

Supplemental Material**Table S1.** Description of coding systems and codes

Coding System	Code	Description
<i>COVID-19 diagnoses and lab tests</i>		
ICD-10	U07.1, U07.2	COVID-19 (WHO)
ICD-10	B97.29	Other coronavirus as the cause of diseases classified elsewhere
ICD-10	B34.2	Coronavirus infection, unspecified
ICD-10	J12.81	Pneumonia due to SARS-associated coronavirus
LOINC	94505-5,94506-3,94558-4, 94562-6, 94762-2,94769-7,95209-3	SARS-CoV-2 (COVID19) [presence] in serum or plasma by immunoassay
<i>COVID-19 vaccination</i>		
CPT-4	91300,0001A,0002A,0003A,0004A, 91305,0051A,0052A,0053A,0054A 91307,0071A,0072A,0073A,0074A 91308,0081A,0082A,0083A,0084A	Pfizer-BioNTech
CPT-4	91301,0011A,0012A,0013A,91306, 0064A,91311,0111A,0112A,0113A, 91309,0091A,0092A,0093A,0094A	Moderna
CPT-4	91302,0021A,0022A	AstraZeneca
CPT-4	91303,0031A,0034A	Janssen
CPT-4	91304,0041A,0042A	Novavax
CPT-4	91310,0104A	Sanofi Pasteur
<i>Baseline characteristics</i>		
ICD-10	I10	Essential hypertension
ICD-10	E10-E11	Diabetes (type I and II)
ICD-10	E66	Overweight, obesity
ICD-10	N18	Chronic kidney diseases
ICD-10	I50	Heart failure
ICD-10	I63	Stroke
ICD-10	I20-I25	Ischemic heart disease
ICD-10	J45	Asthma
ICD-10	J44	Chronic obstructive pulmonary disease
ICD-10	F33	Depression
ICD-10	F41	Anxiety
ICD-10	F31	Bipolar disorder
ICD-10	F17	Tobacco/nicotine dependence

Substance use disorder

ICD-10	F10.1, F10.2	Alcohol use disorder
ICD-10	F11.1, F11.2	Opioid use disorder
ICD-10	F12.1, F12.2	Cannabis use disorder
ICD-10	F14.1, F14.2	Cocaine use disorder
ICD-10	F15.1, F15.2	Stimulant use disorder
ICD-10	F13.1, F13.2, F16.1, F16.2, F18.1, F18.2, F19.1, F19.2	Other substance use disorder

Table S2. Characteristics of the study population by COVID-19 reinfection outcome

