

Article

Title: Assessing Smoking Status and Risk of SARS CoV-2 Infection: A Machine Learning Approach among Veterans

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Supplementary Materials

Table S1. Full list of all patients' characteristics.

Variables	Never Smoker n= 380648 (32.3%)	Former Smoker n=456348 (38.8%)	p-value	Current Smoker n= 221515 (18.8%)	p- value	Unknown n = 117795 (10.0%)	p- value
Tested positive	85605 (22.5)	93665 (20.5)	0.0001	26809 (12.1)	0.0001	24171 (20.5)	0.0001
Sex (Male)	318343 (83.6)	422136 (92.5)	0.0001	202063 (91.2)	0.0001	74857 (63.5)	0.0001
Race							
White	239184 (62.8)	332558 (72.9)	0.0001	150741 (68.1)	0.0001	47987 (40.7)	0.0001
Black	101211 (26.6)	83695 (18.3)	0.0001	53037 (23.9)	0.0001	17251 (14.6)	0.0001
Others	40253 (10.6)	40095 (8.8)	0.0001	17737 (8.0)	0.0001	52557 (44.6)	0.0001
Ethnicity							
Non-Hispanic or Latino	325720 (85.6)	406810 (89.1)	0.0001	202003 (91.2)	0.0001	64420 (54.7)	0.0001
Hispanic Or Latino	41593 (10.9)	34679 (7.6)	0.0001	12506 (5.6)	0.0001	7567 (6.4)	0.0001
Unknown	13335 (3.5)	14859 (3.3)	0.0001	7006 (3.2)	0.0001	45808 (38.9)	0.0001
Age [Mean, SD]							
Age 18–30	17299 (4.5)	10373 (2.3)	0.0001	9122 (4.1)	0.0001	15584 (13.2)	0.0001
Age 30–40	42223 (11.1)	34708 (7.6)	0.0001	26861 (12.1)	0.0001	26233 (22.3)	0.0001
Age 40–50	50187 (13.2)	35889 (7.9)	0.0001	23508 (10.6)	0.0001	20558 (17.5)	0.0001
Age 50–65	116777 (30.7)	111103 (24.3)	0.0001	83803 (37.8)	0.0001	28990 (24.6)	0.0001
Age 65–75	101991 (26.8)	172289 (37.8)	0.0001	64754 (29.2)	0.0001	15546 (13.2)	0.0001
Age 75–85	36647 (9.6)	67834 (14.9)	0.0001	11668 (5.3)	0.0001	6539 (5.6)	0.0001
Age > 85	15524 (4.1)	24152 (5.3)	0.0001	1799 (0.8)	0.0001	4344 (3.7)	0.0001
BMI [Mean, SD]							
BMI < 18.5	3048 (0.8)	5820 (1.3)	0.0001	6732 (3.0)	0.0001	1919 (1.6)	0.0001
18.5 ≤ BMI < 30	188058 (49.4)	236762 (51.9)	0.0001	133593 (60.3)	0.0001	70140 (59.5)	0.0001
BMI ≥ 30	189542 (49.8)	213766 (46.8)	0.0001	81190 (36.7)	0.0001	45736 (38.8)	0.0001
Pre-existing Conditions							
Acute Cardiac Injury, N(%)	6715 (1.8)	13242 (2.9)	0.0001	5647 (2.5)	0.0001	1144 (1.0)	0.0001
Acute Liver Injury, N(%)	551 (0.1)	943 (0.2)	0.0001	653 (0.3)	0.0001	146 (0.1)	> 0.05
Acute Myocardial Infarction, N(%)	6703 (1.8)	13210 (2.9)	0.0001	5637 (2.5)	0.0001	1142 (1.0)	0.0001
Acute Respiratory Failure, N(%)	12331 (3.2)	29309 (6.4)	0.0001	12831 (5.8)	0.0001	2591 (2.2)	0.0001
Acute Rheumatic Heart Disease, N(%)	19 (0.0)	29 (0.0)		11 (0.0)		3 (0.0)	
Acute Kidney Failure, N(%)	22825 (6.0)	40092 (8.8)	0.0001	16371 (7.4)	0.0001	4066 (3.5)	0.0001
Alcohol Dependence, N(%)	63960 (16.8)	102131 (22.4)	0.0001	85961 (38.8)	0.0001	7732 (6.6)	0.0001
Anxiety, N(%)	89184 (23.4)	99137 (21.7)	0.0001	60585 (27.4)	0.0001	9058 (7.7)	0.0001
Acute Respiratory Distress Syndrome, N(%)	206 (0.1)	373 (0.1)	> 0.05	183 (0.1)	> 0.05	38 (0.0)	0.0001
Asthma, N(%)	32606 (8.6)	32184 (7.1)	0.0001	11261 (5.1)	0.0001	2572 (2.2)	0.0001
Bipolar Disorder, N(%)	14122 (3.7)	19188 (4.2)	0.0001	17678 (8.0)	0.0001	2074 (1.8)	0.0001

Breastfeeding, N(%)	475 (0.1)	236 (0.1)	> 0.05	88 (0.0)	0.0001	80 (0.1)	> 0.05
Breastfeed At Index	10 (0.0)	4 (0.0)		3 (0.0)		1 (0.0)	
Bronchitis, N(%)	25599 (6.7)	36357 (8.0)	0.0001	19134 (8.6)	0.0001	2687 (2.3)	0.0001
Coronary Atherosclerosis and other			0.0001		0.0001		0.0001
Heart Disease, N(%)	63009 (16.6)	118778 (26.0)		42141 (19.0)		7274 (6.2)	
Cancer, N(%)	73409 (19.3)	116775 (25.6)	0.0001	48138 (21.7)	0.0001	8330 (7.1)	0.0001
Cardiomyopathy, N(%)	11670 (3.1)	20183 (4.4)	0.0001	7878 (3.6)	0.0001	1388 (1.2)	0.0001
Cerebrovascular Disease, N(%)	6863 (1.8)	11416 (2.5)	0.0001	4570 (2.1)	0.0001	1044 (0.9)	0.0001
Congestive Heart Failure, N(%)	24805 (6.5)	47469 (10.4)	0.0001	15537 (7.0)	0.0001	3671 (3.1)	0.0001
Chronic hepatitis, N(%)	779 (0.2)	1436 (0.3)	0.0001	1351 (0.6)	0.0001	169 (0.1)	0.0001
Chronic Lung Disease, N(%)	100324 (26.4)	171849 (37.7)	0.0001	92835 (41.9)	0.0001	11099 (9.4)	0.0001
Chronic Neurological Disease, N(%)	14728 (3.9)	17366 (3.8)	0.018	5928 (2.7)	0.0001	2352 (2.0)	0.0001
Chronic Rheumatic Heart Disease, N(%)	3376 (0.9)	5638 (1.2)	0.0001	1644 (0.7)	0.0001	420 (0.4)	0.0001
Cirrhosis, N(%)	6895 (1.8)	13333 (2.9)	0.0001	8418 (3.8)	0.0001	1659 (1.4)	0.0001
Chronic Kidney Disease, N(%)	49213 (12.9)	76070 (16.7)	0.0001	22267 (10.1)	0.0001	5697 (4.8)	0.0001
Chronic Kidney Failure, N(%)	5853 (1.5)	8660 (1.9)	0.0001	2485 (1.1)	0.0001	997 (0.8)	0.0001
Complex Sleep Apnea, N(%)	72 (0.0)	82 (0.0)		29 (0.0)		8 (0.0)	
Chronic Obstructive Pulmonary Disease, N(%)	36137 (9.5)	101866 (22.3)	0.0001	64124 (28.9)	0.0001	5982 (5.1)	0.0001
Central sleep Apnea Primary, N(%)	1472 (0.4)	1951 (0.4)	> 0.05	649 (0.3)	0.0001	128 (0.1)	0.0001
Central serous retinopathy, N(%)	811 (0.2)	1295 (0.3)	0.0001	379 (0.2)	> 0.05	72 (0.1)	0.0001
Cardiovascular Disease, N(%)	113136 (29.7)	189991 (41.6)	0.0001	74726 (33.7)	0.0001	13663 (11.6)	0.0001
Dementia, N(%)	14937 (3.9)	23270 (5.1)	0.0001	6417 (2.9)	0.0001	4435 (3.8)	0.123
Diabetes Any, N(%)	119904 (31.5)	170917 (37.5)	0.0001	61119 (27.6)	0.0001	12753 (10.8)	0.0001
Diabetes Other, N(%)	11692 (3.1)	17364 (3.8)	0.0001	6193 (2.8)	0.0001	1226 (1.0)	0.0001
Diabetes Type 1, N(%)	6767 (1.8)	9445 (2.1)	0.0001	3445 (1.6)	0.0001	728 (0.6)	0.0001
Diabetes Type 2, N(%)	118959 (31.3)	169769 (37.2)	0.0001	60575 (27.3)	0.0001	12548 (10.7)	0.0001
Diabetes With Complications, N(%)	83422 (21.9)	123064 (27.0)	0.0001	42028 (19.0)	0.0001	8772 (7.4)	0.0001
Diabetes Without Complications, N(%)	108246 (28.4)	154275 (33.8)	0.0001	54757 (24.7)	0.0001	10576 (9.0)	0.0001
Drug Dependence, N(%)	10998 (2.9)	23280 (5.1)	0.0001	34315 (15.5)	0.0001	2826 (2.4)	0.0001
Emphysema, N(%)	3092 (0.8)	12544 (2.7)	0.0001	8342 (3.8)	0.0001	597 (0.5)	0.0001
Guillain-Barre Syndrome, N(%)	235 (0.1)	306 (0.1)	> 0.05	107 (0.0)	0.0001	20 (0.0)	0.0001
Heart Disease, N(%)	81153 (21.3)	145589 (31.9)	0.0001	52375 (23.6)	0.0001	9872 (8.4)	0.0001
Heart Failure, N(%)	31152 (8.2)	58606 (12.8)	0.0001	19333 (8.7)	0.0001	4552 (3.9)	0.0001
Hemorrhagic Stroke, N(%)	925 (0.2)	1379 (0.3)	0.0001	531 (0.2)	> 0.05	170 (0.1)	0.0001
Human Immunodeficiency Virus, N(%)	3354 (0.9)	3766 (0.8)	0.0001	2736 (1.2)	0.0001	828 (0.7)	0.0001
Hypertension, N(%)	226370 (59.5)	316762 (69.4)	0.0001	132837 (60.0)	0.00013	22791 (19.3)	0.0001
Hyperlipidemia, N(%)	218820 (57.5)	297932 (65.3)	0.0001	121331 (54.8)	0.0001	17705 (15.0)	0.0001
Inflammatory bowel Disease, N(%)	12803 (3.4)	17101 (3.7)	0.0001	7833 (3.5)	0.0404	1622 (1.4)	0.0001
Influenza, N(%)	7202 (1.9)	8856 (1.9)	> 0.05	4650 (2.1)	0.0001	1182 (1.0)	0.0001
Ischemic Stroke, N(%)	15716 (4.1)	25963 (5.7)	0.0001	10702 (4.8)	0.0001	2479 (2.1)	0.0001
Kidney Disease All, N(%)	82051 (21.6)	121420 (26.6)	0.0001	43206 (19.5)	0.0001	9712 (8.2)	0.0001

