased in subsequent months, dropping below 50 percent from May through August.

Males also accounted for roughly 58 percent of all hospitalized COVID-19 deaths between April through August compared to females (42 percent). The high percentage of male hospitalized patients in April, during the peak of the pandemic, helps demonstrate the disproportionate toll that COVID-19 had on males.

Figure 2



Comorbidities

The comorbidities selected for this study included kidney disease/impairment, chronic obstructive pulmonary disease (COPD), heart failure, diabetes (type 1 and 2), asthma and hypertension. When looking at hospitalized COVID-19 patients who died between the beginning of April and the end of August, approximately three-fourths had a diagnosis for kidney disease/impairment. The second most common condition among hospitalized COVID patients who died was hypertension, followed by diabetes (73 percent and 47 percent, respectively). From April into July and August, the prevalence of kidney disease/impairment decreased by 33 percent, diabetes by 30 percent, and hypertension and COPD by 20 percent. As age and gender are often prominent risk factors for comorbidities, the decrease in the prevalence of four major comorbidities was unsurprising given the demographic trends noted above.

Figure 3

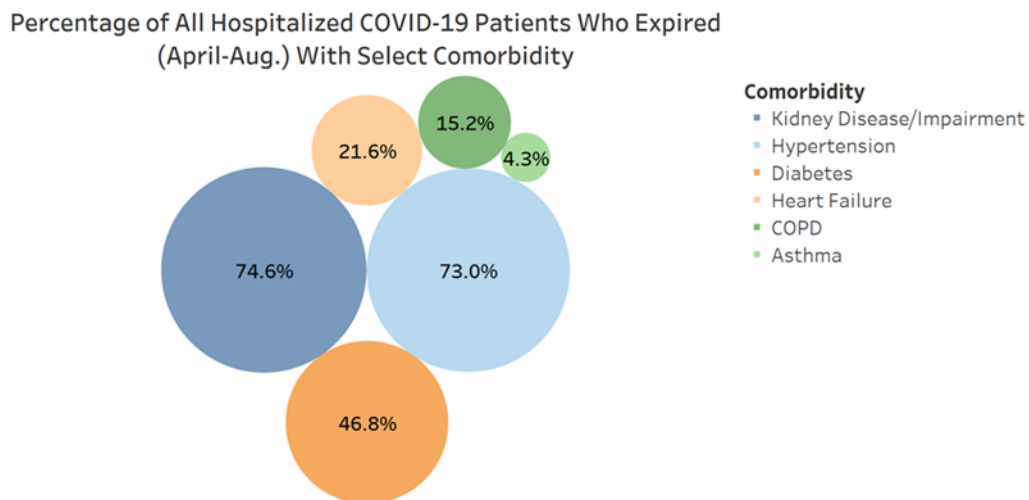
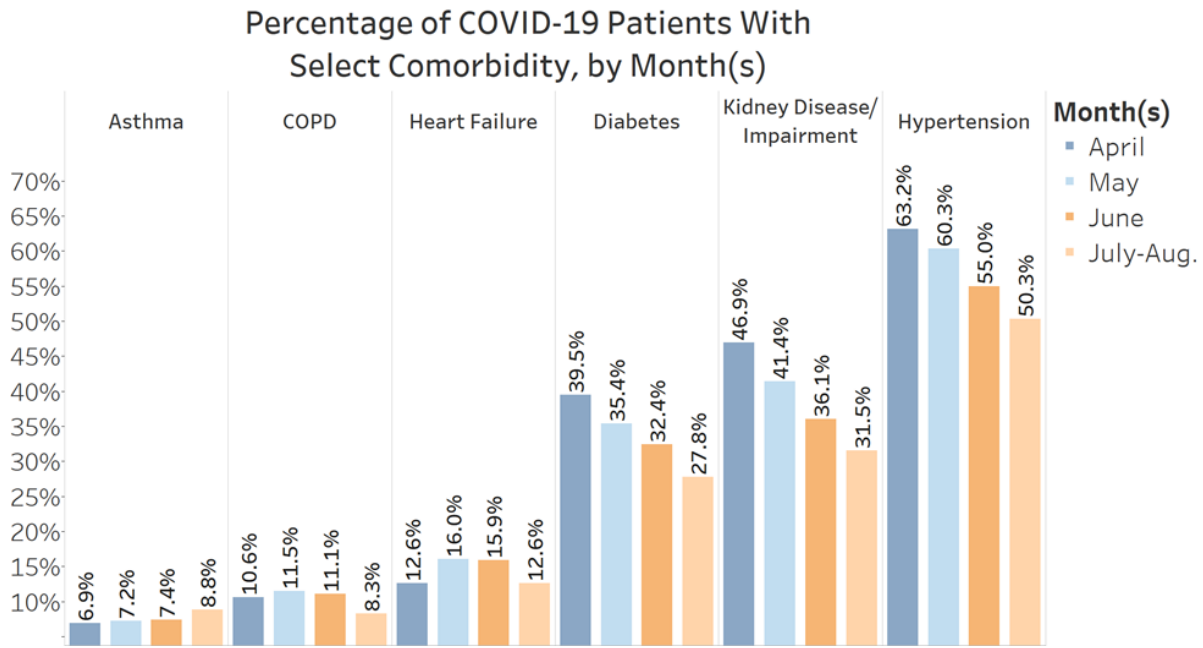


