

Supplemental material

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Supplemental Table 1 Health care resource utilization among hospitalized Veterans with COVID-19

Month	ICU	Mechanical Ventilation	LOS
March 20 - April 19	35.6%	20.6%	13.8
April 20 - May 19	31.0%	13.5%	16.2
May 20 - June 19	31.2%	11.4%	12.1
June 20 - July 19	29.7%	11.7%	11.4
July 20 - August 19	28.2%	11.2%	11
August 20 - September 19	31.6%	9.3%	9.6
Overall	31.2%	13.4%	12.3

ICU: intensive care units; LOS: length of stay.

Supplemental Table 2: C statistics (95% confidence intervals) for nested models using different combination of predictors

Cohort	Veterans with COVID-19		Hospitalized Veterans with COVID-19
	30-day mortality	Hospitalization	30-day mortality
Predictor variables			
Demographics	0.822 (0.816-0.828)	0.678 (0.673-0.684)	0.725 (0.712-0.738)
+ health characteristics	0.832 (0.826-0.838)	0.713 (0.707-0.719)	0.740 (0.726-0.753)
+ contextual factors	0.832 (0.826-0.838)	0.714 (0.708-0.720)	0.741 (0.726-0.754)
+ COVID-19 testing capacity	0.834 (0.828-0.840)	0.715 (0.709-0.721)	0.745 (0.730-0.758)
+ hospital occupancy	0.834 (0.828-0.841)	0.718 (0.712-0.723)	0.746 (0.732-0.759)

Each + indicates including all the variable above that row. For example, "+ contextual factors" indicates including demographics, health characteristics, and contextual factors as predictors.

Supplemental Table 3A: Characteristics of US Veterans with COVID-19 overall and by different month periods							
Characteristic	Overall N = 49238	March 20 – April 19 N = 5896	April 20 – May 19 N = 6685	May 20 – June 19 N = 4824	June 20 – July 19 N = 13084	July 20 – August 19 N = 11874	August 20 – September 19 N = 6875
Age, median (IQR), year	63.3 (49.8-73.1)	65.3 (53.7-73.8)	68.0 (56.6-76.1)	63.9 (50.0-73.4)	59.6 (44.7- 71.4)	62.9 (49.6-72.8)	64.3 (50.2-73.3)
Race, no. (%)							
White	29814 (60.6)	2814 (47.7)	3908 (58.5)	2877 (59.6)	7991 (61.1)	7496 (63.1)	4728 (68.8)
Black	16714 (33.9)	2784 (47.2)	2492 (37.3)	1693 (35.1)	4272 (32.7)	3720 (31.3)	1753 (25.5)
Other	2710 (5.5)	298 (5.1)	285 (4.3)	254 (5.3)	821 (6.3)	658 (5.5)	394 (5.7)
Sex, no. (%), women	5673 (11.5)	604 (10.2)	693 (10.4)	557 (11.5)	1671 (12.8)	1432 (12.1)	716 (10.4)
BMI category, no. (%)							
Underweight (<8.5 kg/m ²)	265 (0.5)	50 (0.8)	56 (0.8)	38 (0.8)	49 (0.4)	44 (0.4)	28 (0.4)
Normal weight (18.5 to <25 kg/m ²)	9939 (20.2)	1163 (19.7)	1645 (24.6)	1018 (21.1)	2508 (19.2)	2272 (19.1)	1333 (19.4)
Overweight (25 to <30 kg/m ²)	15032 (30.5)	1814 (30.8)	2030 (30.4)	1521 (31.5)	4025 (30.8)	3568 (30.0)	2074 (30.2)
Obesity (>18.5 kg/m ²)	24002 (48.7)	2869 (48.7)	2954 (44.2)	2247 (46.6)	6502 (49.7)	5990 (50.4)	3440 (50.0)
Smoke, no. (%)							
Never smoker	27492 (55.8)	3077 (52.2)	3411 (51.0)	2624 (54.4)	7799 (59.6)	6843 (57.6)	3738 (54.4)
Former smoker	13062 (26.5)	1906 (32.3)	2027 (30.3)	1292 (26.8)	2965 (22.7)	2974 (25.0)	1898 (27.6)
Current smoker	8684 (17.6)	913 (15.5)	1247 (18.7)	908 (18.8)	2320 (17.7)	2057 (17.3)	1239 (18.0)
Hypertension, no. (%)	30568 (62.1)	3769 (63.9)	4077 (61.0)	2993 (62.0)	8052 (61.5)	7370 (62.1)	4307 (62.6)
Diabetes, no. (%)	13717 (27.9)	1863 (31.6)	1996 (29.9)	1360 (28.2)	3301 (25.2)	3315 (27.9)	1882 (27.4)
Cancer, no. (%)	4558 (9.3)	728 (12.3)	695 (10.4)	443 (9.2)	1043 (8.0)	1014 (8.5)	635 (9.2)
Cardiovascular disease, no. (%)	10399 (21.1)	1512 (25.6)	1706 (25.5)	1048 (21.7)	2307 (17.6)	2368 (19.9)	1458 (21.2)
Cerebrovascular disease, no. (%)	5192 (10.5)	801 (13.6)	1011 (15.1)	503 (10.4)	1091 (8.3)	1112 (9.4)	674 (9.8)
Dementia, no. (%)	5350 (10.9)	887 (15.0)	1268 (19.0)	586 (12.1)	988 (7.6)	999 (8.4)	622 (9.0)
Chronic kidney disease, no. (%)	9573 (21.9)	1390 (26.1)	1477 (26.2)	963 (22.9)	2161 (18.4)	2237 (20.9)	1345 (21.8)
Peripheral artery disease, no. (%)	1411 (2.9)	247 (4.2)	261 (3.9)	140 (2.9)	301 (2.3)	277 (2.3)	185 (2.7)
HIV, no. (%)	504 (1.0)	91 (1.5)	75 (1.1)	58 (1.2)	130 (1.0)	99 (0.8)	51 (0.7)
Pneumonia, no. (%)	765 (1.6)	205 (3.5)	191 (2.9)	83 (1.7)	108 (0.8)	100 (0.8)	78 (1.1)
COPD, no. (%)	7666 (15.6)	1143 (19.4)	1285 (19.2)	765 (15.9)	1670 (12.8)	1702 (14.3)	1101 (16.0)
ADI rank category, no. (%)							
0 to 33.3	10248 (20.8)	1816 (30.8)	2003 (30.0)	1026 (21.3)	2356 (18.0)	1944 (16.4)	1103 (16.0)