Liver Disease, N(%)	25722 (6.8)	36334 (8.0)	0.0001	19167 (8.7)	0.0001	3199 (2.7)	0.0001
Lower Respiratory Infection, N(%)	32746 (8.6)	38228 (8.4)	0.0011	18067 (8.2)	0.0001	4171 (3.5)	0.0001
Major Depressive Disorder, N(%)	138385 (36.4)	157528 (34.5)	0.0001	96981 (43.8)	0.0001	14395 (12.2)	0.0001
Measles, N(%)	10 (0.0)	9 (0.0)		4 (0.0)		3 (0.0)	
Multiple Sclerosis, N(%)	1757 (0.5)	2051 (0.4)	0.0001	852 (0.4)	0.0001	349 (0.3)	0.0001
Nephrosis, N(%)	10643 (2.8)	16172 (3.5)	0.0001	4765 (2.2)	0.0001	1181 (1.0)	0.0001
Obesity Hypoventilation, N(%)	1579 (0.4)	2519 (0.6)	0.0001	759 (0.3)	0.0001	230 (0.2)	0.0001
Obstructive Sleep Apnea, N(%)	128680 (33.8)	152873 (33.5)	0.0001	55524 (25.1)	0.0001	9929 (8.4)	0.0001
Other and Ill-Defined Heart Disease, N(%)	10359 (2.7)	16653 (3.6)	0.0001	5996 (2.7)	> 0.05	1392 (1.2)	0.0001
Overweight, N(%)	29827 (7.8)	31900 (7.0)	0.0001	10319 (4.7)	0.0001	4907 (4.2)	0.0001
Peripheral Artery Disease, N(%)	34538 (9.1)	67723 (14.8)	0.0001	31710 (14.3)	0.0001	5122 (4.3)	0.0001
Parkinsons Disease, N(%)	5125 (1.3)	7112 (1.6)	0.0001	1425 (0.6)	0.0001	951 (0.8)	0.0001
Polycystic Ovary Syndrome, N(%)	1067 (0.3)	482 (0.1)	0.0001	241 (0.1)	0.0001	62 (0.1)	0.0001
Pneumonia, N(%)	15814 (4.2)	31011 (6.8)	0.0001	13667 (6.2)	0.0001	3082 (2.6)	0.0001
Ventilator-Associated Pneumonia, N(%)	64 (0.0)	129 (0.0)		64 (0.0)		30 (0.0)	
Pregnancy, N(%)	2097 (0.6)	1200 (0.3)	0.0001	543 (0.2)	0.0001	583 (0.5)	0.0001
Pregnancy at Index, N(%)	490 (0.1)	324 (0.1)	> 0.05	146 (0.1)	> 0.05	234 (0.2)	0.0001
Posttraumatic Stress Disorder, N(%)	100159 (26.3)	115852 (25.4)	0.0001	68945 (31.1)	0.0001	10316 (8.8)	0.0001
Pulmonary Heart Disease, N(%)	6676 (1.8)	13010 (2.9)	0.0001	4050 (1.8)	> 0.05	959 (0.8)	0.0001
Schizophrenia, N(%)	7612 (2.0)	10818 (2.4)	0.0001	11573 (5.2)	0.0001	1859 (1.6)	0.0001
Septic Shock, N(%)	7577 (2.0)	14012 (3.1)	0.0001	5810 (2.6)	0.0001	2015 (1.7)	0.0001
Sickle Cell Disease, N(%)	868 (0.2)	637 (0.1)	0.0001	344 (0.2)	> 0.05	67 (0.1)	0.0001
Sleep Related Non-Obstructive Hypoventilation, N(%)	1300 (0.3)	2490 (0.5)	0.0001	849 (0.4)	0.0001	124 (0.1)	0.0001
Spleen Removed, N(%)	517 (0.1)	759 (0.2)	0.0001	380 (0.2)	0.0001	68 (0.1)	> 0.05
Urinary Stones, N(%)	38176 (10.0)	52765 (11.6)	0.0001	19089 (8.6)	0.0001	4276 (3.6)	0.0001
Venous Thromboembolism, N(%)	9158 (2.4)	13571 (3.0)	0.0001	5474 (2.5)	0.0159	1232 (1.0)	0.0001
Pre-infection Medications							
Acetyl Cholinesterase (ACE) Inhibitor, N(%)	99074 (26.0)	144906 (31.8)	0.0001	65228 (29.4)	0.0001	9944 (8.4)	0.0001
Acetaminophen, N(%)	140220 (36.8)	187679 (41.1)	0.0001	97082 (43.8)	0.0001	18717 (15.9)	0.0001
Androgen deprivation therapy, N(%)	4172 (1.1)	6012 (1.3)	0.0001	2102 (0.9)	0.0001	470 (0.4)	0.0001
Albumin, N(%)	1896 (0.5)	3682 (0.8)	0.0001	1589 (0.7)	0.0001	456 (0.4)	0.0001
Allopurinol, N(%)	24223 (6.4)	33987 (7.4)	0.0001	8989 (4.1)	0.0001	1947 (1.7)	0.0001
Alphablocker, N(%)	99655 (26.2)	149798 (32.8)	0.0001	61513 (27.8)	0.0001	10161 (8.6)	0.0001
Antianginal, N(%)	25447 (6.7)	48572 (10.6)	0.0001	17027 (7.7)	0.0001	2818 (2.4)	0.0001
Antiarrhythmic, N(%)	7916 (2.1)	14177 (3.1)	0.0001	3901 (1.8)	0.0001	976 (0.8)	0.0001
Antibiotic, N(%)	156249 (41.0)	205848 (45.1)	0.0001	101168 (45.7)	0.0001	20365 (17.3)	0.0001
Anticoagulant Inpatient, N(%)	43903 (11.5)	79260 (17.4)	0.0001	36785 (16.6)	0.0001	7715 (6.5)	0.0001
Anticoagulant Outpatient, N(%)	51501 (13.5)	91730 (20.1)	0.0001	31645 (14.3)	0.0001	5594 (4.7)	0.0001
Antihistamine, N(%)	163405 (42.9)	195617 (42.9)	> 0.05	98457 (44.4)	0.0001	16242 (13.8)	0.0001

