

Supplemental Table 1 . Concept sets for the definition of target and comparator cohorts

Category	Concept ID	Concept name	Domain	Vocabulary	Excluded	Descendants	Mapped
COVID-19 infection	704996	Patient meets COVID-19 laboratory diagnostic criteria	Observation	OMOP Extension	NO	NO	NO
Osteoporosis	80502	Osteoporosis	Condition	SNOMED	NO	YES	NO
Fractures	4115176	Pathological fracture - ankle and/or foot	Condition	SNOMED	NO	NO	NO
	440511	Pathological fracture - forearm	Condition	SNOMED	NO	NO	NO
	4118017	Pathological fracture - hand	Condition	SNOMED	NO	NO	NO
	440812	Pathological fracture - lower leg	Condition	SNOMED	NO	NO	NO
	434140	Pathological fracture - pelvis and/or thigh	Condition	SNOMED	NO	NO	NO
	4117701	Pathological fracture - shoulder	Condition	SNOMED	NO	NO	NO
	436206	Pathological fracture - upper arm	Condition	SNOMED	NO	NO	NO
	45767042	Pathological fracture of humerus due to osteoporosis	Condition	SNOMED	NO	NO	NO
	4115175	Pathological fractures - multiple	Condition	SNOMED	NO	NO	NO
Osteoporosis medications	1557272	alendronate	Drug	RxNorm	NO	YES	NO
	43534826	alendronic acid and alfacalcidol, sequential; oral	Drug	ATC	NO	YES	NO

21604160	alendronic acid and cholecalciferol; oral	Drug	ATC	NO	YES	NO
40254956	alendronic acid, calcium and cholecalciferol, sequential; oral	Drug	ATC	NO	YES	NO
21604152	alendronic acid; oral	Drug	ATC	NO	YES	NO
44506794	bazedoxifene	Drug	RxNorm	NO	YES	NO
21602626	bazedoxifene; oral	Drug	ATC	NO	YES	NO
40222444	denosumab	Drug	RxNorm	NO	YES	NO
21604169	denosumab; parenteral	Drug	ATC	NO	YES	NO
1512480	ibandronate	Drug	RxNorm	NO	YES	NO
21604154	ibandronic acid; systemic	Drug	ATC	NO	YES	NO
1513103	raloxifene	Drug	RxNorm	NO	YES	NO
21602625	raloxifene; oral	Drug	ATC	NO	YES	NO
1516800	risedronate	Drug	RxNorm	NO	YES	NO
21604159	risedronic acid and calcium, sequential; oral	Drug	ATC	NO	YES	NO
45893276	risedronic acid and cholecalciferol; systemic	Drug	ATC	NO	YES	NO
21604161	risedronic acid, calcium and cholecalciferol, sequential; oral	Drug	ATC	NO	YES	NO
21604155	risedronic acid; oral	Drug	ATC	NO	YES	NO
1511251	romosozumab	Drug	RxNorm	NO	YES	NO
1521987	teriparatide	Drug	RxNorm	NO	YES	NO
21602783	teriparatide; parenteral	Drug	ATC	NO	YES	NO
1524674	zoledronic acid	Drug	RxNorm	NO	YES	NO

	1588679	zoledronic acid, calcium and cholecalciferol, sequential; systemic	Drug	ATC	NO	YES	NO
	21604156	zoledronic acid; parenteral	Drug	ATC	NO	YES	NO

