

Regional Variation in Patient Characteristics and Treatment Patterns for Over 17 Million COVID-19 Patients in the United States

Objective

This study described the regional variation in demographic and clinical characteristics as well as treatment patterns among COVID-19 patients receiving treatment in the US.

Conclusions

- Less than one in five of the total reported US COVID-19 patients had a medical claim with diagnosis of COVID-19; a higher burden of treated COVID-19 patients was observed among patients from the Northeast and South US regions.
- Younger adults (aged 18 to 44 years) within each US region accounted for a large proportion of the treated COVID-19 patients.
- Conditions related to metabolic syndrome including essential hypertension, hyperlipidemia, type 2 diabetes mellitus were among the most common significant comorbid conditions among treated COVID-19 patients with highest prevalence among patients from South US region.
- Despite the high overall number of treated COVID-19 patients, utilization of COVID-19 specific approved and unapproved medications were low nationwide, with lowest utilization observed in Northeast US region.

Limitations

- Limitations regarding study design and data sources should be considered while interpreting the results from this analysis.
- Pre-adjudicated open-source claims databases like Dx and LRx are assumed to have missing data compared with closed claims databases thereby resulting in under-reporting of some diagnoses and medication use.
- Additionally, claims data, in general, are subject to incomplete or inaccurate coding, missing data, and the lack of specific billing codes for some conditions since the purpose of claims is obtaining reimbursements.
- Given the retrospective design of this study, no causal inferences can be made.

References

- Donovan D. U.S. Surpasses 100 Million Reported COVID-19 Cases – Johns Hopkins Coronavirus Resource Center. Available on <https://coronavirus.jhu.edu/pandemic-data-initiative/data-outlook/u-s-surpasses-100-million-reported-covid-19-cases> Accessed on March 21, 2023
- CDC COVID-19 Response Team. Geographic Differences in COVID-19 Cases, Deaths, and Incidence – United States, February 12–April 7, 2020. *MMWR Morb Mortal Wkly Rep.* 2020 Apr 17;69(15):465–471
- Gundlapati AV, Lavery AM, Boehmer TK, Beach MJ, Walke HT, Sutton PD, Anderson RN. Death Certificate-Based ICD-10 Diagnosis Codes for COVID-19 Mortality Surveillance – United States, January–December 2020. *MMWR Morb Mortal Wkly Rep.* 2021;70(14):523–527
- Mehta HB, An H, Andersen KM, Mansour O, Madhira V, Rashidi ES, Bates B, Setoguchi S, Joseph C, Kocis PT, Moffitt R, Bennett TD, Chute CG, Garibaldi BT, Alexander GC; National COVID Cohort Collaborative (N3C). Use of Hydroxychloroquine, Remdesivir, and Dexamethasone Among Adults Hospitalized With COVID-19 in the United States: A Retrospective Cohort Study. *Ann Intern Med.* 2021 Oct;174(10):1395–1403