Antipsychotic, N(%)	30686 (8.1)	41224 (9.0)	0.0001	34934 (15.8)	0.0001	4585 (3.9)	0.0001
Antiviral, N(%)	34109 (9.0)	37739 (8.3)	0.0001	19329 (8.7)	0.0001	5948 (5.0)	0.0001
Angiotensin II Receptor Blocker, N(%)	51761 (13.6)	71243 (15.6)	0.0001	22206 (10.0)	0.0001	4153 (3.5)	0.0001
Aromatase Inhibitors, N(%)	825 (0.2)	525 (0.1)	0.0001	246 (0.1)	0.0001	58 (0.0)	0.0001
Azithromycin, N(%)	35610 (9.4)	51654 (11.3)	0.0001	26702 (12.1)	0.0001	4594 (3.9)	0.0001
Bacillus Calmette-Guerin, N(%)	404 (0.1)	1188 (0.3)	0.0001	435 (0.2)	0.0001	51 (0.0)	0.0001
Benzodiazepine, N(%)	42551 (11.2)	59332 (13.0)	0.0001	36452 (16.5)	0.0001	5207 (4.4)	0.0001
Beta Agonist Nebulizer, N(%)	26255 (6.9)	53791 (11.8)	0.0001	28165 (12.7)	0.0001	4485 (3.8)	0.0001
Beta Blocker, N(%)	112848 (29.6)	177470 (38.9)	0.0001	71001 (32.1)	0.0001	12367 (10.5)	0.0001
Bronchodilator, N(%)	75167 (19.7)	130087 (28.5)	0.0001	74386 (33.6)	0.0001	8600 (7.3)	0.0001
Calcium Channel Blocker, N(%)	93177 (24.5)	132587 (29.1)	0.0001	57700 (26.0)	0.0001	9387 (8.0)	0.0001
Chloroquine, N(%)	9 (0.0)	9 (0.0)		2 (0.0)		0 (0.0)	
Cis-atracurium, N(%)	64 (0.0)	114 (0.0)		63 (0.0)		10 (0.0)	
Colchicine, N(%)	9877 (2.6)	13471 (3.0)	0.0001	4338 (2.0)	0.0001	850 (0.7)	0.0001
Corticosteroid, N(%)	138794 (36.5)	189501 (41.5)	0.0001	86454 (39.0)	0.0001	13861 (11.8)	0.0001
Degarelix, N(%)yrs	71 (0.0)	89 (0.0)		34 (0.0)		15 (0.0)	
Dexamethasone, N(%)	13688 (3.6)	18955 (4.2)	0.0001	8981 (4.1)	0.0001	1835 (1.6)	0.0001
Dobutamine, N(%)	341 (0.1)	709 (0.2)	0.0001	213 (0.1)	> 0.05	43 (0.0)	0.0001
Eculizumab, N(%)	7 (0.0)	8 (0.0)		3 (0.0)		0 (0.0)	
Epinephrine, N(%)	11341 (3.0)	12637 (2.8)	0.0001	5657 (2.6)	0.0001	1060 (0.9)	0.0001
Estrogen, N(%)	12269 (3.2)	7536 (1.7)	0.0001	3680 (1.7)	0.0001	911 (0.8)	0.0001
Famotidine, N(%)	32110 (8.4)	42797 (9.4)	0.0001	19202 (8.7)	0.0001	3316 (2.8)	0.0001
Furosemide, N(%)	37342 (9.8)	68350 (15.0)	0.0001	22713 (10.3)	0.0001	5194 (4.4)	0.0001
Glucocorticoid, N(%)	83724 (22.0)	112888 (24.7)	0.0001	56713 (25.6)	0.0001	9589 (8.1)	0.0001
Histamine 2 Receptor Blocker, N(%)	33603 (8.8)	43993 (9.6)	0.0001	19824 (8.9)	> 0.05	3187 (2.7)	0.0001
Hydrochlorothiazide, N(%)	60649 (15.9)	77779 (17.0)	0.0001	33962 (15.3)	0.0001	5139 (4.4)	0.0001
Hydroxychloroquine, N(%)	3291 (0.9)	3989 (0.9)	> 0.05	1382 (0.6)	0.0001	264 (0.2)	0.0001
Inhaled Corticosteroids, N(%)	7947 (2.1)	11208 (2.5)	0.0001	4006 (1.8)	0.0001	679 (0.6)	0.0001
Inhaled Corticosteroids and Long-Acting Beta-Agonist, N(%)	29494 (7.7)	61378 (13.4)	0.0001	33023 (14.9)	0.0001	3170 (2.7)	0.0001
Induction Ventilation Medications, N(%)	6615 (1.7)	10240 (2.2)	0.0001	4827 (2.2)	0.0001	935 (0.8)	0.0001
Inhaled Budesonide, N(%)	1290 (0.3)	1999 (0.4)	0.0001	575 (0.3)	> 0.05	156 (0.1)	0.0001
Inhaled Epo-prostenol, N(%)	29 (0.0)	69 (0.0)		16 (0.0)		6 (0.0)	
Isoproterenol, N(%)	35 (0.0)	66 (0.0)		24 (0.0)		7 (0.0)	
Long-Acting Beta-Agonist, N(%)	766 (0.2)	2402 (0.5)	0.0001	974 (0.4)	0.0001	106 (0.1)	0.0001
Lopinavir, N(%)	20 (0.0)	30 (0.0)		24 (0.0)		5 (0.0)	
Losartan, N(%)	47113 (12.4)	63735 (14.0)	0.0001	20044 (9.0)	0.0001	3754 (3.2)	0.0001
Metformin, N(%)	72749 (19.1)	100442 (22.0)	0.0001	38267 (17.3)	0.0001	6021 (5.1)	0.0001
Milrinone, N(%)	181 (0.0)	370 (0.1)	0.0001	101 (0.0)		19 (0.0)	
Norepinephrine, N(%)	1289 (0.3)	2775 (0.6)	0.0001	1097 (0.5)	0.0001	330 (0.3)	0.975
Non-steroidal Anti-Inflammatory Drug, N(%)	235755 (61.9)	285628 (62.6)	0.0001	145315 (65.6)	0.0001	27160 (23.1)	0.0001

Opioid, N(%)	16907 (4.4)	28996 (6.4)	0.0001	17443 (7.9)	0.0001	2676 (2.3)	0.0001
Platelet Aggregation Inhibitor, N(%)	20287 (5.3)	40000 (8.8)	0.0001	16090 (7.3)	0.0001	2466 (2.1)	0.0001
Phenylephrine, N(%)	6486 (1.7)	9446 (2.1)	0.0001	4064 (1.8)	0.004	753 (0.6)	0.0001
Proton Pump Inhibitor, N(%)	135932 (35.7)	191245 (41.9)	0.0001	84305 (38.1)	0.0001	13200 (11.2)	0.0001
Remdesivir, N(%)	10 (0.0)	32 (0.0)		4 (0.0)		2 (0.0)	
Ribavirin, N(%)	25 (0.0)	54 (0.0)		62 (0.0)		8 (0.0)	
Sarilumab, N(%)	1 (0.0)	9 (0.0)		2 (0.0)		0 (0.0)	
Selective Estrogen Receptor Degradar, N(%)	19 (0.0)	18 (0.0)		9 (0.0)		4 (0.0)	
Selective Estrogen Receptor Modulators, N(%)	469 (0.1)	355 (0.1)	> 0.05	107 (0.0)	0.0001	30 (0.0)	0.0001
Serotonin and Norepinephrine Reuptake Inhibitors, N(%)	52973 (13.9)	68321 (15.0)	0.0001	36673 (16.6)	0.0001	4533 (3.8)	0.0001
Selective Serotonin Reuptake Inhibitors, N(%)	79424 (20.9)	95112 (20.8)	> 0.05	53298 (24.1)	0.0001	8411 (7.1)	0.0001
Statin, N(%)	179529 (47.2)	264318 (57.9)	0.0001	109726 (49.5)	0.0001	16040 (13.6)	0.0001
Tocilizumab, N(%)	119 (0.0)	222 (0.0)		75 (0.0)		10 (0.0)	
Tricyclic, N(%)	19769 (5.2)	21785 (4.8)	0.0001	12138 (5.5)	0.0001	1575 (1.3)	0.0001
Valsartan, N(%)	5540 (1.5)	9045 (2.0)	0.0001	2624 (1.2)	0.0001	486 (0.4)	0.0001
Vasopressin, N(%)	465 (0.1)	990 (0.2)	0.0001	345 (0.2)	0.0001	110 (0.1)	> 0.05
Vasopressor, N(%)	7571 (2.0)	11270 (2.5)	0.0001	4536 (2.0)	> 0.05	1123 (1.0)	0.0001
Vecuronium, N(%)	15 (0.0)	29 (0.0)		17 (0.0)		6 (0.0)	

Table S2a. List of variables studied and results of most important variable selection from prevalence, Univariate Analysis, LASSO and sequential forward stepwise selection for Imputed data.

