

### **Appendix 1: Potential confounders used in estimating propensity score.**

Some sociodemographic and clinical factors were considered to be associated with both anticoagulants use and adverse outcomes. Sociodemographic factors consisted of age (in years), age square, sex and health insurance type at cohort entry. Clinical factors included 20 comorbidities (arrhythmia, asthma, atrial fibrillation, autoimmune disease, chronic lung disease, coronary artery disease, dementia, diabetes mellitus, heart failure, hyperlipidemia, hypertension, kidney disease, liver disease, malignancy, peripheral vascular disease, pneumonia including tuberculosis, psychiatric disorders, stroke or TIA, other cerebrovascular diseases, thromboembolism) and 12 pre-exposure co-medications use (acetaminophen, antibacterials, antimentia, antidepressants, antidiabetics, antiplatelets, antipsychotics, antivirals, anxiolytics, immunosuppressants, lipid lowering agents including statin, NSAIDs). Comorbidities were defined by using in-hospital ICD-10 diagnostic codes and assessed from 3 years before cohort entry until the beginning of exposure assessment and out-patient ATC codes with ascertainment window from -240d to -120d. Detailed working definitions of the clinical factors are provided in Table S1. To reduce false-positive classifications, we defined malignancy using expanded benefit codes in addition to diagnosis codes.

**Table S1** Diagnosis codes based on the Korean Standard Classification of Diseases, 7<sup>th</sup> Revision or International Classification of Disease, 10<sup>th</sup> Revision codes, National Procedure codes, and drug codes based on World Health Organization-Anatomical Therapeutic Chemical classification codes