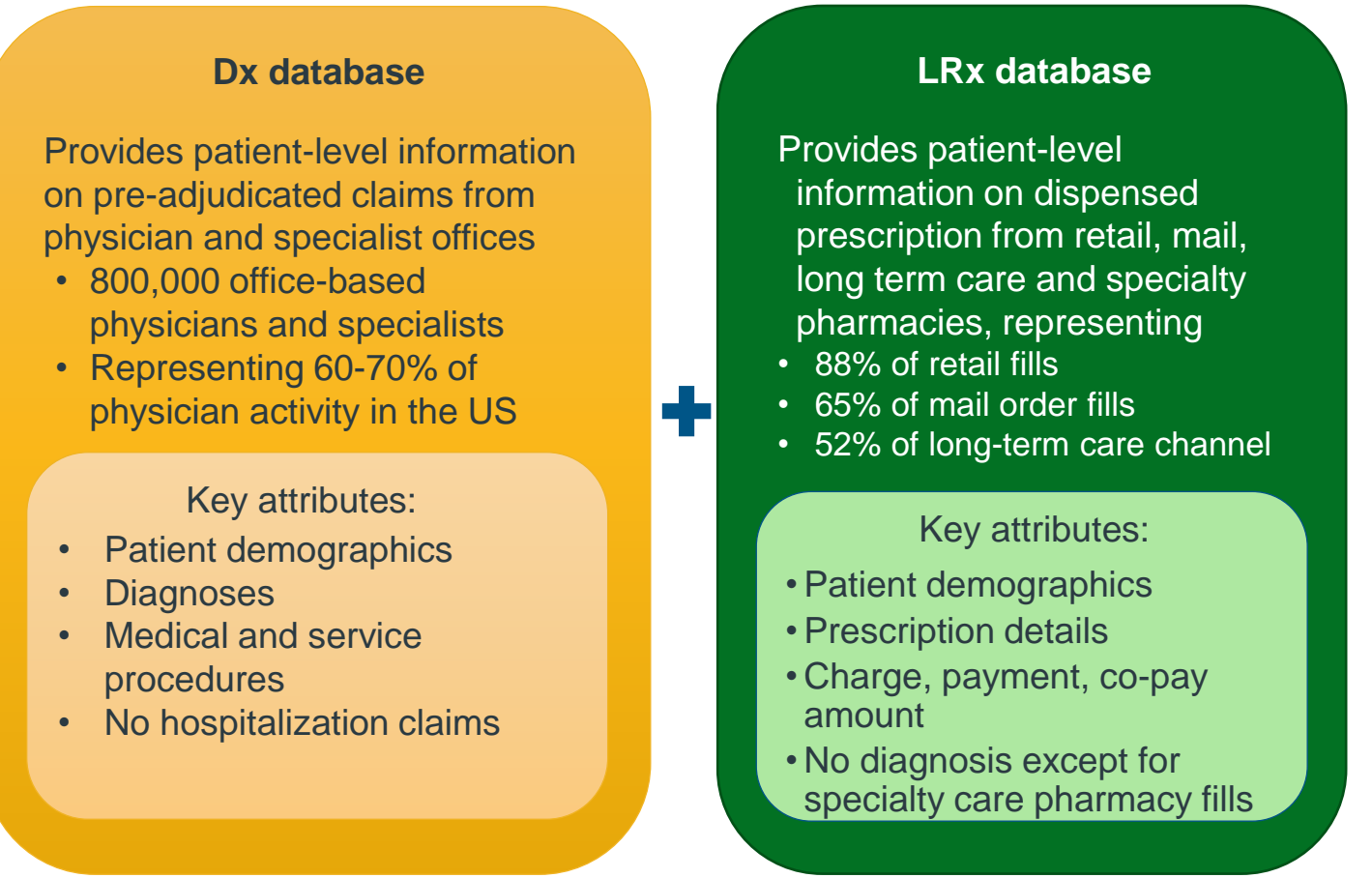
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Introduction

- Over 100 million Americans reported Coronavirus Disease 2019 (COVID-19) infection by early 2023. However, only a small proportion of these patients generated healthcare claims with a documented COVID-19 diagnosis.¹
- The northeast United States (US) states account for a higher proportion of confirmed COVID-19 cases compared to other US regions.² Little is known about regional differences in distribution of clinical conditions (identified as chain-of-event and significant comorbid conditions)³ identified as risk factors for mortality among COVID-19 patients.
- Research on patients hospitalized with COVID-19 infections showed that the proportion of patients receiving remdesivir increased gradually through February 2021 and varied drastically across health centers.⁴ However, regional differences in treatment patterns among COVID-19 patients is lacking.⁴

Data sources

Figure 1. IQVIA's New Data Warehouse Dx and LRx databases



Study population

- Among over 277 million patients in the Dx database, 6.4% had an ICD-10 diagnosis code for COVID-19 during the selection window. Figure 2 illustrates the patient selection for this study
- The northeast US region had a prevalence of 7.15% of treated COVID-19 patients (Figure 2)