Variables	Prevalence (%)	Univariate Analysis		LASS	Forward	Logistic
				O	Selection	regression
						Coefficient
		Beta	pValue			t
Sex (male)	86.5	0.07	P < 0.0001	Yes	Yes	
Age						
Age 18–30	3.6	0.14	P < 0.0001	Yes	No	
Age 30–40	10.8	0.13	P < 0.0001	Yes	No	
Age 40–50	10.6	0.17	P < 0.0001	Yes	No	
Age 50–65	28.2	-0.05	P < 0.0001	No	No	
Age 65–75	30.1	-0.2	P < 0.0001	Yes	No	
Age 75–85	12.2	0.01	P < 0.0001	No	No	
Age > 85	4.5	0.3	P < 0.0001	Yes	Yes	0.2830
Race						
White, N(%)	65.5	-0.03	P = 0.0009	Yes	No	
Black , N(%)	21.7	0	P > 0.05	No	No	
Other , N(%)	12.8	0.06	P < 0.0001	Yes	Yes	
Ethnicity						
Hispanic or Latino, N(%)	8.1		P < 0.0001	Yes	Yes	0.1606
BMI						
BMI < 18.5	1.5	0.29	P < 0.0001	Yes	Yes	-0.3120
18.5 ≤ BMI <30	53.4		P < 0.0001	No		
BMI ≥ 30	45.1		P < 0.0001	Yes	Yes	0.2695
Acetyl Cholinesterase (ACE) Inhibitor, N(%)	27.1	-0.06	P < 0.0001	Yes	No	
Acetaminophen, N(%)	37.3	-0.19	P < 0.0001	Yes	No	
Acute Cardiac Injury, N(%)	2.3	-0.04	P = 0.0002	No	No	
Acute Liver Injury, N(%)	< 1%		P > 0.05	No	No	
Acute Myocardial Infarction, N(%)	2.3	-0.04	P = 0.0002	No	No	
Acute Respiratory Failure, N(%)	4.9	0.1	P = 0.003	Yes	No	
Acute Rheumatic Heart Disease, N(%)	< 1%		P > 0.05	No	No	
Androgen deprivation therapy, N(%)	1.1	-0.27	P < 0.0001	Yes	No	
Acute Kidney Failure, N(%)	7.1	0.02	P = 0.012	No	No	
Albumin, N(%)	< 1%		P > 0.05	No	No	
Alcohol Dependence, N(%)	22.1	-0.16	P < 0.0001	No	No	
Allopurinol, N(%)	5.9	0.08	P < 0.0001	Yes	No	
Alphablocker, N(%)	27.3	-0.13	P < 0.0001	Yes	No	
Antianginal, N(%)	8.0	-0.1	P < 0.0001	No	No	
Antiarrhythmic, N(%)	2.3	-0.13	P < 0.0001	Yes	No	
Antibiotic, N(%)	41.1	-0.21	P < 0.0001	Yes	No	

Anticoagulant Inpatient, N(%)	14.3	-0.14	P < 0.0001	Yes	No	
Anticoagulant Outpatient, N(%)	15.3	-0.09	P < 0.0001	No	No	
Antihistamine, N(%)	40.3	-0.14	P < 0.0001	No	No	
Antipsychotic, N(%)	9.5	-0.23	P < 0.0001	Yes	No	
Antiviral, N(%)	8.3	-0.05	P < 0.0001	No	No	
Anxiety, N(%)	21.9	-0.1	P < 0.0001	No	No	
Angiotensin II Receptor Blocker, N(%)	12.7	0.03	P < 0.0001	No	No	
Acute Respiratory Distress Syndrome, N(%)	< 1%		P > 0.05	No	No	
Aromatase Inhibitors, N(%)	< 1%		P > 0.05	No	No	
Asthma, N(%)	6.7	0	P > 0.05	No	No	
Azithromycin, N(%)	10.1	-0.02	P < 0.0001	Yes	No	
Bacillus Calmette-Guerin, N(%)	< 1%		P > 0.05	No	No	
Benzodiazepine, N(%)	12.2	-0.26	P < 0.0001	Yes	No	
Beta Agonist Nebulizer, N(%)	9.6	-0.16	P < 0.0001	Yes	No	
Beta Blocker, N(%)	31.8	-0.12	P < 0.0001	Yes	No	
Bipolar Disorder, N(%)	4.5	-0.31	P < 0.0001	Yes	No	
Bronchitis, N(%)	7.1	-0.04	P < 0.0001	Yes	No	
Bronchodilator, N(%)	24.5	-0.17	P < 0.0001	No	No	
Coronary Atherosclerosis and other Heart Disease, N(%)	19.7	-0.06	P < 0.0001	Yes	No	
Cancer, N(%)	21.0	-0.3	P < 0.0001	Yes	Yes	-0.3253
Cardiomyopathy, N(%)	3.5	-0.17	P < 0.0001	Yes	No	
Calcium Channel Blocker, N(%)	24.9	-0.08	P < 0.0001	No	No	
Cerebrovascular Disease, N(%)	2.0	-0.02	P > 0.05	No	No	
Congestive Heart Failure, N(%)	7.8	-0.08	P < 0.0001	Yes	No	
Chloroquine, N(%)	< 1%		P > 0.05	No	No	
Chronic hepatitis, N(%)	< 1%		P > 0.05	No	No	
Chronic Lung Disease, N(%)	32.0	-0.18	P < 0.0001	Yes	No	
Chronic Neurological Disease, N(%)	3.4	0.07	P < 0.0001	Yes	No	
Chronic Rheumatic Heart Disease, N(%)	< 1%		P > 0.05	No	No	
Cirrhosis, N(%)	2.6	-0.37	P < 0.0001	Yes	No	
Cis-atracurium, N(%)	< 1%		P > 0.05	No	No	
Chronic Kidney Disease, N(%)	13.0	0.03	P < 0.0001	Yes	No	
Chronic Kidney Failure, N(%)	1.5	0.06	0.0021	No	No	
Colchicine, N(%)	2.4	0	P > 0.05	No	No	
Complex Sleep Apnea, N(%)	< 1%		P > 0.05	No	No	
Chronic Obstructive Pulmonary Disease, N(%)	17.7	-0.24	P < 0.0001	No	No	
Corticosteroid, N(%)	36.4	-0.14	P < 0.0001	Yes	No	
Central Sleep Apnea Primary, N(%)	< 1%		P > 0.05	No	No	
Central Serous Retinopathy, N(%) (CRS)	< 1%		P > 0.05	No	No	
Cardiovascular Disease, N(%)	33.3	-0.12	P < 0.0001	Yes	No	

Degarelix, N(%)	< 1%		P > 0.05	No	No	0.3506
Dementia, N(%)	4.2	0.38	P < 0.0001	Yes	Yes	
Dexamethasone, N(%)	3.7	-0.17	P < 0.0001	No	No	
Diabetes Any, N(%)	31.0	0.11	P < 0.0001	Yes	Yes	
Diabetes Other, N(%)	3.1	-0.03	P = 0.0029	Yes	Yes	
Diabetes Type 1, N(%)	1.7	0	P > 0.05	No	No	
Diabetes Type 2, N(%)	30.8	0.11	P < 0.0001	Yes	No	
Diabetes With Complications, N(%)	21.9	0.09	P < 0.0001	No	No	
Diabetes Without Complications, N(%)	27.9	0.11	P < 0.0001	No	No	
Dobutamine, N(%)	< 1%		P > 0.05	No	No	
Non-Alcohol Drug Dependence, N(%)	6.1	-0.49	P < 0.0001	Yes	Yes	
Eculizumab, N(%)	< 1%		P > 0.05	No	No	
Emphysema, N(%)	2.1	-0.33	P < 0.0001	Yes	No	
Epinephrine, N(%)	2.6	-0.11	P < 0.0001	Yes	No	
Estrogen, N(%)	2.1	-0.09	P < 0.0001	Yes	No	
Famotidine, N(%)	8.3	-0.12	P < 0.0001	No	No	
Furosemide, N(%)	11.4	-0.06	P < 0.0001	No	No	
Guillain-Barre Syndrome, N(%)	< 1%		P > 0.05	No	No	
Glucocorticoid, N(%)	22.4	-0.13	P < 0.0001	No	No	
Histamine 2 Receptor Blocker, N(%)	8.6	-0.19	P < 0.0001	Yes	No	
Hydrochlorothiazide, N(%)	15.1	-0.03	P = 0.0024	No	No	
Heart Disease, N(%)	24.6	-0.07	P < 0.0001	Yes	No	
Heart Failure, N(%)	9.7	-0.06	P < 0.0001	No	No	
Hemorrhagic Stroke, N(%)	< 1%		P > 0.05	No	No	
Human Immunodeficiency Virus, N(%)	< 1%		P > 0.05	No	No	
Hypertension, N(%)	59.4	-0.04	P = 0.0033	Yes	No	
Hydroxychloroquine, N(%)	< 1%		P > 0.05	No	No	
Hyperlipidemia, N(%)	55.7	0.03	P < 0.0001	Yes	No	
Inflammatory bowel Disease, N(%)	3.3	-0.16	P < 0.0001	Yes	No	
Inhaled Corticosteroids, N(%)	2.0	-0.12	P < 0.0001	Yes	No	
Inhaled Corticosteroids and Long-Acting Beta-Agonist, N(%)	10.8	-0.15	P < 0.0001	Yes	No	
Induction Ventilation Medications, N(%)	1.9	-0.25	P < 0.0001	No	No	
Influenza, N(%)	1.9	0.09	P < 0.0001	Yes	No	
Inhaled Budesonide, N(%)	< 1%		P > 0.05	No	No	
Inhaled Epo-prostenol, N(%)	< 1%		P > 0.05	No	No	
Ischemic Stroke, N(%)	4.7	-0.01	P > 0.05	No	No	
Isoproterenol, N(%)	< 1%		P > 0.05	No	No	
Kidney Disease All, N(%)	21.8	-0.03	P < 0.0001	Yes	No	
Long-Acting Beta-Agonist, N(%)	< 1%		P > 0.05	No	No	
Liver Disease, N(%)	7.2	-0.16	P < 0.0001	Yes	No	
Lopinavir, N(%)	< 1%		P > 0.05	No	No	