Figure 4

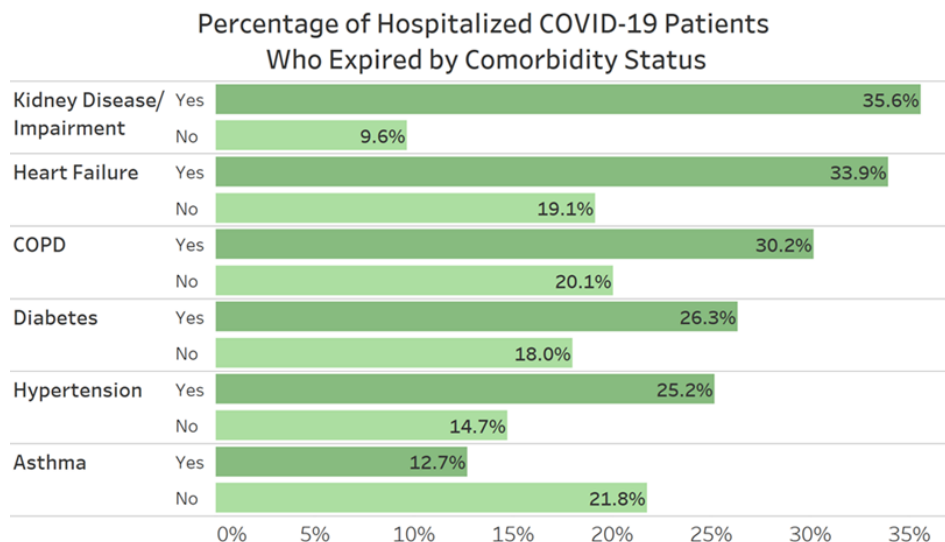


While both kidney disease/impairment and hypertension remained highly prevalent among expired hospitalized COVID-19 patients, Figure 5 helps highlight the particularly stark relationship between kidney disease/impairment and COVID-19-related mortality.

Approximately 36 percent of hospitalized COVID-19 patients with a diagnosis for kidney disease/impairment died compared to 10 percent with normal kidney function. The proportion of those with heart failure who died was 34 percent versus 19 percent among those without heart failure. The difference between these percentages was smaller for hypertensive versus non-hypertensive COVID patients who died (25 percent and 15 percent, respectively).

Despite the early focus of COVID-19's impact on the lungs, the damage it causes to other vital organs has gained increasing attention. According to the CDC, there is consistently strong evidence to suggest that chronic kidney disease and heart failure place individuals at a higher risk for severe health complications from COVID-19.⁴ The evidence is less conclusive for hypertension.⁴⁻⁶ Put broadly, those with kidney impairments and heart failure may be more predisposed to severe COVID-19-related illnesses, including death.⁶⁻¹⁶

Figure 5



A history of kidney disease may place patients at greater risk for acute kidney injury (AKI).⁷⁻¹⁰ This is the abrupt or sudden deterioration in kidney function, which can lead to the rapid buildup of dangerous toxins in the body as the kidneys are unable to remove waste products from the blood.¹¹ An October study examined data from a sample of COVID-19 patients admitted to an intensive care unit throughout hospitals in London, U.K., from mid-March through July.⁷ Renal impairment occurred in approximately 58 percent of study patients. In-hospital mortality for these patients was roughly 50 percent compared to 21 percent for those with normal renal function.⁷ According to another study, which looked at a sample of patients admitted to Mount Sinai Health System between the end of February through May, approximately 46 percent experienced AKI, 18 percent of whom required dialysis.⁹ The odds of death were roughly 9 times higher for those with acute kidney injury compared to those without AKI, even after controlling for patients' demographic characteristics and comorbidities.⁹