Figure 2. Patient selection

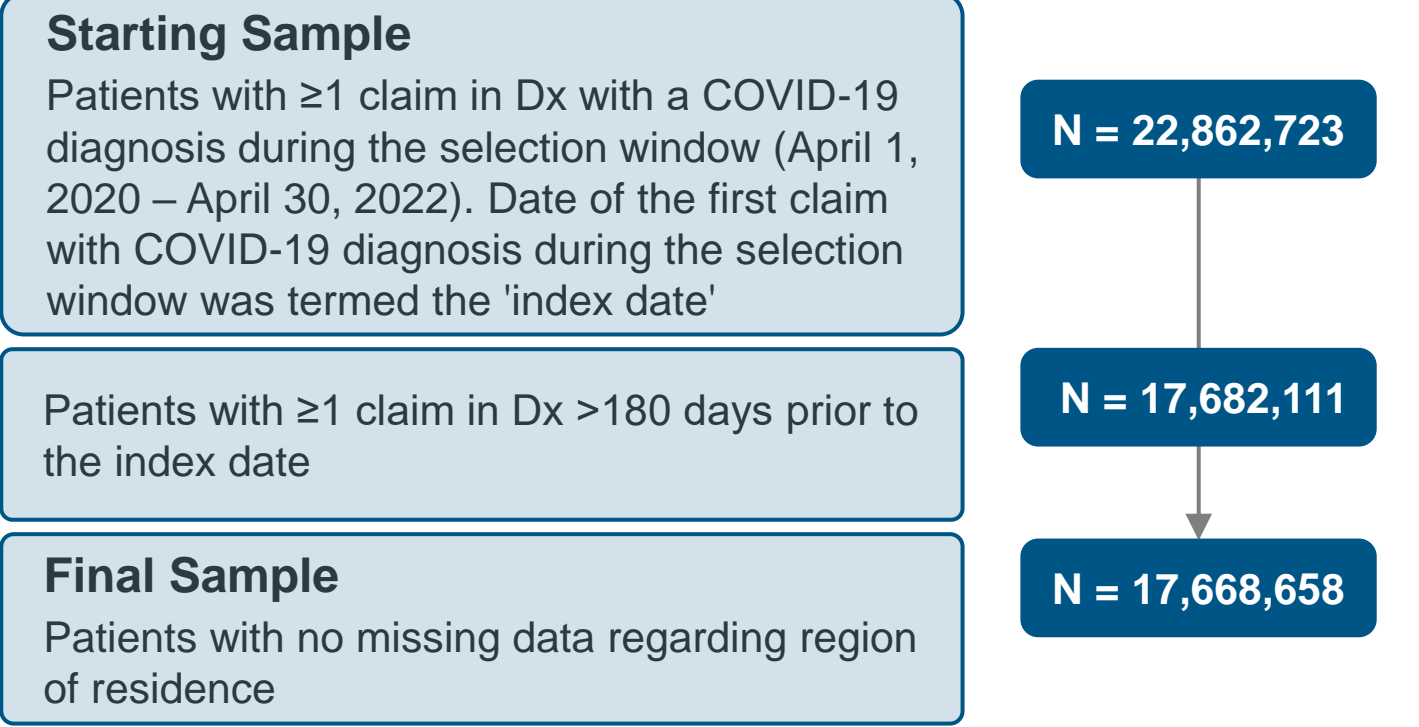
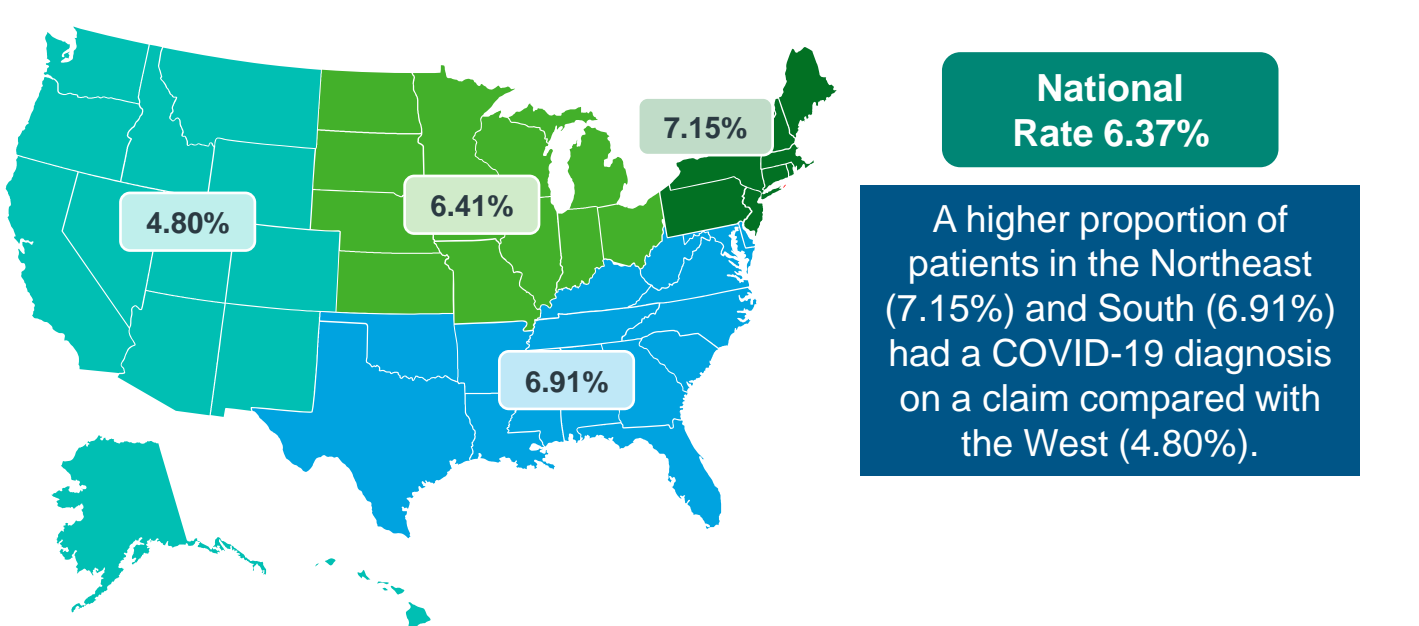