Supplemental Table 2. Concept sets for the definition of outcome cohorts

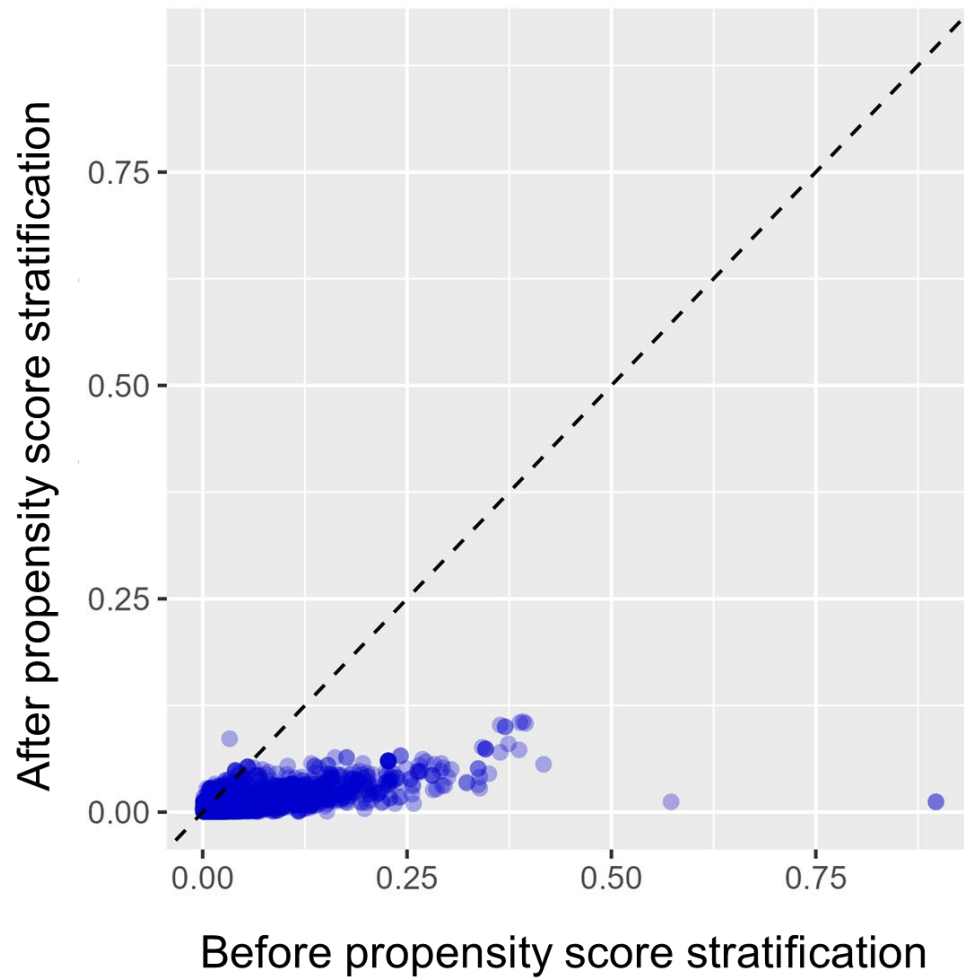
Category	Concept Id	Concept Name	Domain	Vocabulary	Excluded	Descendants	Mapped	
Pneumonia	45770911	Acute pneumonia due to coccidioidomycosis	Condition	SNOMED	YES	YES	NO	
	4001167	Acute ulcerative gastroenteritis complicating pneumonia	Condition	SNOMED	YES	YES	NO	
	4050869	Atypical pneumonia	Condition	SNOMED	NO	YES	NO	
	4049965	Fungal pneumonia	Condition	SNOMED	YES	YES	NO	
	36712839	Idiopathic pneumonia syndrome	Condition	SNOMED	YES	YES	NO	
	252552	Ornithosis with pneumonia	Condition	SNOMED	YES	YES	NO	
	255848	Pneumonia	Condition	SNOMED	NO	YES	NO	
Hospitalization	262	Emergency Room and Inpatient Visit	Visit	Visit	NO	YES	NO	
	9201	Inpatient Visit	Visit	Visit	NO	YES	NO	
ARDS	4191650	Acute respiratory distress	Condition	SNOMED	YES	YES	NO	
	4195694	Acute respiratory distress syndrome	Condition	SNOMED	NO	YES	NO	
	319049	Acute respiratory failure	Condition	SNOMED	NO	YES	NO	
	258866	Respiratory distress syndrome in the newborn	Condition	SNOMED	YES	YES	NO	
MACE	Acute MI	4329847	Myocardial infarction	Condition	SNOMED	NO	YES	NO
		314666	Old myocardial infarction	Condition	SNOMED	YES	YES	NO
	Heart failure	315295	Congestive rheumatic heart failure	Condition	SNOMED	YES	YES	NO
		316139	Heart failure	Condition	SNOMED	NO	YES	NO
	Stroke	372924	Cerebral artery occlusion	Condition	SNOMED	NO	NO	NO
		375557	Cerebral embolism	Condition	SNOMED	NO	NO	NO
		443454	Cerebral infarction	Condition	SNOMED	NO	YES	NO
		441874	Cerebral thrombosis	Condition	SNOMED	NO	NO	NO