Losartan, N(%)	11.4	0.03	P < 0.0001	No	No	
Lower Respiratory Infection, N(%)	7.9	0.13	P < 0.0001	Yes	Yes	0.0888
Major Depressive Disorder, N(%)	34.6	-0.13	P < 0.0001	Yes	No	
Measles, N(%)	< 1%		P > 0.05	No	No	
Metformin, N(%)	18.5	0.11	P < 0.0001	Yes	No	
Milrinone, N(%)	< 1%		P > 0.05	No	No	
Multiple Sclerosis, N(%)	< 1%		P > 0.05	No	No	
Nephrosis, N(%)	2.8	0	P > 0.05	No	No	
Norepinephrine, N(%)	< 1%		P > 0.05	No	No	
Non-steroidal Anti-Inflammatory Drug, N(%)	59.0	-0.15	P < 0.0001	Yes	No	
Obesity Hypoventilation, N(%)	< 1%		P > 0.05	No	No	
Opioid, N(%)	5.6	-0.3	P < 0.0001	Yes	No	
Obstructive Sleep Apnea, N(%)	29.5	0.05	P < 0.0001	No	No	
Other and Ill-Defined Heart Disease, N(%)	2.9	-0.07	P < 0.0001	No	No	
Overweight, N(%)	6.5	0.27	P < 0.0001	Yes	No	
Peripheral Artery Disease, N(%)	11.8	-0.19	P < 0.0001	Yes	No	
Platelet Aggregation Inhibitor, N(%)	6.7	-0.06	P < 0.0001	Yes	No	
Parkinsons Disease, N(%)	1.2	0.12	P < 0.0001	Yes	No	
Polycystic Ovary Syndrome, N(%)	< 1%		P > 0.05	No	No	
Phenylephrine, N(%)	1.8	-0.27	P < 0.0001	Yes	No	-0.2799
Pneumonia, N(%)	5.4	0.12	P < 0.0001	Yes	No	0.1790
Ventilator-Associated Pneumonia, N(%)	< 1%		P > 0.05	No	No	
Proton Pump Inhibitor, N(%)	36.1	-0.15	P < 0.0001	Yes	No	
Pregnancy, N(%)	< 1%		P > 0.05	No	No	
Pregnancy at Index, N(%)	< 1%		P > 0.05	No	No	
Posttraumatic Stress Disorder, N(%)	25.1	-0.1	P < 0.0001	No	No	
Pulmonary Heart Disease, N(%)	2.1	-0.12	P < 0.0001	Yes	Yes	
Remdesivir, N(%)	< 1%		P > 0.05	No	No	
Ribavirin, N(%)	< 1%		P > 0.05	No	No	
Rosiglitazone, N(%)	< 1%		P > 0.05	No	No	
Sarilumab, N(%)	< 1%		P > 0.05	No	No	
Schizophrenia, N(%)	2.7	-0.23	P < 0.0001	Yes	No	
Septic Shock, N(%)	2.5	0.12	P < 0.0001	Yes	Yes	0.0675
Selective Estrogen Receptor Degradar, N(%)	< 1%		P > 0.05	No	No	
Selective Estrogen Receptor Modulators, N(%)	< 1%		P > 0.05	No	No	
Sickle Cell Disease, N(%)	< 1%		P > 0.05	No	No	
Sleep Related Non-Obstructive Hypoventilation, N(%)	< 1%		P > 0.05	No	No	
Never Smoker	36.7	0.28	P < 0.0001	Yes	No	
Former Smoker	43.0	0.09	P < 0.0001	No	No	-0.1203
Current Smoker	20.2	-0.63	P < 0.0001	Yes	Yes	-0.6828

Serotonin and Norepinephrine Reuptake Inhibitors, N(%)	13.8	-0.16	P < 0.0001	Yes	No
Spleen Removed, N(%)	< 1%		P > 0.05	No	No
Selective Serotonin Reuptake Inhibitors, N(%)	20.1	-0.09	P < 0.0001	No	No
Statin, N(%)	48.4	-0.09	P < 0.0001	Yes	No
Tested positive, N(%)	19.6		P < 0.0001	No	
Tocilizumab, N(%)	< 1%		P > 0.05	No	No
Tricyclic, N(%)	4.7	-0.17	P < 0.0001	Yes	No
Urinary Stones, N(%)	9.7	-0.13	P < 0.0001	Yes	No
Valsartan, N(%)	1.5	-0.01	P > 0.05	No	No
Vasopressin, N(%)	< 1%		P > 0.05	No	No
Vasopressor, N(%)	2.1	-0.15	P < 0.0001	Yes	No
Vecuronium, N(%)	< 1%		P > 0.05	No	No
Venous Thromboembolism, N(%)	2.5	-0.01	P > 0.05	No	No

Table S2b. List of variables studied and results of feature selection (FS) from prevalence, Univariate Analysis, LASSO, and sequential forward stepwise selection for Unimputed data.

Variables	Prevalence (%)	Univariate Analysis		LASSO	Forward Selection	Logistic regression Coefficient
		Beta	pValue	O		
Sex (Male)	89.0		P < 0.0001	Yes	No	
Age						
Age 18–30	2.7		P < 0.0001	Yes	No	
Age 30–40	9.6		P < 0.0001	Yes	No	
Age 40–50	9.8		P < 0.0001	Yes	No	
Age 50–65	28.6		P < 0.0001	No	No	
Age 65–75	31.9		P < 0.0001	Yes	No	
Age 75–85	12.9		P < 0.0001	No	No	
Age > 85	4.5		P < 0.0001	Yes	Yes	0.2836
Race						
White	68.3		P < 0.0001	Yes	No	
Black	22.5		P > 0.05	No	No	
Other	9.3		P < 0.0001	No	No	
Ethnicity						
Hispanic or Latino, N(%)	8.4		P < 0.0001	Yes	No	
BMI						
BMI < 18.5	1.5		P < 0.0001	Yes	Yes	-0.3154
18.5 ≤ BMI <30	52.7		P < 0.0001	No	No	
BMI ≥ 30	45.8		P < 0.0001	Yes	Yes	0.2726
Acetyl Cholinesterase (ACE) Inhibitor, N(%)	29.2		P < 0.0001	Yes	No	
Acetaminophen, N(%)	40.1		P < 0.0001	Yes	No	
Acute Cardiac Injury, N(%)	2.4		P < 0.0001	Yes	No	
Acute Liver Injury, N(%)	< 1%		P > 0.05	No	No	
Acute Myocardial Infarction, N(%)	2.4		P < 0.0001	No	No	
Acute Respiratory Failure, N(%)	5.1		P > 0.05	No	No	
Acute Rheumatic Heart Disease, N(%)	< 1%		P > 0.05	No	No	
Androgen deprivation therapy, N(%)	1.2		P < 0.0001	Yes	No	
Acute Kidney Failure, N(%)	7.5		P = 0.091	No	No	
Albumin, N(%)	< 1%		P > 0.05	No	No	
Alcohol Dependence, N(%)	23.8		P < 0.0001	No	No	
Allopurinol, N(%)	6.3		P < 0.0001	Yes	No	
Alphablocker, N(%)	29.4		P < 0.0001	No	No	
Antianginal, N(%)	8.6		P < 0.0001	No	No	
Antiarrhythmic, N(%)	2.5		P < 0.0001	No	No	
Antibiotic, N(%)	43.8		P < 0.0001	Yes	Yes	

Anticoagulant Inpatient, N(%)	15.1	P < 0.0001	No	No	-0.3232
Anticoagulant Outpatient, N(%)	16.5	P < 0.0001	Yes	No	
Antihistamine, N(%)	43.2	P < 0.0001	No	No	
Antipsychotic, N(%)	10.1	P < 0.0001	Yes	No	
Antiviral, N(%)	8.6	P < 0.0001	No	No	
Anxiety, N(%)	23.5	P < 0.0001	No	No	
Angiotensin II Receptor Blocker, N(%)	13.7	P < 0.0001	No	No	
Acute Respiratory Distress Syndrome, N(%)	< 1%	P > 0.05	No	No	
Aromatase Inhibitors, N(%)	< 1%	P > 0.05	No	No	
Asthma, N(%)	7.2	P > 0.05	No	No	
Azithromycin, N(%)	10.8	P < 0.0001	Yes	No	
Bacillus Calmette-Guerin, N(%)	< 1%	P > 0.05	No	No	
Benzodiazepine, N(%)	13.1	P < 0.0001	Yes	No	
Beta Agonist Nebulizer, N(%)	10.2	P < 0.0001	Yes	No	
Beta Blocker, N(%)	34.1	P < 0.0001	Yes	No	
Bipolar Disorder, N(%)	4.8	P < 0.0001	Yes	No	
Bronchitis, N(%)	7.7	P < 0.0001	Yes	No	
Bronchodilator, N(%)	26.4	P < 0.0001	No	No	
Coronary Atherosclerosis and other Heart Disease, N(%)	21.2	P < 0.0001	Yes	No	
Cancer, N(%)	22.5	P < 0.0001	Yes	Yes	
Cardiomyopathy, N(%)	3.8	P < 0.0001	Yes	No	
Calcium Channel Blocker, N(%)	26.8	P < 0.0001	No	No	
Cerebrovascular Disease, N(%)	2.2	P = 0.0006	No	No	-0.3232
Congestive Heart Failure, N(%)	8.3	P < 0.0001	Yes	No	
Chloroquine, N(%)	< 1%	P > 0.05	No	No	
Chronic hepatitis, N(%)	< 1%	P > 0.05	No	No	
Chronic Lung Disease, N(%)	34.5	P < 0.0001	Yes	No	
Chronic Neurological Disease, N(%)	3.6	P < 0.0001	Yes	No	
Chronic Rheumatic Heart Disease, N(%)	1.0	P > 0.05	Yes	No	
Cirrhosis, N(%)	2.7	P < 0.0001	Yes	No	
Cis-atracurium, N(%)	< 1%	P > 0.05	No	No	
Chronic Kidney Disease, N(%)	13.9	P < 0.0001	Yes	No	
Chronic Kidney Failure, N(%)	1.6	P > 0.05	No	No	
Colchicine, N(%)	2.6	P > 0.05	No	No	
Complex Sleep Apnea, N(%)	< 1%	P > 0.05	No	No	
Chronic Obstructive Pulmonary Disease, N(%)	19.1	P < 0.0001	No	No	
Corticosteroid, N(%)	39.2	P < 0.0001	Yes	No	
Central sleep Apnea Primary, N(%)	< 1%	P > 0.05	No	No	
Central serous retinopathy, N(%)	< 1%	P > 0.05	No	No	
Cardiovascular Disease, N(%)	35.7	P < 0.0001	Yes	No	