Figure 3. Prevalence of COVID-19 by US Regions



Methods

- For this retrospective cohort study, patients with a healthcare claim in IQVIA's professional claims database (Dx) (Figure 1) with a COVID-19 diagnosis (ICD-10 CM code) between 01 April 2020 and 30 April 2022 were identified (Figure 2).
 - The date of the first COVID-19 diagnosis was termed as the index date.
- Demographic characteristics were assessed on index date among patients in the overall cohort and within each region.
- Clinical characteristics including chain-of-event conditions were assessed +/- 7 days of the last COVID-19 diagnosis. Significant comorbid conditions were assessed during the 6-month period prior to the index date through end of the follow-up period.
- Treatment patterns for key approved and unapproved COVID-19 medications were assessed for patients using HCPCS codes in Dx and NDC codes in IQVIA's longitudinal prescription claims database (LRx).

Demographic characteristics

- Among overall treated COVID-19 patients in the US, the highest proportion of patients were aged 18-44 years (33.8%) followed by those aged 45-64 years (27.9%) and 65+ years (23.7%). Minors (<18 years) accounted for only 14.4% of the overall treated COVID-19 population (Table 1).
 - Within each age group, the south US region accounted for highest proportion of patients compared to other US regions.
 - Within each region, those aged 18-44 years accounted for over a third of the treated COVID-19 patients
- Over 57% of the treated COVID-19 patients nationally were women.
 - The gender distribution of study patients was similar across regions.
- Commercially insured patients accounted for over 80% of patients nationally and within each region.

Table 1: Demographic characteristics of treated COVID-19 patients stratified by US region

Demographic characteristics	Overall (N=17,682,111)	Northeast (N=3,778,734)	Midwest (N=3,484,577)	South (N=7,444,318)	West (N=2,961,029)	Unknown (N=13,453)
Age group						
<18 years	2,544,842 (14.4%)	519,615 (13.8%)	411,802 (11.8%)	1,184,379 (15.9%)	426,884 (14.4%)	2,162 (16.1%)
18-44 years	5,967,006 (33.7%)	1,318,865 (34.9%)	1,171,704 (33.6%)	2,431,662 (32.7%)	1,041,107 (35.2%)	3,668 (27.3%)
45-64 years	4,926,798 (27.9%)	1,080,605 (28.6%)	994,749 (28.5%)	2,055,372 (27.6%)	793,450 (26.8%)	2,622 (19.5%)
65+ years	4,199,493 (23.7%)	851,017 (22.5%)	899,363 (25.8%)	1,753,530 (23.6%)	690,614 (23.3%)	4,969 (36.9%)
Missing/unknown	43,972 (0.2%)	8,632 (0.2%)	6,959 (0.2%)	19,375 (0.3%)	8,974 (0.3%)	32 (0.2%)
Sex						
Female	10,139,688 (57.3%)	2,147,885 (56.8%)	1,986,808 (57.0%)	4,290,717 (57.6%)	1,706,475 (57.6%)	7,803 (58.0%)
Male	7,498,820 (42.4%)	1,622,370 (42.9%)	1,490,881 (42.8%)	3,134,319 (42.1%)	1,245,629 (42.1%)	5,621 (41.8%)
Missing/Unknown	43,603 (0.2%)	8,479 (0.2%)	6,888 (0.2%)	19,282 (0.3%)	8,925 (0.3%)	29 (0.2%)
Insurance type						
Commercial	14,680,364 (83.0%)	3,158,394 (83.6%)	2,837,833 (81.4%)	6,214,777 (83.5%)	246,0991 (83.1%)	8,369 (62.2%)
Medicare	2,582,054 (14.6%)	534,589 (14.1%)	585,850 (16.8%)	1,084,846 (14.6%)	371,724 (12.6%)	5,045 (37.5%)
Medicaid	415,149 (2.3%)	85,081 (2.3%)	59,742 (1.7%)	143,004 (1.9%)	127,302 (4.3%)	20 (0.1%)
Cash/Uninsured/Other	4,518 (<0.1%)	670 (<0.1%)	1,152 (<0.1%)	1,691 (<0.1%)	1,012 (<0.1%)	19 (0.1%)