Alongside kidney function is the growing concern over heart injury among hospitalized COVID-19 patients, particularly myocarditis, the dangerous inflammation of the heart.⁶ One recent Germany study in particular has captured the attention of medical field. In their follow-up of recovering, previously hospitalized COVID-19 patients, the authors found ongoing cardiac inflammation in approximately 60 percent of study patients.¹² In a separate study, around 40 percent of sampled hospitalized COVID-19 patients from New York City and Milan, Italy, had abnormal echocardiograms indicating a major irregularity in the structure of the heart.¹³ According to the same study, hospitalized COVID-19 patients with a history of heart failure had around 5 times the odds of death compared to those without.

The connection between hypertension and COVID-19 is more nuanced for a number of reasons. As hypertension is also related to other major determinants of health, such as medications, age and other comorbidities, it has been difficult for researchers to determine whether it is hypertension by itself, or these other factors, affecting COVID-19 patients.⁴⁻⁶ The CDC also acknowledges that there is only limited evidence to suggest that hypertension places individuals at an increased risk.⁴ A clearer picture will likely continue to emerge around various comorbidities, as researchers work to uncover the biological and physiological pathways through which COVID-19 attacks the body.

Despite the varying statistics and numbers being reported, increasingly robust evidence suggests that COVID-19 can lead to the formation of tiny blood clots and cause extreme inflammation throughout the body.⁶ These physiological responses may significantly increase the risk of damage to major organs other than the lungs. Comorbidities may therefore place patients at a significant disadvantage when it comes to fending off the virus's attack on the body. While decreasing from 47 percent in April, slightly under one-third of New Jersey's hospitalized COVID-19 patients still presented with a kidney disease/impairment in July through August, and the percentage of those with heart failure during these two months remained approximately the same as in April (approximately 13 percent). The prevalence of comorbidities therefore remains a threat to many when it comes to COVID-19.

Outcomes and Treatment

While COVID-19 hospitalizations and deaths are on the rise again this fall, New Jersey experienced a decrease in hospitalized COVID-19 deaths, as well as reductions in severe forms of treatments and in average length of stay (ALOS) during the first few summer months. The trends around comorbidities, age and gender may be partially behind these improvements. At the same time, New Jersey hospitals and their cross-discipline clinical teams shared knowledge with colleagues statewide to help inform improved treatments, and medication advances provided new treatment options. While those efforts cannot be measured in this report, they help form a wider perspective on a significant improvement in mortality as the COVID-19 outbreak advanced in New Jersey.

During the April surge, 25.3 percent of hospitalized COVID-19 patients died during their hospital stays. By July-August, that number had improved to 5.8 percent. Aside from mortality, this CHART analysis looked at other proxies for severe illness, including ALOS and the need for ventilation (both invasive and noninvasive) and intubation. Invasive ventilation involves the use of a tube, often inserted into a patient's trachea, to deliver oxygen to the lungs, while noninvasive ventilation delivers oxygen through a mask placed over the mouth and nose. The process of inserting a tube into the trachea is often referred to as intubation. The percentage of hospitalized COVID-19 patients who required ventilation decreased from approximately 21 percent to 8 percent, while the percentage who required intubation went from 16 percent to 4 percent. Within the same period, the ALOS for hospitalized COVID-19 patients decreased from 9.5 days to 6.3 days. By comparison, ALOS for hospitalized non-COVID-19 patients admitted in April through August did not exceed 4.1 days.