Degarelix, N(%)	< 1%	P > 0.05	No	No	0.3496
Dementia, N(%)	4.2	P < 0.0001	Yes	Yes	
Dexamethasone, N(%)	3.9	P < 0.0001	No	No	
Diabetes Any, N(%)	33.2	P < 0.0001	Yes	No	0.3496
Diabetes Other, N(%)	3.3	P = 0.0006	Yes	No	
Diabetes Type 1, N(%)	1.9	P > 0.05	No	No	
Diabetes Type 2, N(%)	33.0	P < 0.0001	Yes	No	0.3496
Diabetes With Complications, N(%)	23.5	P < 0.0001	No	No	
Diabetes Without Complications, N(%)	30.0	P < 0.0001	No	No	
Dobutamine, N(%)	< 1%	P > 0.05	No	No	0.3496
Non-Alcohol Drug Dependence, N(%)	6.5	P < 0.0001	Yes	No	
Ecilizumab, N(%)	< 1%	P > 0.05	No	No	
Emphysema, N(%)	2.3	P < 0.0001	No	No	0.3496
Epinephrine, N(%)	2.8	P < 0.0001	Yes	No	
Estrogen, N(%)	2.2	P < 0.0001	No	No	
Famotidine, N(%)	8.9	P < 0.0001	No	No	0.3496
Furosemide, N(%)	12.1	P < 0.0001	No	No	
Guillain-Barre Syndrome, N(%)	< 1%	P > 0.05	No	No	
Glucocorticoid, N(%)	23.9	P < 0.0001	No	No	0.3496
Histamine 2 Receptor Blocker, N(%)	9.2	P < 0.0001	Yes	No	
Hydrochlorothiazide, N(%)	16.3	P = 0.0016	No	No	
Heart Disease, N(%)	26.4	P < 0.0001	Yes	No	0.3496
Heart Failure, N(%)	10.3	P < 0.0001	No	No	
Hemorrhagic Stroke, N(%)	< 1%	P > 0.05	No	No	
Human Immunodeficiency Virus, N(%)	< 1%	P > 0.05	No	No	0.3496
Hypertension, N(%)	63.9	P < 0.0001	Yes	No	
Hydroxychloroquine, N(%)	< 1%	P > 0.05	No	No	
Hyperlipidemia, N(%)	60.3	P < 0.0001	Yes	No	0.3496
Inflammatory bowel Disease, N(%)	3.6	P < 0.0001	Yes	No	
Inhaled Corticosteroids, N(%)	2.2	P < 0.0001	Yes	No	
Inhaled Corticosteroids and Long-Acting Beta-Agonist, N(%)	11.7	P < 0.0001	Yes	No	0.3496
Induction Ventilation Medications, N(%)	2.0	P < 0.0001	No	No	
Influenza, N(%)	2.0	P = 0.00012	Yes	No	
Inhaled Budesonide, N(%)	< 1%	P > 0.05	No	No	0.3496
Inhaled Epo-prostenol, N(%)	< 1%	P > 0.05	No	No	
Ischemic Stroke, N(%)	4.9	P = 0.0003	Yes	No	
Isoproterenol, N(%)	< 1%	P > 0.05	No	No	0.3496
Kidney Disease All, N(%)	23.3	P < 0.0001	Yes	No	
Long-Acting Beta-Agonist, N(%)	< 1%	P > 0.05	No	No	
Liver Disease, N(%)	7.7	P < 0.0001	Yes	No	0.3496

Lopinavir, N(%)	< 1%	P > 0.05	No	No	
Losartan, N(%)	12.4	P < 0.0001	No	No	
Lower Respiratory Infection, N(%)	8.4	P < 0.0001	Yes	Yes	0.0907
Major Depressive Disorder, N(%)	37.1	P < 0.0001	Yes	No	
Measles, N(%)	< 1%	P > 0.05	No	No	
Metformin, N(%)	20.0	P < 0.0001	Yes	No	
Milrinone, N(%)	< 1%	P > 0.05	No	No	
Multiple Sclerosis, N(%)	< 1%	P > 0.05	No	No	
Nephrosis, N(%)	3.0	P > 0.05	No	No	
Norepinephrine, N(%)	< 1%	P > 0.05	No	No	
Non-steroidal Anti-Inflammatory Drug, N(%)	63.0	P < 0.0001	Yes	No	
Obesity Hypoventilation, N(%)	< 1%	P > 0.05	No	No	
Opioid, N(%)	6.0	P < 0.0001	Yes	No	
Obstructive Sleep Apnea, N(%)	31.8	P < 0.0001	No	No	
Other and Ill-Defined Heart Disease, N(%)	3.1	P < 0.0001	No	No	
Overweight, N(%)	6.8	P < 0.0001	Yes	No	
Peripheral Artery Disease, N(%)	12.7	P < 0.0001	Yes	No	
Platelet Aggregation Inhibitor, N(%)	7.2	P < 0.0001	Yes	No	
Parkinsons Disease, N(%)	1.3	P < 0.0001	Yes	No	
Polycystic Ovary Syndrome, N(%)	< 1%	P > 0.05	No	No	
Phenylephrine, N(%)	1.9	P < 0.0001	Yes	Yes	-0.2779
Pneumonia, N(%)	5.7	P < 0.0001	Yes	Yes	0.1789
Ventilator-Associated Pneumonia, N(%)	< 1%	P > 0.05	No	No	
Proton Pump Inhibitor, N(%)	38.9	P < 0.0001	Yes	No	
Pregnancy, N(%)	0.4	P > 0.05	No	No	
Pregnancy at Index, N(%)	< 1%	P > 0.05	No	No	
Posttraumatic Stress Disorder, N(%)	26.9	P < 0.0001	No	No	
Pulmonary Heart Disease, N(%)	2.2	P < 0.0001	Yes	No	
Remdesivir, N(%)	< 1%	P > 0.05	No	No	
Ribavirin, N(%)	< 1%	P > 0.05	No	No	
Rosiglitazone, N(%)	< 1%	P > 0.05	No	No	
Sarilumab, N(%)	< 1%	P > 0.05	No	No	
Schizophrenia, N(%)	2.8	P < 0.0001	Yes	No	
Septic Shock, N(%)	2.6	P < 0.0001	Yes	Yes	0.0652
Selective Estrogen Receptor Degradar, N(%)	< 1%	P > 0.05	No	No	
Selective Estrogen Receptor Modulators, N(%)	< 1%	P > 0.05	No	No	
Sickle Cell Disease, N(%)	< 1%	P > 0.05	No	No	
Sleep Related Non-Obstructive Hypoventilation, N(%)	< 1%	P > 0.05	No	No	
Never Smoker	36.0	P < 0.0001	Yes	No	
Former Smoker	43.1	P < 0.0001	No	No	-0.1098
Current Smoker	20.9	P < 0.0001	Yes	Yes	-0.6943

Serotonin and Norepinephrine Reuptake Inhibitors, N(%)	14.9	P < 0.0001	Yes	No
Spleen Removed, N(%)	< 1%	P > 0.05	No	No
Selective Serotonin Reuptake Inhibitors, N(%)	21.5	P < 0.0001	No	No
Statin, N(%)	52.3	P < 0.0001	Yes	No
Tested positive, N(%)	19.5	P < 0.0001	No	No
Tocilizumab, N(%)	< 1%	P > 0.05	No	No
Tricyclic, N(%)	5.1	P < 0.0001	Yes	No
Urinary Stones, N(%)	10.4	P < 0.0001	Yes	No
Valsartan, N(%)	1.6	P > 0.05	No	No
Vasopressin, N(%)	< 1%	P > 0.05	No	No
Vasopressor, N(%)	2.2	P < 0.0001	Yes	No
Vecuronium, N(%)	< 1%	P > 0.05	No	No
Venous Thromboembolism, N(%)	2.7	P = 0.046	Yes	No