Table 2: Distribution of COE and SCC among treated COVID-19 patients stratified by US region

Clinical Characteristics	Total Covid-19 Patients (N=17,682,111)	Region					
		Northeast (N=3,778,734)	Midwest (N=3,484,577)	South (N=7,444,318)	West (N=2,961,029)	Unknown (N=13,453)	
Chain of event conditions							
Pneumonia, unspecified	902,008 5.10%	148,344 3.93%	173,179 4.97%	417,274 5.61%	163,075 5.51%	136 1.01%	
Acute respiratory failure	1,299,699 7.35%	195,658 5.18%	285,085 8.18%	560,124 7.52%	258,718 8.74%	114 0.85%	
Respiratory failure, unspecified	237,023 1.34%	38,163 1.01%	49,915 1.43%	103,852 1.40%	45,066 1.52%	27 0.20%	
Cardiac arrest, unspecified	56,356 0.32%	9,226 0.24%	10,564 0.30%	25,894 0.35%	10,664 0.36%	8 0.06%	
Adult respiratory distress syndrome	144,919 0.82%	24,712 0.65%	33,658 0.97%	57,019 0.77%	29,504 1.00%	26 0.19%	
Sepsis, unspecified	394,375 2.23%	65,580 1.74%	73,105 2.10%	167,550 2.25%	88,095 2.98%	45 0.33%	
Viral pneumonia, unspecified	83,313 0.47%	17,128 0.45%	17,067 0.49%	36,080 0.48%	13,017 0.44%	21 0.16%	
Asphyxia	836,361 4.73%	127,618 3.38%	193,393 5.55%	355,513 4.78%	159,707 5.39%	130 0.97%	
Respiratory arrest	6,369 0.04%	1,086 0.03%	1,193 0.03%	2,979 0.04%	1,110 0.04%	1 0.01%	
Significant contributing conditions							
Essential (primary) hypertension	6,453,254 36.50%	1,286,895 34.06%	1,303,797 37.42%	2,866,928 38.51%	990,369 33.45%	5,265 39.14%	
Diabetes mellitus without complications, unspecified	54,377 0.31%	15,718 0.42%	10,076 0.29%	20,489 0.28%	8,073 0.27%	21 0.16%	
Dementia, unspecified	617,863 3.49%	143,109 3.79%	133,452 3.83%	250,514 3.37%	90,684 3.06%	104 0.77%	
Chronic obstructive pulmonary disease, unspecified	1,298,901 7.35%	240,507 6.36%	308,571 8.86%	562,674 7.56%	186,648 6.30%	501 3.72%	
Atherosclerotic heart disease	1,751,310 9.90%	368,515 9.75%	376,434 10.80%	768,632 10.33%	236,770 8.00%	959 7.13%	
Type 2 diabetes mellitus without complications	3,370,452 19.06%	708,834 18.76%	649,611 18.64%	1,426,970 19.17%	580,667 19.61%	4,370 32.48%	
Atrial fibrillation and flutter	1,155,546 6.54%	227,170 6.01%	268,522 7.71%	482,561 6.48%	176,870 5.97%	423 3.14%	
Congestive heart failure	1,350,220 7.64%	253,141 6.70%	305,264 8.76%	579,914 7.79%	211,364 7.14%	537 3.99%	
Tobacco use	1,268,898 7.18%	243,031 6.43%	322,820 9.26%	506,990 6.81%	195,888 6.62%	169 1.26%	
Chronic kidney disease, unspecified	870,893 4.93%	156,923 4.15%	184,531 5.30%	380,834 5.12%	147,978 5.00%	627 4.66%	
Alzheimer disease, unspecified	269,817 1.53%	59,624 1.58%	63,334 1.82%	109,465 1.47%	37,128 1.25%	266 1.98%	
Hypertensive heart disease without congestive heart failure	379,199 2.14%	94,054 2.49%	52,164 1.50%	179,128 2.41%	51,894 1.75%	1,959 14.56%	
Hyperlipidemia, unspecified	3,970,804 22.46%	919,670 24.34%	758,427 21.77%	1,635,303 21.97%	654,649 22.11%	2,755 20.48%	
Other specified disorders of kidney and ureter	878,380 4.97%	204,642 5.42%	186,684 5.36%	344,004 4.62%	142,670 4.82%	443 3.29%	
Obesity, unspecified	3,476,655 19.66%	740,297 19.59%	719,475 20.65%	1,420,929 19.09%	593,963 20.06%	1,991 14.80%	
Stroke, not specified as hemorrhage or infarction	487,416 2.76%	99,909 2.64%	102,672 2.95%	207,343 2.79%	77,355 2.61%	137 1.02%	