Cerebral hemorrhage	376713	Cerebral hemorrhage	Condition	SNOMED	NO	NO	NO	
	439847	Intracranial hemorrhage	Condition	SNOMED	NO	NO	NO	
	43530674	Spontaneous cerebellar hemorrhage	Condition	SNOMED	NO	NO	NO	
	43530727	Spontaneous cerebral hemorrhage	Condition	SNOMED	NO	NO	NO	
	42535425	Spontaneous hemorrhage of cerebral hemisphere	Condition	SNOMED	NO	NO	NO	
	4148906	Spontaneous subarachnoid hemorrhage	Condition	SNOMED	NO	NO	NO	
	432923	Subarachnoid hemorrhage	Condition	SNOMED	NO	NO	NO	
	Sudden cardiac death	4048809	Brainstem death	Condition	SNOMED	NO	YES	NO
		321042	Cardiac arrest	Condition	SNOMED	NO	YES	NO
		442289	Death in less than 24 hours from onset of symptoms	Observation	SNOMED	NO	YES	NO
4317150		Sudden cardiac death	Condition	SNOMED	NO	YES	NO	
4132309		Sudden death	Observation	SNOMED	NO	YES	NO	
437894		Ventricular fibrillation	Condition	SNOMED	YES	YES	NO	
Venous thromboembolism		435616	Amniotic fluid embolism	Condition	SNOMED	YES	YES	NO
	435887	Antepartum deep vein thrombosis	Condition	SNOMED	YES	YES	NO	
	196715	Budd-Chiari syndrome	Condition	SNOMED	YES	YES	NO	
	4062269	Cerebral venous thrombosis in pregnancy	Condition	SNOMED	YES	YES	NO	
	40481089	Embolism from thrombosis of vein of lower extremity	Condition	SNOMED	NO	YES	NO	
	442055	Obstetric air pulmonary embolism	Condition	SNOMED	YES	YES	NO	
	433832	Obstetric blood-clot pulmonary embolism	Condition	SNOMED	YES	YES	NO	
	435026	Obstetric pulmonary embolism	Condition	SNOMED	YES	YES	NO	
	440477	Obstetric pyemic and septic pulmonary embolism	Condition	SNOMED	YES	YES	NO	