33.4 to 66.6	20861 (42.4)	2203 (37.4)	2594 (38.8)	1967 (40.8)	5788 (44.2)	5113 (43.1)	3196 (46.5)
66.7 to 100	18129 (36.8)	1877 (31.8)	2088 (31.2)	1831 (38.0)	4940 (37.8)	4817 (40.6)	2576 (37.5)
COVID-19 testing capacity, mean (SD), per 10000 people	3.1 (1.9)	1.3 (0.9)	1.7 (1.0)	2.1 (1.2)	4.1 (2.1)	3.7 (1.6)	3.8 (1.7)
Hospital occupancy, mean (SD), %	37.0 (10.8)	41.3 (11.8)	35.4 (9.9)	35.8 (10.2)	36.5 (10.3)	37.0 (10.5)	36.8 (11.5)
ADI: area deprivation index; COPD: Chronic obstructive pulmonary disease; eGFR: Estimated Glomerular Filtration Rate; HIV: Human immunodeficiency virus; IQR: interquartile range; IQR: interquartile range; SD: standard deviation.							

Supplemental Table 3B: Characteristics of hospitalized US Veterans with COVID-19 overall and by different month periods							
Characteristic	Overall N = 9428	March 20 – April 19 N = 1992	April 20 – May 19 N = 1152	May 20 – June 19 N = 966	June 20 – July 19 N = 2274	July 20 – August 19 N = 1872	August 20 – September 19 N = 1172
Age, median (IQR), year	70.6 (61.2-76.8)	70.7 (61.8, 76.7)	72.2 (63.7-79.3)	69.7 (59.7- 76.8)	69.1 (58.9-75.6)	70.8 (61.1-76.5)	71.5 (62.3-77.2)
Race, no. (%)							
White	5054 (53.6)	811 (40.7)	607 (52.7)	533 (55.2)	1255 (55.2)	1081 (57.7)	767 (65.4)
Black	3809 (40.4)	1084 (54.4)	496 (43.1)	389 (40.3)	861 (37.9)	649 (34.7)	330 (28.2)
Other	565 (6.0)	97 (4.9)	49 (4.3)	44 (4.6)	158 (6.9)	142 (7.6)	75 (6.4)
Sex, no. (%), women	527 (5.6)	95 (4.8)	53 (4.6)	73 (7.6)	147 (6.5)	112 (6.0)	47 (4.0)
BMI category, no. (%)							
Underweight (<8.5 kg/m ²)	83 (0.9)	24 (1.2)	14 (1.2)	10 (1.0)	18 (0.8)	12 (0.6)	5 (0.4)
Normal weight (18.5 to <25 kg/m ²)	1836 (19.5)	387 (19.4)	276 (24.0)	182 (18.8)	423 (18.6)	350 (18.7)	218 (18.6)
Overweight (25 to <30 kg/m ²)	2922 (31.0)	611 (30.7)	344 (29.9)	322 (33.3)	684 (30.1)	582 (31.1)	379 (32.3)
Obesity (>18.5 kg/m ²)	4587 (48.7)	970 (48.7)	518 (45.0)	452 (46.8)	1149 (50.5)	928 (49.6)	570 (48.6)
Smoke, no. (%)							
Never smoker	4713 (50.0)	913 (45.8)	511 (44.4)	474 (49.1)	1250 (55.0)	980 (52.4)	585 (49.9)
Former smoker	2956 (31.4)	766 (38.5)	409 (35.5)	283 (29.3)	607 (26.7)	535 (28.6)	356 (30.4)
Current smoker	1759 (18.7)	313 (15.7)	232 (20.1)	209 (21.6)	417 (18.3)	357 (19.1)	231 (19.7)
Hypertension, no. (%)	6347 (67.3)	1345 (67.5)	763 (66.2)	649 (67.2)	1546 (68.0)	1264 (67.5)	780 (66.6)
Diabetes, no. (%)	3695 (39.2)	798 (40.1)	473 (41.1)	386 (40.0)	856 (37.6)	715 (38.2)	467 (39.8)
Cancer, no. (%)	1443 (15.3)	346 (17.4)	169 (14.7)	150 (15.5)	328 (14.4)	261 (13.9)	189 (16.1)
Cardiovascular disease, no. (%)	3417 (36.2)	735 (36.9)	453 (39.3)	338 (35.0)	773 (34.0)	674 (36.0)	444 (37.9)
Cerebrovascular disease, no. (%)	1836 (19.5)	403 (20.2)	279 (24.2)	179 (18.5)	399 (17.5)	328 (17.5)	248 (21.2)
Dementia, no. (%)	1953 (20.7)	420 (21.1)	345 (29.9)	212 (21.9)	398 (17.5)	336 (17.9)	242 (20.6)