Table S3. Prevalence of patient characteristics by testing status

Variables	Tested Negative n= 946,056 (80.4%)	Tested Positive n= 230,250 (19.6%)
Sex (Male)	816322. (86.3)	201077. (87.3)
Race		
White	620336. (65.6)	150134. (65.2)
Black	205536. (21.7)	49658. (21.6)
Others	120184. (12.7)	30458. (13.2)
Ethnicity		
Not Hispanic Or Latino	806525. (85.3)	192428. (83.6)
Hispanic Or Latino	74221. (7.8)	22124. (9.6)
Unknown	65310. (6.9)	15698. (6.8)
Age [Mean, SD]		
Age 18–30	41230. (4.4)	11148. (4.8)
Age 30–40	102685. (10.9)	27340. (11.9)
Age 40–50	101603. (10.7)	28539. (12.4)
Age 50–65	277380. (29.3)	63293. (27.5)
Age 65–75	291438. (30.8)	63142. (27.4)
Age 75–85	97509. (10.3)	25179. (10.9)
Age > 85	34210. (3.6)	11609. (5.0)
BMI [Mean, SD]		
BMI < 18.5	15266. (1.6)	2253. (1.0)
18.5 ≤ BMI <30	517919. (54.7)	110634. (48.0)
BMI ≥ 30	412871. (43.6)	117363. (51.0)
Pre-existing Conditions		
Acute Cardiac Injury, N(%)	21745. (2.3)	5003. (2.2)
Acute Liver Injury, N(%)	1950. (0.2)	343. (0.1)
Acute Myocardial Infarction, N(%)	21699. (2.3)	4993. (2.2)
Acute Respiratory Failure, N(%)	45619. (4.8)	11443. (5.0)
Acute Rheumatic Heart Disease, N(%)	53. (0.0)	9. (0.0)
Acute Kidney Failure, N(%)	67036. (7.1)	16318. (7.1)
Alcohol Dependence, N(%)	214249. (22.6)	45535. (19.8)
Anxiety, N(%)	210951. (22.3)	47013. (20.4)
Acute Respiratory Distress Syndrome, N(%)	552. (0.1)	248. (0.1)
Asthma, N(%)	63349. (6.7)	15274. (6.6)
Bipolar Disorder, N(%)	45105. (4.8)	7957. (3.5)
Breastfeeding, N(%)	670. (0.1)	209. (0.1)
Breastfeed At Index	14. (0.0)	4. (0.0)
Bronchitis, N(%)	68086. (7.2)	15691. (6.8)
Coronary Atherosclerosis and other Heart Disease, N(%)	187437. (19.8)	43765. (19.0)
Cancer, N(%)	207470. (21.9)	39182. (17.0)
Cardiomyopathy, N(%)	34151. (3.6)	6968. (3.0)

Cerebrovascular Disease, N(%)	19361. (2.0)	4532. (2.0)
Congestive Heart Failure, N(%)	74701. (7.9)	16781. (7.3)
Chronic hepatitis, N(%)	3201. (0.3)	534. (0.2)
Chronic Lung Disease, N(%)	309740. (32.7)	66367. (28.8)
Chronic Neurological Disease, N(%)	32078. (3.4)	8296. (3.6)
Chronic Rheumatic Heart Disease, N(%)	9166. (1.0)	1912. (0.8)
Cirrhosis, N(%)	26015. (2.7)	4290. (1.9)
Chronic Kidney Disease, N(%)	122425. (12.9)	30822. (13.4)
Chronic Kidney Failure, N(%)	14384. (1.5)	3611. (1.6)
Complex Sleep Apnea, N(%)	162. (0.0)	29. (0.0)
Chronic Obstructive Pulmonary Disease, N(%)	173612. (18.4)	34497. (15.0)
Central sleep Apnea Primary, N(%)	3440. (0.4)	760. (0.3)
Central serous retinopathy, N(%)	2141. (0.2)	416. (0.2)
Cardiovascular Disease, N(%)	319657. (33.8)	71859. (31.2)
Dementia, N(%)	36320. (3.8)	12739. (5.5)
Diabetes Any, N(%)	288130. (30.5)	76563. (33.3)
Diabetes Other, N(%)	29557. (3.1)	6918. (3.0)
Diabetes Type 1, N(%)	16385. (1.7)	4000. (1.7)
Diabetes Type 2, N(%)	285834. (30.2)	76017. (33.0)
Diabetes With Complications, N(%)	203835. (21.5)	53451. (23.2)
Diabetes Without Complications, N(%)	259149. (27.4)	68705. (29.8)
Drug Dependence, N(%)	62290. (6.6)	9129. (4.0)
Emphysema, N(%)	20877. (2.2)	3698. (1.6)
Guillain-Barre Syndrome, N(%)	553. (0.1)	115. (0.0)
Heart Disease, N(%)	234426. (24.8)	54563. (23.7)
Heart Failure, N(%)	92456. (9.8)	21187. (9.2)
Hemorrhagic Stroke, N(%)	2395. (0.3)	610. (0.3)
Human Immunodeficiency Virus, N(%)	8895. (0.9)	1789. (0.8)
Hypertension, N(%)	562605. (59.5)	136155. (59.1)
Hyperlipidemia, N(%)	524911. (55.5)	130877. (56.8)
Inflammatory bowel Disease, N(%)	32661. (3.5)	6698. (2.9)
Influenza, N(%)	17326. (1.8)	4564. (2.0)
Ischemic Stroke, N(%)	44261. (4.7)	10599. (4.6)
Kidney Disease All, N(%)	207173. (21.9)	49216. (21.4)
Liver Disease, N(%)	69995. (7.4)	14427. (6.3)
Lower Respiratory Infection, N(%)	73546. (7.8)	19666. (8.5)
Major Depressive Disorder, N(%)	333472. (35.2)	73817. (32.1)
Measles, N(%)	19. (0.0)	7. (0.0)
Multiple Sclerosis, N(%)	4108. (0.4)	901. (0.4)
Nephrosis, N(%)	26402. (2.8)	6359. (2.8)
Obesity Hypoventilation, N(%)	4005. (0.4)	1082. (0.5)
Obstructive Sleep Apnea, N(%)	276999. (29.3)	70007. (30.4)

Other and Ill-Defined Heart Disease, N(%)	28123. (3.0)	6277. (2.7)
Overweight, N(%)	58473. (6.2)	18480. (8.0)
Peripheral Artery Disease, N(%)	115486. (12.2)	23607. (10.3)
Parkinsons Disease, N(%)	11431. (1.2)	3182. (1.4)
Polycystic Ovary Syndrome, N(%)	1488. (0.2)	364. (0.2)
Pneumonia, N(%)	49597. (5.2)	13977. (6.1)
Ventilator-Associated Pneumonia, N(%)	234. (0.0)	53. (0.0)
Pregnancy, N(%)	3403. (0.4)	1020. (0.4)
Pregnancy at Index, N(%)	895. (0.1)	299. (0.1)
Posttraumatic Stress Disorder, N(%)	241243. (25.5)	54029. (23.5)
Pulmonary Heart Disease, N(%)	20401. (2.2)	4294. (1.9)
Schizophrenia, N(%)	26709. (2.8)	5153. (2.2)
Septic Shock, N(%)	23110. (2.4)	6304. (2.7)
Sickle Cell Disease, N(%)	1562. (0.2)	354. (0.2)
Sleep Related Non-Obstructive Hypoventilation, N(%)	3895. (0.4)	868. (0.4)
Spleen Removed, N(%)	1451. (0.2)	273. (0.1)
Urinary Stones, N(%)	94118. (9.9)	20188. (8.8)
Venous Thromboembolism, N(%)	23786. (2.5)	5649. (2.5)
Pre-infection Medications		
Acetyl Cholinesterase (ACE) Inhibitor, N(%)	258742. (27.3)	60410. (26.2)
Acetaminophen, N(%)	366495. (38.7)	77203. (33.5)
Androgen deprivation therapy, N(%)	10769. (1.1)	1987. (0.9)
Albumin, N(%)	6353. (0.7)	1270. (0.6)
Allopurinol, N(%)	54674. (5.8)	14472. (6.3)
Alphablocker, N(%)	262869. (27.8)	58258. (25.3)
Antianginal, N(%)	76874. (8.1)	16990. (7.4)
Antiarrhythmic, N(%)	22298. (2.4)	4672. (2.0)
Antibiotic, N(%)	399342. (42.2)	84288. (36.6)
Anticoagulant Inpatient, N(%)	139376. (14.7)	28287. (12.3)
Anticoagulant Outpatient, N(%)	147393. (15.6)	33077. (14.4)
Antihistamine, N(%)	387554. (41.0)	86167. (37.4)
Antipsychotic, N(%)	93437. (9.9)	17992. (7.8)
Antiviral, N(%)	78971. (8.3)	18154. (7.9)
Angiotensin II Receptor Blocker, N(%)	119267. (12.6)	30096. (13.1)
Aromatase Inhibitors, N(%)	1401. (0.1)	253. (0.1)
Azithromycin, N(%)	96217. (10.2)	22343. (9.7)
Bacillus Calmette-Guerin, N(%)	1864. (0.2)	214. (0.1)
Benzodiazepine, N(%)	120923. (12.8)	22619. (9.8)
Beta Agonist Nebulizer, N(%)	93498. (9.9)	19198. (8.3)
Beta Blocker, N(%)	305095. (32.2)	68591. (29.8)
Bronchodilator, N(%)	237864. (25.1)	50376. (21.9)
Calcium Channel Blocker, N(%)	238232. (25.2)	54619. (23.7)