Characteristics	Individuals with COVID-19 Reinfection, n (%)									
	Reinfection, n (%)		Emergency Department (30-day)		Hospitalization (30-day)		Intensive Care (30-day)		Death (30-day)	
	Yes (N=872,446)	No (N=1,809,987)	Yes (N=163,012)	No (N=709,434)	Yes (N=45,362)	No (N=827,084)	Yes (N=12,782)	No (N=859,664)	Yes (N=5,858)	No (N=866,588)
Age at index, mean±SD [†]	43.8±16.5	45.3±17.1	45.4±18.2	43.4±16	53.7±19.1	43.2±16.1	56.2±17.6	43.6±16.4	67.5±15.5	43.6±16.4
Age										
18-39	404,011 (46.3)	764,126 (42.2)	72,806 (44.7)	331,205 (46.7)	12,693(28)	391,318 (47.3)	2,584 (20.2)	401,427 (46.7)	381 (6.5)	403,630 (46.6)
40-64	353,590 (40.5)	762,587 (42.1)	61,007 (37.4)	292,583 (41.2)	17,504 (38.6)	336,086 (40.6)	5,573 (43.6)	348,017 (40.5)	1,753 (29.9)	351,837 (40.6)
65+	114,845 (13.2)	283,274 (15.7)	29,199 (17.9)	85,646 (12.1)	15,165 (33.4)	99,680 (12.1)	4,625 (36.2)	110,220 (12.8)	3,724 (63.6)	111,121 (12.8)
Female	517,916 (59.4)	966,370 (53.4)	100,293 (61.5)	417,623 (58.9)	24,690 (54.4)	493,226 (59.6)	5,997 (46.9)	511,919 (59.5)	2,699 (46.1)	515,217 (59.5)
Hispanic	53,381 (6.1)	126,502 (7)	16,168 (9.9)	37,213 (5.2)	5,009 (11)	48,372 (5.8)	1,255 (9.8)	52,126 (6.1)	373 (6.4)	53,008 (6.1)
Race										
White	410,391 (47)	809,554 (44.7)	97,110 (59.6)	313,281 (44.2)	29,984 (66.1)	380,407 (46)	8,151 (63.8)	402,240 (46.8)	3,915 (66.8)	406,476 (46.9)
Black	115,406 (13.2)	240,255 (13.3)	43,787 (26.9)	71,619 (10.1)	10,389 (22.9)	105,017 (12.7)	3,091 (24.2)	112,315 (13.1)	1,227 (20.9)	114,179 (13.2)
Other	346,649 (39.7)	760,178 (42)	22,115 (13.6)	324,534 (45.7)	4,989 (11)	341,660 (41.3)	1,540 (12)	345,109 (40.1)	716 (12.2)	345,933 (39.9)
Hypertension	152,909 (17.5)	255,440 (14.1)	51,182 (31.4)	101,727 (14.3)	20,779 (45.8)	132,130 (16)	6,699 (52.4)	146,210 (17)	3,348 (57.2)	149,561 (17.3)
Diabetes	74,105 (8.5)	128,342 (7.1)	27,554 (16.9)	46,551 (6.6)	12,533 (27.6)	61,572 (7.4)	4,377 (34.2)	69,728 (8.1)	2,195 (37.5)	71,910 (8.3)
Obesity/overweight	112,102 (12.8)	166,507 (9.2)	35,402 (21.7)	76,700 (10.8)	11,726 (25.8)	100,376 (12.1)	3,421 (26.8)	108,681 (12.6)	1,469 (25.1)	110,633 (12.8)
Chronic kidney disease	32,936 (3.8)	44,435 (2.5)	12,979 (8)	19,957 (2.8)	7,625 (16.8)	25,311 (3.1)	2,736 (21.4)	30,200 (3.5)	1,778 (30.4)	31,158 (3.6)
Heart Failure	23,458 (2.7)	30,654 (1.7)	10,966 (6.7)	12,492 (1.8)	6,745 (14.9)	16,713 (2)	2,636 (20.6)	20,822 (2.4)	1,639 (28)	21,819 (2.5)
Stroke	14,214 (1.6)	19,947 (1.1)	5,562 (3.4)	8,652 (1.2)	2,766 (6.1)	11,448 (1.4)	958 (7.5)	13,256 (1.5)	598 (10.2)	13,616 (1.6)
Ischemic Heart Disease	43,909 (5)	65,166 (3.6)	17,935 (11)	25,974 (3.7)	9,384 (20.7)	34,525 (4.2)	3,319 (26)	40,590 (4.7)	1,971 (33.6)	41,938 (4.8)
Asthma	69,883 (8)	90,818 (5)	24,551 (15.1)	45,332 (6.4)	6,512 (14.4)	63,371 (7.7)	1,895 (14.8)	67,988 (7.9)	636 (10.9)	69,247 (8)
COPD	22,857 (2.6)	31,103 (1.7)	10,541 (6.5)	12,316 (1.7)	5,484 (12.1)	17,373 (2.1)	2,061 (16.1)	20,796 (2.4)	1,148 (19.6)	21,709 (2.5)
Depression	95,776 (11)	117,360 (6.5)	33,688 (20.7)	62,088 (8.8)	11,025 (24.3)	84,751 (10.2)	3,133 (24.5)	92,643 (10.8)	1,300 (22.2)	94,476 (10.9)
Bipolar	13,976 (1.6)	15,537 (0.9)	7,096 (4.4)	6,880 (1)	2,457 (5.4)	11,519 (1.4)	672 (5.3)	13,304 (1.5)	217 (3.7)	13,759 (1.6)
Anxiety	121,345 (13.9)	154,624 (8.5)	37,970 (23.3)	83,375 (11.8)	11,359 (25)	109,986 (13.3)	3,146 (24.6)	118,199 (13.7)	1,179 (20.1)	120,166 (13.9)
Vaccine dose										
None	818,515 (93.8)	1,719,387 (95)	151,116 (92.7)	667,399 (94.1)	41,355 (91.2)	777,160 (94)	11,784 (92.2)	806,731 (93.8)	5,582 (95.3)	812,933 (93.8)
One	12,079 (1.4)	22,997 (1.3)	2,805 (1.7)	9,274 (1.3)	922 (2)	11,157 (1.3)	240 (1.9)	11,839 (1.4)	63 (1.1)	12,016 (1.4)