Figure 6
 Percentage of Hospitalized COVID-19 Patients Who Expired by Month(s)

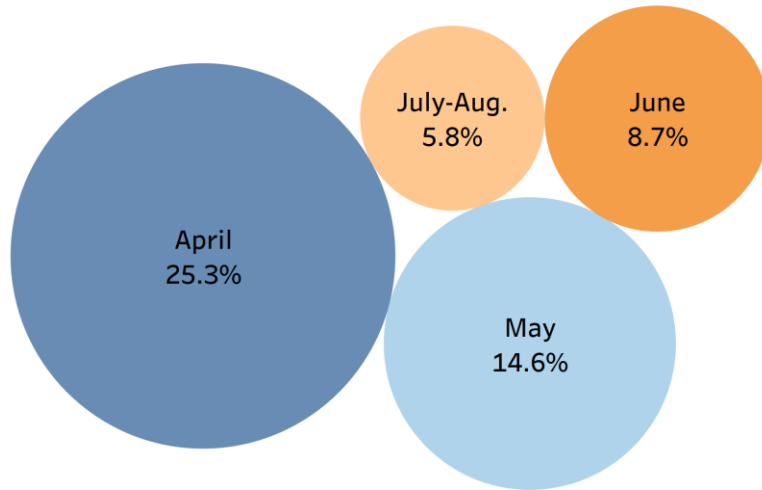


Figure 7
 Percentage of Hospitalized COVID-19 Patients Requiring Ventilation or Intubation, by Month(s)