Chronic kidney disease, no. (%)	3042 (34.9)	704 (37.8)	368 (35.9)	293 (33.2)	716 (33.7)	575 (33.3)	386 (35.5)
Peripheral artery disease, no. (%)	543 (5.8)	127 (6.4)	87 (7.6)	59 (6.1)	120 (5.3)	92 (4.9)	58 (4.9)
HIV, no. (%)	141 (1.5)	44 (2.2)	16 (1.4)	12 (1.2)	40 (1.8)	23 (1.2)	6 (0.5)
Pneumonia, no. (%)	336 (3.6)	104 (5.2)	59 (5.1)	37 (3.8)	51 (2.2)	50 (2.7)	35 (3.0)
COPD, no. (%)	2429 (25.8)	524 (26.3)	311 (27.0)	251 (26.0)	549 (24.1)	462 (24.7)	332 (28.3)
ADI rank category, no. (%)							
0 to 33.3	1785 (18.9)	583 (29.3)	290 (25.2)	169 (17.5)	335 (14.7)	249 (13.3)	159 (13.6)
33.4 to 66.6	3643 (38.6)	671 (33.7)	454 (39.4)	383 (39.6)	904 (39.8)	733 (39.2)	498 (42.5)
66.7 to 100	4000 (42.4)	738 (37.0)	408 (35.4)	414 (42.9)	1035 (45.5)	890 (47.5)	515 (43.9)

COVID-19 testing capacity, mean (SD), per 10000 people	2.8 (1.8)	1.2 (0.9)	1.6 (0.8)	2.1 (1.1)	3.9 (1.5)	3.8 (1.4)	4.0 (1.7)
Hospital occupancy, mean (SD), %	38.1 (10.5)	42.4 (11.3)	35.0 (9.7)	36.1 (8.9)	38.1 (9.4)	37.1 (10.4)	37.0 (10.6)
ADI: area deprivation index; COPD: Chronic obstructive pulmonary disease; eGFR: Estimated Glomerular Filtration Rate; HIV: Human immunodeficiency virus; IQR: interquartile range; SD: standard deviation.							

Supplemental Table 4 Contribution of changes in demographic, health, and contextual characteristics to temporal differences in outcomes between 3/20–4/19, 2020 and 6/20–7/20, 2020

Factors	Among Veterans with COVID-19				Among hospitalized Veterans with COVID-19	
	30-day mortality rate changes		Hospitalization rate changes		30-day mortality rate changes	
	Predicted rate of change	Percent contribution to total change (predicted/observed)	Predicted rate of change	Percent contribution to total change (predicted/observed)	Predicted rate of change	Percent contribution to total change (predicted/observed)
Demographics	-2.4%	26.1%	-3.3%	19.6%	-3.0%	23.6%
Health characteristics	-0.7%	7.6%	-1.5%	9.0%	-0.3%	2.4%
Contextual characteristics	0.1%	-1.1%	0.1%	-0.6%	0.1%	-0.8%
COVID-19 testing capacity	-0.5%	5.4%	-0.9%	5.4%	-0.2%	1.6%
Hospital occupancy	-0.2%	2.2%			-0.4%	3.1%
Net rate of change predicted by demographic, health, contextual characteristics, testing capacity, and hospital occupancy (A)	-3.7%	40.2%	-5.6%	33.3%	-3.8%	29.9%
Observed rate of change (B)	-9.2%		-16.8%		-12.7%	
Epidemiological change (difference between observed and net predicted rate of change) (B)-(A)	-5.5%	59.8%	-11.2%	66.7%	-8.9%	70.1%

Demographics include age, race, and gender; Health characteristics include BMI, diabetes, cancer, cardiovascular disease, cerebrovascular disease, chronic kidney disease, dementia, HIV, hypertension, peripheral artery disease, pneumonia, and smoking status; contextual factors include ADI; epidemiological change includes the 30-day periods of testing positive dates.