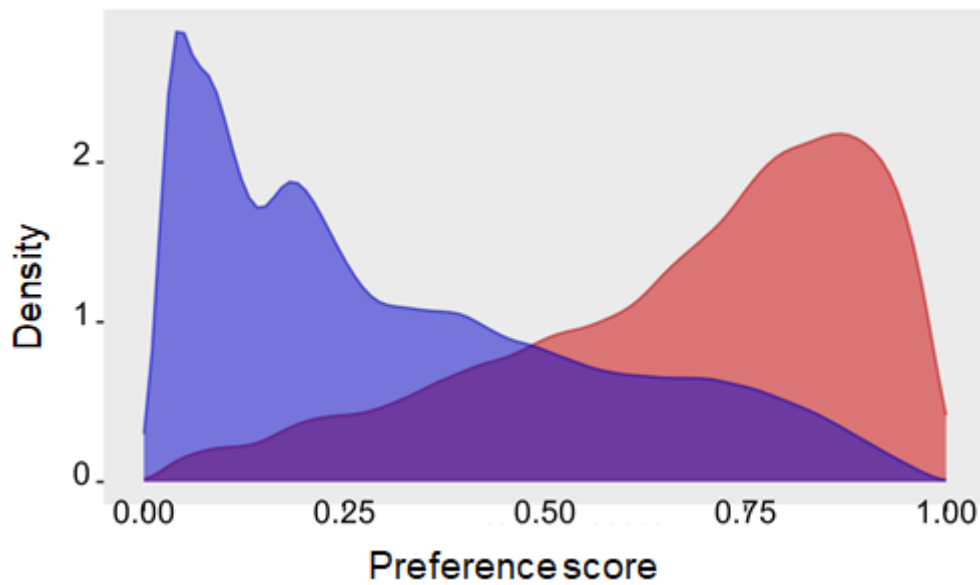
318137	Phlebitis and thrombophlebitis of intracranial sinuses	Condition	SNOMED	YES	YES	NO
199837	Portal vein thrombosis	Condition	SNOMED	YES	YES	NO
438820	Postpartum deep phlebothrombosis	Condition	SNOMED	YES	YES	NO
440417	Pulmonary embolism	Condition	SNOMED	NO	YES	NO
254662	Pulmonary infarction	Condition	SNOMED	NO	YES	NO
36713113	Saddle embolus of pulmonary artery	Condition	SNOMED	NO	YES	NO
35615055	Saddle embolus of pulmonary artery with acute cor pulmonale	Condition	SNOMED	NO	YES	NO
4235812	Septic thrombophlebitis	Condition	SNOMED	YES	YES	NO
195294	Thrombosed hemorrhoids	Condition	SNOMED	YES	YES	NO
4187790	Thrombosis of retinal vein	Condition	SNOMED	YES	YES	NO
318775	Venous embolism	Condition	SNOMED	NO	YES	NO
444247	Venous thrombosis	Condition	SNOMED	NO	YES	NO

ARDS, acute respiratory distress syndrome, MACE, major cardiovascular adverse event, MI, myocardial infarction

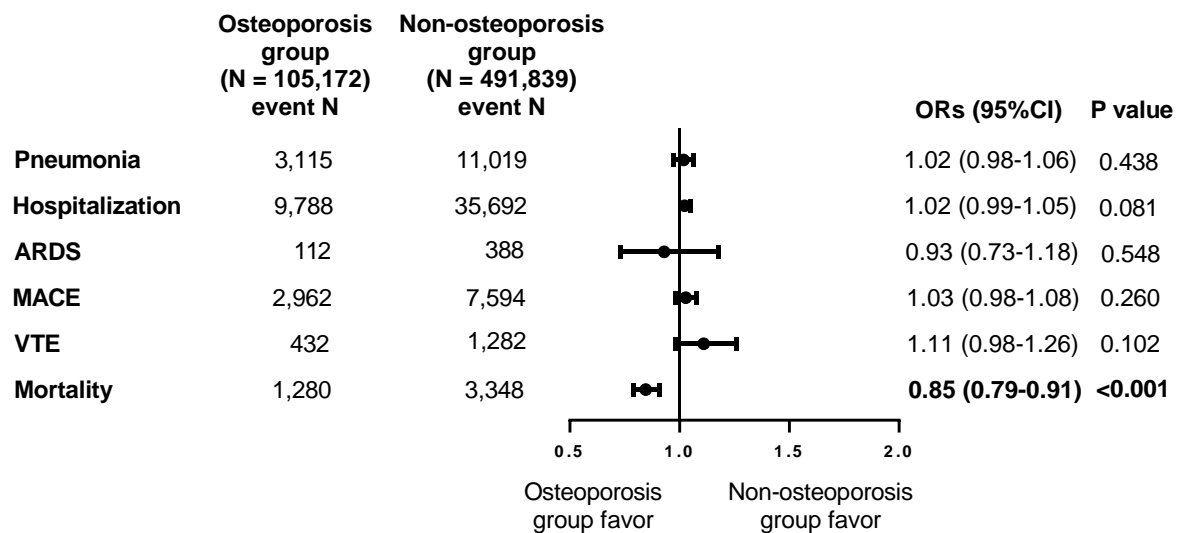
Supplemental Figure 1. Covariate balance before and after large-scale PS stratification. Each dot represents standardized difference of means for a single variate before and after PS stratification. PS, propensity score.