Two or more	41,852 (4.8)	67,603 (3.7)	9,091 (5.6)	32,761 (4.6)	3,085 (6.8)	38,767 (4.7)	758 (5.9)	41,094 (4.8)	213 (3.6)	41,639 (4.8)
Smoking	59,674 (6.8)	89,652 (5)	26,629 (16.3)	33,045 (4.7)	8,580 (18.9)	51,094 (6.2)	2,842 (22.2)	56,832 (6.6)	898 (15.3)	58,776 (6.8)
Substance use disorder										
Alcohol	15,801 (1.8)	18,422 (1)	7,986 (4.9)	7,815 (1.1)	3,373 (7.4)	12,428 (1.5)	1,200 (9.4)	14,601 (1.7)	392 (6.7)	15,409 (1.8)
Opioid	7,642 (0.9)	7,462 (0.4)	4,461 (2.7)	3,181 (0.4)	1,844 (4.1)	5,798 (0.7)	587 (4.6)	7,055 (0.8)	186 (3.2)	7,456 (0.9)
Cocaine	4,117 (0.5)	3,367 (0.2)	2,738 (1.7)	1,379 (0.2)	1,161 (2.6)	2,956 (0.4)	414 (3.2)	3,703 (0.4)	96 (1.6)	4,021 (0.5)
Stimulant	3,922 (0.4)	3,921 (0.2)	2,593 (1.6)	1,329 (0.2)	1,094 (2.4)	2,828 (0.3)	351 (2.7)	3,571 (0.4)	84 (1.4)	3,838 (0.4)
Cannabis	6,464 (0.7)	6,683 (0.4)	3,879 (2.4)	2,585 (0.4)	1,477 (3.3)	4,987 (0.6)	461 (3.6)	6,003 (0.7)	107 (1.8)	6,357 (0.7)
Other	13,533 (1.6)	13,848 (0.8)	7,256 (4.5)	6,277 (0.9)	2,651 (5.8)	10,882 (1.3)	897 (7)	12,636 (1.5)	276 (4.7)	13,257 (1.5)