COE = Chain of Event, SCC = Significant contributing conditions

Clinical characteristics and health resource utilization

- The majority of the treated COVID-19 patients had a Charlson comorbidity index (CCI) score of zero indicative of no CCI comorbidity
- Respiratory failure and pneumonia were the most common chain-of-event conditions among patients in each region (Table 2)
- Essential hypertension, hyperlipidemia, type 2 diabetes mellitus and obesity were the most common significant contributing conditions reported among the overall COVID-19 cohort; with patients from South US reporting the highest prevalence of the former three conditions whereas patients from Midwest US reported the higher prevalence of obesity.
- On average patients from Northeast US had highest number of days with any medical claims during 12 months prior to index diagnosis. Patients from South US had the highest mean number of pharmacy claims during 12 months prior to the index diagnosis (Table 3)

Table 3: Baseline HCRU among treated COVID-19 patients stratified by US region

Treatment Characteristics	Region			
	Northeast (N=3,778,734)	Midwest (N=3,484,577)	South (N=7,444,318)	West (N=2,961,029)
Number of days with medical claims 12-month pre-index				
Mean	16.0	14.4	12.8	13.4
SD	34.7	25.6	24.2	23.6
Median	6.0	6.0	6.0	6.0
Number of pharmacy claims 12-month pre-index				
Mean	21.6	25.2	24.1	22.9
SD	29.8	33.1	31.4	31.9
Median	11.0	14.0	13.0	11.0

Treatment patterns

- For approved medications, utilization ranged from 1.7% within Northeast US region to 2.7% within Midwest US region for remdesivir (Table 4)
- For casirivimab/imdevimab utilization ranged from 0.7% in Northeast US region to 2.2% in South US region
- The utilization of the unapproved medication (for COVID-19) hydroxychloroquine ranged from 0.9% in Northeast US region to 1.6% in South US region among treated COVID-19 patients
- Similarly, the utilization of unapproved medication (for COVID-19) ivermectin was low ranging from 0.4% in Northeast US to 1.8% in South US region

Table 4: Treatment patterns among COVID-19 patients by US regions

COVID-19 medication utilization	Regions			
	Northeast (N=3,778,734)	Midwest (N=3,484,577)	South (N=7,444,318)	West (N=2,961,029)
Approved medications				
Bamlanivab (+/- Etesevimab)	16,157 (0.4%)	43,823 (1.3%)	48,467 (0.7%)	12,753 (0.4%)
Casirivimab/imdevimab	27,265 (0.7%)	52,554 (1.5%)	160,705 (2.2%)	21,327 (0.7%)
Convalescent plasma	6,892 (0.2%)	14,821 (0.4%)	34,901 (0.5%)	13,599 (0.5%)
Remdesivir	62,524 (1.7%)	94,689 (2.7%)	151,164 (2.0%)	74,247 (2.5%)
Unapproved medications				
Ivermectin	14,396 (0.4%)	17,871 (0.5%)	135,619 (1.8%)	21,658 (0.7%)
Hydroxychloroquine	35,577 (0.9%)	37,541 (1.1%)	121,360 (1.6%)	31,454 (1.1%)