Chloroquine, N(%)	15. (0.0)	5. (0.0)
Cis-atracurium, N(%)	220. (0.0)	31. (0.0)
Colchicine, N(%)	23016. (2.4)	5520. (2.4)
Corticosteroid, N(%)	351344. (37.1)	77266. (33.6)
Degarelix, N(%)yrs	180. (0.0)	29. (0.0)
Dexamethasone, N(%)	36265. (3.8)	7194. (3.1)
Dobutamine, N(%)	1096. (0.1)	210. (0.1)
Eculizumab, N(%)	15. (0.0)	3. (0.0)
Epinephrine, N(%)	25280. (2.7)	5415. (2.4)
Estrogen, N(%)	19990. (2.1)	4406. (1.9)
Famotidine, N(%)	80219. (8.5)	17206. (7.5)
Furosemide, N(%)	108865. (11.5)	24734. (10.7)
Glucocorticoid, N(%)	216312. (22.9)	46602. (20.2)
Histamine 2 Receptor Blocker, N(%)	83648. (8.8)	16959. (7.4)
Hydrochlorothiazide, N(%)	143246. (15.1)	34283. (14.9)
Hydroxychloroquine, N(%)	7416. (0.8)	1510. (0.7)
Inhaled Corticosteroids, N(%)	19658. (2.1)	4182. (1.8)
Inhaled Corticosteroids and Long-Acting Beta-Agonist, N(%)	104819. (11.1)	22246. (9.7)
Induction Ventilation Medications, N(%)	19185. (2.0)	3432. (1.5)
Inhaled Budesonide, N(%)	3306. (0.3)	714. (0.3)
Inhaled Epo-prostenol, N(%)	94. (0.0)	26. (0.0)
Isoproterenol, N(%)	112. (0.0)	20. (0.0)
Long-Acting Beta-Agonist, N(%)	3562. (0.4)	686. (0.3)
Lopinavir, N(%)	69. (0.0)	10. (0.0)
Losartan, N(%)	107423. (11.4)	27223. (11.8)
Metformin, N(%)	171484. (18.1)	45995. (20.0)
Milrinone, N(%)	556. (0.1)	115. (0.0)
Norepinephrine, N(%)	4509. (0.5)	982. (0.4)
Non-steroidal Anti-Inflammatory Drug, N(%)	565074. (59.7)	128784. (55.9)
Opioid, N(%)	56275. (5.9)	9747. (4.2)
Platelet Aggregation Inhibitor, N(%)	64141. (6.8)	14702. (6.4)
Phenylephrine, N(%)	17529. (1.9)	3220. (1.4)
Proton Pump Inhibitor, N(%)	348099. (36.8)	76583. (33.3)
Remdesivir, N(%)	8. (0.0)	40. (0.0)
Ribavirin, N(%)	136. (0.0)	13. (0.0)
Rosiglitazone, N(%)	0. (0.0)	0. (0.0)
Sarilumab, N(%)	11. (0.0)	1. (0.0)
Selective Estrogen Receptor Degradar, N(%)	46. (0.0)	4. (0.0)
Selective Estrogen Receptor Modulators, N(%)	804. (0.1)	157. (0.1)
Serotonin and Norepinephrine Reuptake Inhibitors, N(%)	134438. (14.2)	28062. (12.2)
Selective Serotonin Reuptake Inhibitors, N(%)	192925. (20.4)	43320. (18.8)

Statin, N(%)	461512. (48.8)	108101. (46.9)
Tocilizumab, N(%)	342. (0.0)	84. (0.0)
Tricyclic, N(%)	45863. (4.8)	9404. (4.1)
Valsartan, N(%)	14252. (1.5)	3443. (1.5)
Vasopressin, N(%)	1582. (0.2)	328. (0.1)
Vasopressor, N(%)	20231. (2.1)	4269. (1.9)
Vecuronium, N(%)	60. (0.0)	7. (0.0)
Never Smokers	334659. (35.4)	97419. (42.3)
Former Smokers	402724. (42.6)	103482. (44.9)
Current Smokers	208673. (22.1)	29349. (12.7)

Table S4: Pre-existing respiratory diseases

Variables	Never Smoker n = 423972	Former Smoker n = 505465	p-Value	Current Smoker n = 245127	p-Value	Unknown Smoker n = 130427	p-Value
Chronic Lung Disease, N(%)	110297 (26.0)	187984 (37.2)	p<0.0001	101492 (41.4)	p<0.0001	12233 (9.4)	p<0.0001
Obstructive Sleep Apnea, N(%)	143519 (33.9)	169011 (33.4)	p<0.0001	61377 (25)	p<0.0001	11160 (8.6)	p<0.0001
Chronic Obstructive Pulmonary Disease, N(%)	39445 (9.3)	111223 (22)	p<0.0001	69962 (28.5)	p<0.0001	6569 (5)	p<0.0001
Asthma, N(%)	36058 (8.5)	35361 (7)	p<0.0001	12304 (5)	p<0.0001	2855 (2.2)	p<0.0001
Lower Respiratory Infection, N(%)	35529 (8.4)	41361 (8.2)	p<0.0001	19316 (7.9)	p<0.0001	4587 (3.5)	p<0.0001
Bronchitis, N(%)	27671 (6.5)	39182 (7.8)	p<0.0001	20514 (8.4)	p<0.0001	2936 (2.3)	p<0.0001
Pneumonia, N(%)	18381 (4.3)	35078 (6.9)	p<0.0001	15428 (6.3)	p<0.0001	3522 (2.7)	p<0.0001
Influenza, N(%)	7785 (1.8)	9463 (1.9)	p<0.0001	4980 (2)	p<0.0001	1263 (1)	p<0.0001
Pulmonary Heart Disease, N(%)	7235 (1.7)	13973 (2.8)	p<0.0001	4325 (1.8)	p = 0.003	1012 (0.8)	p<0.0001
Acute Respiratory Failure, N(%)	7207 (1.7)	16829 (3.3)	p<0.0001	8193 (3.3)	p<0.0001	1721 (1.3)	p<0.0001
Emphysema, N(%)	3374 (0.8)	13553 (2.7)	p<0.0001	8966 (3.7)	p<0.0001	647 (0.5)	p<0.0001
Acute Respiratory Distress Syndrome, N(%)	201 (0)	378 (0.1)		175 (0.1)		35 (0)	
Complex Sleep Apnea, N(%)	82 (0)	90 (0)		33 (0)		7 (0)	
Ventilator-Associated Pneumonia, N(%)	61 (0)	136 (0)		64 (0)		30 (0)	

Table S5. Association between smoking status and COVID-19 positivity stratify by age for imputed and unimputed data

Variables	Odds Ratio (95% Confidence intervals)	
	Unadjusted	Adjusted
Imputed Unknown Smoker to Never, Former, and Current Smoker		
Model 1 [†]		
Former Smoker vs. Never Smoker	0.88 (0.87, 0.89)	0.89 (0.88, 0.90)
Current Smoker vs. Never Smoker	0.48 (0.47, 0.49)	0.51 (0.50, 0.52)
Model 2 [‡]		
<i>Age ≥ 65</i>		
Former Smoker vs. Never Smoker	0.99 (0.97, 1.00)	0.98 (0.97, 1.00)
Current Smoker vs. Never Smoker	0.50 (0.49, 0.51)	0.52 (0.51, 0.53)
<i>Age < 65</i>		
Former Smoker vs. Never Smoker	0.83 (0.81, 0.84)	0.83 (0.81, 0.84)
Current Smoker vs. Never Smoker	0.47 (0.46, 0.48)	0.48 (0.47, 0.49)
Unimputed Unknown Smoker		
Model 1 [†]		
Former Smoker vs. Never Smoker	0.89 (0.88, 0.90)	0.90 (0.89, 0.91)
Current Smoker vs. Never Smoker	0.47 (0.46, 0.48)	0.50 (0.49, 0.51)
Unknown Smoker vs. Never Smoker	0.89 (0.88, 0.90)	0.93 (0.91, 0.94)
Model 2 [‡]		
<i>Age ≥ 65</i>		
Former Smoker vs. Never Smoker	1.01 (0.99, 1.02)	1.00 (0.99, 1.01)
Current Smoker vs. Never Smoker	0.50 (0.49, 0.51)	0.51 (0.50, 0.53)
Unknown Smoker vs. Never Smoker	1.27 (1.24, 1.31)	1.22 (1.18, 1.25)
<i>Age < 65</i>		
Former Smoker vs. Never Smoker	0.83 (0.82, 0.84)	0.83 (0.82, 0.84)
Current Smoker vs. Never Smoker	0.45 (0.44, 0.46)	0.48 (0.47, 0.49)
Unknown Smoker vs. Never Smoker	0.75 (0.74, 0.76)	0.82 (0.80, 0.83)

[†] Model 1 adjusted by Age ≥ 85, BMI < 18.5, BMI ≥ 30, Sex, Former Smoker, Current Smoker, Cancer, Dementia, Hispanic or Latino, Low Respiratory Infections, Pneumonia, Phenylephrine, and Septic Shock.

[‡] Model 2 stratified by age and adjusted by BMI < 18.5, BMI ≥ 30, Sex, Former Smoker, Current Smoker, Cancer, Dementia, Hispanic or Latino, Low Respiratory Infections, Pneumonia, Phenylephrine, and Septic Shock.

Bold indicate reduced risk of SARS-CoV-2 infection.