Supplemental Figure 2. Preference score distributions for osteoporosis and non-osteoporosis groups. Preference score is a transformation of the propensity score that adjusts for differences in the sizes of the two treatment groups. A higher overlap indicates subjects in the two groups were more similar in terms of their predicted probability of receiving one treatment over the other. Red: osteoporosis group, Blue: non-osteoporosis group.

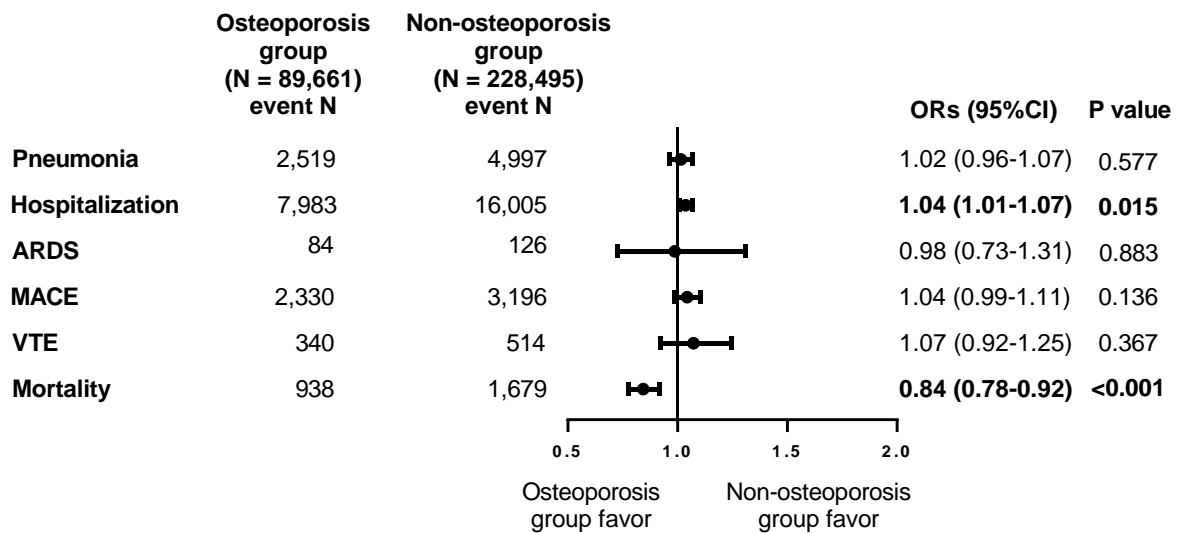


Supplemental Figure 3. Odds ratios for clinical outcomes within 90 days after COVID-19 infection in patients with a previous history of osteoporosis after large-scale PS stratification. ARDS, acute respiratory distress syndrome, MACE, major adverse cardiovascular events, VTE, venous thromboembolism, ORs, odds ratios, CI, confidence interval. Logistic regression analysis was performed after large-scale PS stratification.