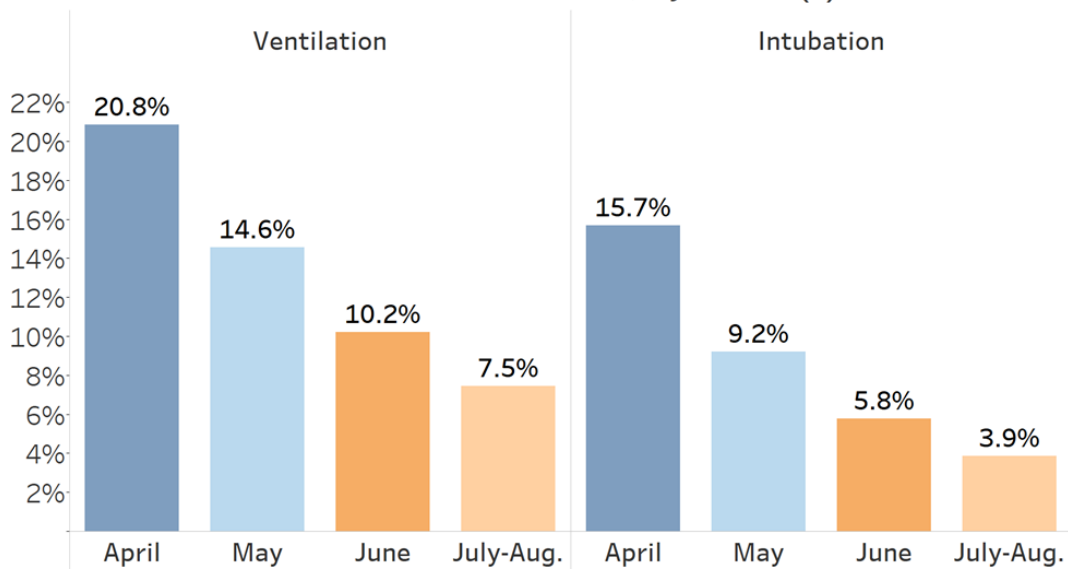


Table 2

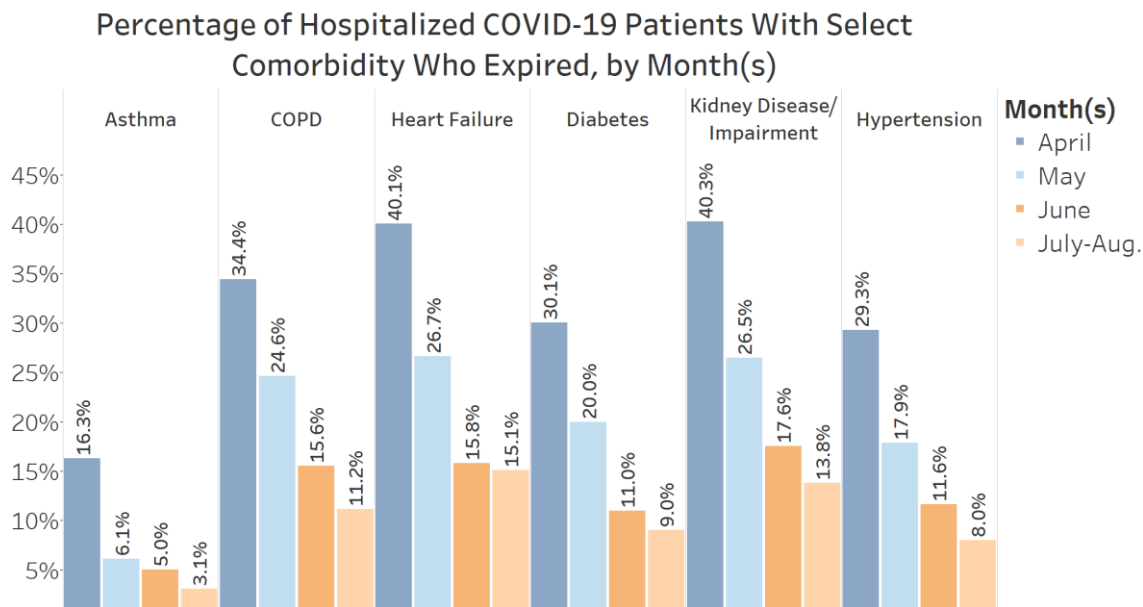
Month	ALOS (COVID-19 Positive)		
	Not Expired	Expired	All
April	9.2	10.6	9.5
May	7.6	11.6	8.1
June	6.7	11.3	7.2
July-Aug.	5.9	12.4	6.3

Improvements in the health outcomes of hospitalized COVID-19 patients have likely coincided with reductions in comorbidities. However, improvements in mortality cannot be fully attributed to lower rates of comorbidities, as the prevalence of mortality among those with high-risk comorbidities has also decreased significantly. In April, approximately 40 percent of hospitalized COVID-19 patients with chronic kidney disease, and 40 percent of those with heart failure, died. These percentages were 15 percent and 14 percent, respectively, in July through August.

A recent study, published in the *Journal of Hospital Medicine*, analyzed data from over 5,000 hospitalized COVID-19 patients admitted to New York University Langone Health from March through August to examine the link between treatment and mortality.¹⁷ During that six-month period, COVID-19 mortality rates decreased from approximately 25 percent to 7 percent, even after controlling for differences in patients' gender, age, race/ethnicity, comorbidities and severity of symptoms upon admission. According the authors, this decline was not merely due to advancements in treatment methods. Improved community awareness (patients seeking care earlier); healthcare workers' ability to identify and test patients more rapidly; and reduced patient loads on healthcare workers likely played important roles as well.¹⁷

Despite overall improvements, this paper demonstrates that hospitalized COVID-19 patients with high-risk comorbidities continued to experience worse health outcomes in the subsequent months after April. As COVID-19 hospitalization rates continue to rise, the presence of both COVID-19 and comorbidities remains a deadly combination for many.

Figure 8



Final Thoughts

In the few short months after April, New Jersey hospitals experienced a substantial decline in COVID-19 patients, as well as reductions in the percentage of COVID-19 patients who died or required invasive medical procedures. These shifts are the result of a diverse combination of factors, many of which researchers are only beginning to comprehend. As we head toward the peak of the 2020-2021 flu season, the question on the minds of many is whether New Jersey's healthcare system can fend off the potentially devastating impacts of COVID-19 in the midst of another impending virus that poses severe health risks to older adults.

Amid the rising rates of COVID-19 hospitalizations this autumn, comorbidities are likely to remain an ever-present threat. CHART's [previous research](#) has shown that the prevalence of comorbidities is often higher among those in vulnerable communities. Furthermore, many researchers have focused on the relationships between social determinants of health (SDH), the economic and social conditions of individuals' living and working environments, and health status. Continuing efforts to address disparities in SDH should therefore be a priority. As people of color are also disproportionately impacted

by chronic conditions, the inability to protect those with comorbidities against COVID-19 may exaggerate the already present racial/ethnic disparities in health outcomes.

The fall weather and shorter days are increasingly stark reminders that New Jersey, and the country, are far from out of the woods. The trends presented in this study are not indicative of continuing improvements by any means. The summer months of 2020 offered only a temporary respite as we are reminded of COVID-19's devastating assault on the healthcare system back in April. NJHA is working with hospitals and long-term care facilities, in its continuing dedication to not only its members but the entire New Jersey population, to help prepare for any number of challenges that lay ahead in the coming months.

Visit www.njha.com/chart/ for additional resources.

Footnotes

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