Diagnoses	Codes
Inclusion criteria	
COVID-19 (KCD-7)	B342, B972, Z208, Z290, U18, U181, Z038, Z115, U071, U072
Confirmed (Database-specific code)	'Y'
Study endpoints	
All-cause death (Database-specific code)	'Y'
Intensive care unit admission (NPC)	AH110, AH190-192, AH194, AH195, AH210, AH29-299, AH390-AH396, AH398, AH399, AH501, AJ001, AJ003-011, AJ020, AJ021, AJ031, AJ043-046, AJ100, AJ102, AJ110, AJ112, AJ120, AJ122, AJ130, AJ132, AJ140, AJ142, AJ143, AJ150, AJ152 AJ160, AJ180, AJ190, AJ200, AJ202, AJ210, AJ212, AJ220, AJ222, AJ230, AJ240, AJ242, AJ250, AJ252, AJ260, AJ280, AJ290, AJ300, AJ302, AJ310, AJ312, AJ320, AJ322, AJ330, AJ332, AJ340, AJ342, AJ350, AJ352, AJ360, AJ380, AJ390, AJ500, AJ510, AJ520, AJ530, AJ540, AJ550, AJ560, AJ580, AJ590
Mechanical ventilation use (NPC)	M0850, M0857, M0858, M0860, M5830, M5850-5858, M5860, MM360, MM400
Comorbidities (ICD-10)	
Arrhythmia	I44, I45, I47 (or Anti-arrhythmias drug uses ATC code 'C01B')
Asthma	J45, J46
Atrial fibrillation	I48
Autoimmune disease	
Autoimmune thyroiditis, polyglandula failure, hepatitis	E063, E31, K754
Glomerular disease	N00-N08
Idiopathic thrombocytopenic purpura, autoimmune hemolytic anemia	D693, D59
Intestinal malabsorption, celiac disease	K90
Lupus	L93, M32
Multiple sclerosis, myasthenia gravis	G35, G700
Noninfectious enteritis and colitis, ulcerative colitis, crohn's disease	K50-K52, R652, R653
Other interstitial pulmonary disease	J84
Psoriasis	L40, L41, M07, M09
Psoriatic arthritis, Juvenile Rheumatoid arthritis, Ankylosic spondylitis	M07, M08, M45
Sarcoidosis	D86, G532, M633 (and Immunosuppressant drug uses ATC codes 'L04A', 'H02', 'P01BA')
Transplanted status, rejection	Z97, T86
Vasculitis	M05
Chronic lung disease	
Bronchiectasis	J47
Chronic obstructive pulmonary disease	J40, J41, J43, J44, E11
Interstitial pulmonary disease	J84
Coronary artery disease	
Atherosclerosis	I70
Coronary artery disease	I20-I25
Dementia	F00-F03, G30, G3100, G3182
Diabetes mellitus	E10-E14
Heart failure	
Heart failure	I110, I50
Valvular heart disease	I34-I37
Hyperlipidemia	E78
Hypertension	I10-I15 (and Anti-hypertensive drug uses ATC codes 'C09A', 'C09B', 'C09C', 'C09D', 'C07', 'C08', 'C03', 'C01D', 'C02A', 'C02B', 'C02C')
Kidney disease	
Acute kidney failure	N17
Chronic kidney disease (CKD)	N18, N19
Liver disease	
Chronic liver disease	K70-K77
Viral hepatitis	B15-B19
Malignancy	C00-C97 (and expanded benefit coverage codes 'V027', 'V193', 'V194')
Other cerebrovascular diseases	G46, I65-I69
Peripheral vascular disease	I70-I79
Pneumonia including tuberculosis	
Pneumonia	J12-J18
Tuberculosis	A15-A19
Psychiatric disorders	F04-F99
Stroke or TIA	
Stroke	G45
TIA	I60-I64, G463-G468
Thromboembolism	I26, I63, I74, I801, I802, I803, I809, I82
Study Drugs (ATC)	
Anticoagulants	B01AA, B01AB, B01AE, B01AF, B01AX
Co-medications (ATC)	
Acetaminophen	N02BE01, N02BE05, N02BE51, N02BE71
Antibacterials	J01
Antidementia	N06D
Antidepressants	N06A
Antidiabetics	A10
Antineoplastic	L01
Antiplatelets	A01AD05, C07FX02, C07FX03, C07FX04, C10BX01, C10BX02, C10BX04, C10BX05, C10BX06, C10BX08, C10BX12, M01BA03, N02AJ02, N02AJ07, N02AJ18, N02BA01, N02BA51, N02BA71, B01AC
Antipsychotics	N05A
Antivirals	J05
Anxiolytics	N05B
Immunosuppressants	L04A (L04AA, L04AB, L04AC, L04AD, L04AX), H02, P01BA
Lipid lowering including statin	C10, A10BH51, A10BH52
NSAIDs	M01A

ATC, Anatomical Therapeutic Chemical classification code; COVID-19, coronavirus disease 2019; KCD-7, Korean Standard Classification of Diseases 7<sup>th</sup> Revision; ICD-10, International Classification of Disease 10<sup>th</sup> Revision; NPC, national procedure codes; TIA, transient cerebral ischemic attack; NSAIDs, nonsteroidal anti-inflammatory drugs.

**Table S2** Risk of primary endpoint associated with anticoagulants use among COVID-19 patients with  $\geq 40$  years of age

Characteristic of patients non-user user	Number of Patients	Cumulative incidence (%)		Odds ratio	(95% confidence interval)
		Non-user	User		
Primary endpoint (All-cause death, mechanical ventilation use, ICU admission)					
Confirmed-patients with COVID-19					
Anticoagulants user vs Non-user	4613	10.4	29.9	1.06	(0.58-1.93)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4613	10.5	31.6	1.11	(0.60-2.05)
Hospitalized-patients with COVID-19					
Anticoagulants user vs Non-user	4349	10.9	29.7	1.11	(0.60-2.05)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4349	10.9	31.5	1.10	(0.59-2.06)
Statistical method based on propensity score					
SMR weighting with trimming	2003	16.5	30.2	1.02	(0.54-1.93)
SMR weighting with doubly robust method	4349	10.9	29.7	1.34	(1.10-1.53)
IPT weighting	4349	10.9	29.7	2.59	(1.10-6.11)
Outcome adjustment model	4349	10.9	29.7	1.39	(0.82-2.38)
PS matching	4349	10.9	29.7	1.34	(0.64-2.84)