[†]SD: standard deviation

All the differences were statistically significant at the 0.05 level

Table S3. Risk of COVID-19 reinfection and outcomes

Factors	Reinfection, aOR (95% CI)	Individuals with COVID-19 Reinfection: Outcomes within 30 days of reinfection			
		Emergency Department, aOR (95% CI)	Hospitalization, aOR (95% CI)	Intensive Care, aOR (95% CI)	Death, aOR (95% CI)
Intercept					
Female	1.11** (1.08,1.15)	0.96 (0.91,1.01)	0.85** (0.8,0.91)	0.80** (0.72,0.89)	0.99 (0.83,1.19)
Age (ref: 18-39 yrs)					
40-64 yrs	0.97 (0.94,1.01)	0.91** (0.86,0.97)	1.20** (1.12,1.30)	1.36** (1.20,1.54)	2.42** (1.87,3.13)
65+ yrs	0.88** (0.83,0.94)	0.89* (0.82,0.98)	1.43** (1.27,1.60)	1.38** (1.16,1.66)	4.49** (3.31,6.09)
Hispanic	1.46** (1.38,1.56)	1.07 (0.98,1.17)	1.21** (1.08,1.36)	0.99 (0.83,1.21)	0.65* (0.45,0.95)
Race (ref: White)					
Black	1.09** (1.05,1.14)	1.52** (1.43,1.61)	1.11** (1.03,1.20)	1.08 (0.95,1.22)	0.86 (0.69,1.06)
Other	0.71** (0.67,0.74)	1.42** (1.31,1.54)	0.93 (0.84,1.04)	1.37** (1.17,1.61)	1.46** (1.12,1.89)
Hypertension	1.10** (1.06,1.15)	1.14** (1.07,1.20)	1.34** (1.24,1.45)	1.44** (1.27,1.62)	0.97 (0.78,1.20)
Diabetes	1.07** (1.02,1.12)	1.17** (1.09,1.24)	1.30** (1.20,1.41)	1.64** (1.46,1.85)	1.30** (1.07,1.58)
Obesity/overweight	1.10** (1.05,1.14)	0.94* (0.89,0.99)	0.87** (0.81,0.94)	0.76** (0.68,0.86)	0.85 (0.70,1.03)
Chronic kidney disease	1.11** (1.05,1.17)	0.93 (0.86,1.01)	1.29** (1.17,1.42)	1.34** (1.17,1.54)	2.11** (1.72,2.58)
Heart failure	1.18 (1.10,1.26)	1.25** (1.14,1.38)	1.39** (1.25,1.54)	1.53** (1.32,1.77)	1.84** (1.48,2.29)
Stroke	0.99 (0.93,1.06)	0.86** (0.78,0.94)	0.98 (0.87,1.10)	1.01 (0.85,1.19)	1.43** (1.13,1.81)
Ischemic heart disease	1.02 (0.96,1.07)	1.27** (1.18,1.38)	1.20** (1.10,1.31)	1.18* (1.03,1.35)	1.28* (1.04,1.58)
Asthma	1.28** (1.23,1.34)	1.20** (1.13,1.27)	0.98 (0.90,1.06)	0.99 (0.88,1.12)	0.86 (0.69,1.07)
COPD	1.20** (1.13,1.27)	1.16** (1.06,1.26)	1.45** (1.32,1.59)	1.63** (1.43,1.87)	1.58** (1.29,1.94)
Depression	1.20 (1.16,1.24)	1.00 (0.95,1.05)	1.04 (0.97,1.12)	0.93 (0.83,1.03)	0.93 (0.78,1.12)
Anxiety	1.11** (1.07,1.15)	0.95 (0.90,1.00)	1.06 (0.99,1.13)	1.10 (0.98,1.23)	0.88 (0.73,1.06)
Bipolar	1.13** (1.07,1.18)	1.46** (1.36,1.56)	1.25** (1.15,1.36)	0.93 (0.80,1.07)	0.95 (0.73,1.23)
Smoking	0.96* (0.93,0.99)	1.42 (1.35,1.49)	1.29** (1.21,1.38)	1.29** (1.16,1.44)	1.15 (0.96,1.37)
Vaccine dose (ref: none)					
1	0.89* (0.79,0.99)	0.94 (0.79,1.11)	0.98 (0.79,1.22)	0.86 (0.60,1.22)	0.87 (0.48,1.56)
2+	1.05 (0.97,1.12)	0.72** (0.64,0.80)	0.71** (0.61,0.83)	0.50** (0.37,0.66)	0.50** (0.31,0.80)

Alcohol use disorder	1.26** (1.21,1.30)	1.41** (1.34,1.49)	1.77** (1.66,1.89)	1.86** (1.67,2.07)	1.76** (1.46,2.12)
Opioid use disorder	1.29** (1.24,1.34)	1.56** (1.47,1.65)	1.69** (1.58,1.82)	1.49** (1.33,1.67)	1.61** (1.33,1.96)
Cocaine use disorder	1.28** (1.21,1.35)	1.37** (1.27,1.48)	1.22** (1.12,1.33)	1.21** (1.06,1.39)	0.90 (0.70,1.16)
Stimulant use disorder	1.13** (1.07,1.19)	1.69** (1.57,1.83)	1.63** (1.49,1.78)	1.50** (1.30,1.72)	1.33* (1.02,1.73)
Cannabis use disorder	1.18** (1.13,1.23)	1.51** (1.42,1.61)	1.49** (1.38,1.61)	1.34** (1.18,1.52)	1.18 (0.94,1.50)
Other use disorder	1.22** (1.18,1.26)	1.26** (1.20,1.33)	1.07 (1.00,1.14)	1.13* (1.02,1.26)	1.11 (0.92,1.33)

* $p < 0.05$; ** $p < 0.01$

aOR: Adjusted odds ratio; 95% CI: 95% confidence intervals