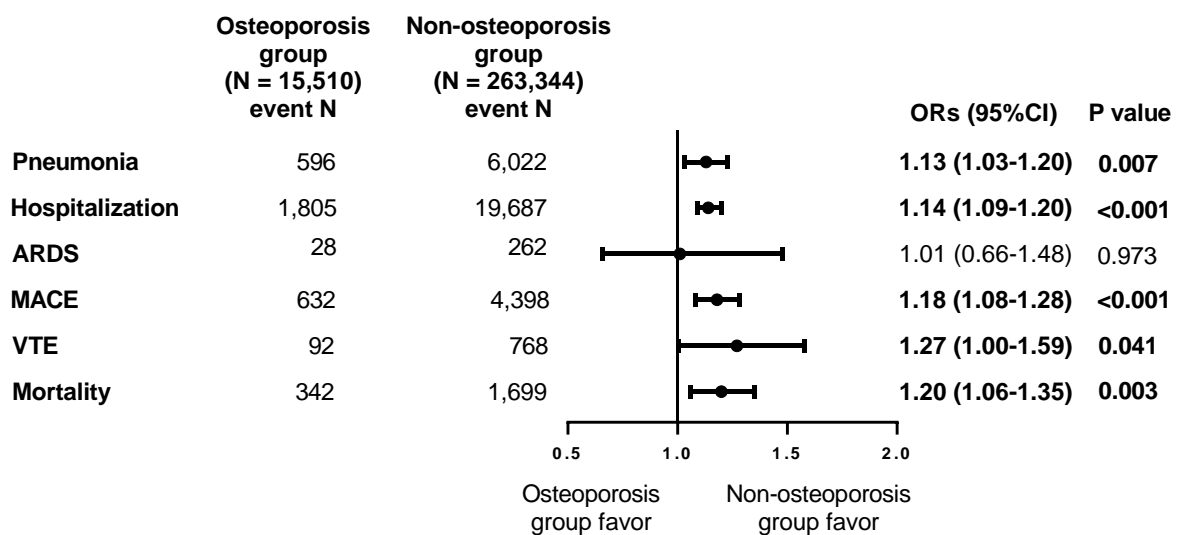


Supplemental Figure 4. Odds ratios for clinical outcomes within 90 days after COVID-19 infection in patients with a previous history of osteoporosis according to sex after large-scale PS stratification. (a) Women (b) Men. ARDS, acute respiratory distress syndrome, MACE, major adverse cardiovascular events, VTE, venous thromboembolism, ORs, odds ratios, CI, confidence interval. Logistic regression analysis was performed after large-scale PS stratification.

(a) Women

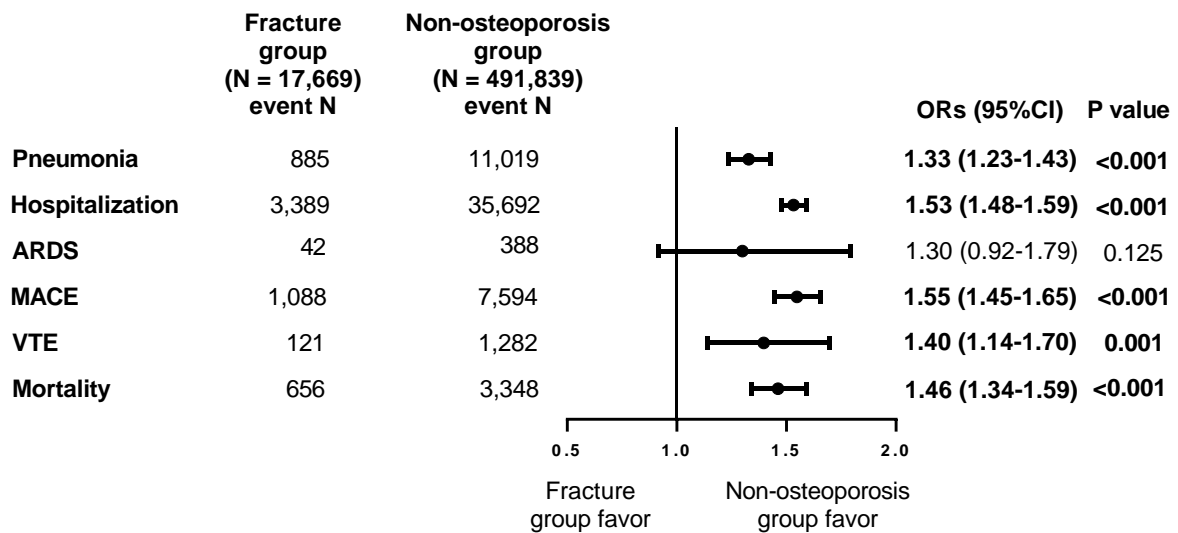


(b) Men



Supplemental Figure 5. Odds ratios for clinical outcomes within 90 days after COVID-19 infection according to previous history of fractures after large-scale PS stratification. (a) The fracture group (b) The non-fracture group. ARDS, acute respiratory distress syndrome, MACE, major adverse cardiovascular events, VTE, venous thromboembolism, ORs, odds ratios, CI, confidence interval. Logistic regression analysis was performed after large-scale PS stratification.

(a) Fracture group



(b) Non-fracture group