**Table S3** Risk of all-cause death associated with anticoagulants use among COVID-19 patients with  $\geq 40$  years of age

Characteristic of patients non-user user	Number of patients	Cumulative incidence (%)		Odds ratio	(95% confidence interval)
		Non-user	User		
All-cause death					
Confirmed-patients with COVID-19					
Anticoagulants user vs Non-user	4613	4.4	20.9	0.90	(0.44-1.81)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4613	4.4	22.8	0.97	(0.47-1.99)
Hospitalized-patients with COVID-19					
Anticoagulants user vs Non-user	4349	4.5	21.1	0.99	(0.48-2.08)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4349	4.5	23.4	1.02	(0.49-2.12)
Statistical method based on propensity score					
SMR weighting with trimming	2003	8.9	23.3	1.00	(0.47-2.11)
SMR weighting with doubly robust method	4349	4.5	21.1	1.55	(1.26-1.90)
IPT weighting	4349	4.5	21.1	1.47	(0.71-3.07)
Outcome adjustment model	4349	4.5	21.1	1.53	(0.77-3.06)
PS matching	4349	4.5	21.1	1.18	(0.47-2.96)

**Table S4** Risk of adverse mechanical ventilation associated with anticoagulants use among COVID-19 patients with  $\geq 40$  years of age

Characteristic of patients non-user user	Number of patients	Cumulative incidence (%)		Odds ratio	(95% confidence interval)
		Non-user	User		
mechanical ventilation					
Confirmed-patients with COVID-19					
Anticoagulants user vs Non-user	4613	2.5	8.2	2.16	(1.03-4.51)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4613	2.5	8.8	2.54	(1.16-5.56)
Hospitalized-patients with COVID-19					
Anticoagulants user vs Non-user	4349	2.7	8.6	2.12	(0.99-4.54)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4349	2.7	9.0	2.42	(1.09-5.35)
Statistical method based on propensity score					
SMR weighting with trimming	2003	4.7	9.5	2.19	(1.01-4.77)
SMR weighting with doubly robust method	4349	2.7	8.6	1.84	(1.33-2.54)
IPT weighting	4349	2.7	8.6	1.17	(0.43-3.12)
Outcome adjustment model	4349	2.7	8.6	2.18	(0.91-5.22)
PS matching	4349	2.7	8.6	3.31	(1.47-7.45)

**Table S5** Risk of ICU admission associated with anticoagulants use among COVID-19 patients with  $\geq 40$  years of age

Characteristic of patients non-user user	Number of patients	Cumulative incidence (%)		Odds ratio	(95% confidence interval)
		Non-user	User		
ICU admission					
Confirmed-patients with COVID-19					
Anticoagulants user vs Non-user	4613	7.0	14.2	1.41	(0.64-3.07)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4613	7.1	14.0	1.33	(0.62-2.86)
Hospitalized-patients with COVID-19					
Anticoagulants user vs Non-user	4349	7.4	14.1	1.32	(0.60-2.92)
Redefining the exposure searching window					
90 days before and including the date of cohort entry					
Anticoagulants user vs Non-user	4349	7.4	13.5	1.12	(0.49-2.56)
Statistical method based on propensity score					
SMR weighting with trimming	2003	9.4	12.9	1.15	(0.49-2.68)
SMR weighting with doubly robust method	4349	7.4	14.1	1.29	(0.99-1.68)
IPT weighting	4349	7.4	14.1	2.94	(1.05-8.22)
Outcome adjustment model	4349	7.4	14.1	2.76	(0.89-8.54)