

Supplement material

Polymerase chain reaction (PCR) test code:

- ✓ TNX:9088 SARS coronavirus 2 and related RNA [Presence]
UMLS:LNC:94764-8 SARS-CoV-2 (COVID-19) whole genome [Nucleotide sequence] in Isolate or Specimen by Sequencing
- ✓ UMLS:LNC:94531-1 SARS-CoV-2 (COVID-19) RNA panel - Respiratory specimen by NAA with probe detection
- ✓ UMLS:LNC:94306-8 SARS-CoV-2 (COVID-19) RNA panel - Specimen by NAA with probe detection
- ✓ UMLS:LNC:41458-1 SARS coronavirus RNA [Presence] in Specimen by NAA with probe detection
- ✓ UMLS:LNC:95522-9 SARS-CoV-2 (COVID-19) N gene [Log #/volume] (viral load) in Respiratory specimen by NAA with probe detection

COVID-19-related vaccination code:

- ✓ UMLS:CPT:91300 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 30 mcg/0.3mL dosage, diluent reconstituted, for intramuscular use
- ✓ UMLS:CPT:91301 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 100 mcg/0.5mL dosage, for intramuscular use
- ✓ UMLS:CPT:91302 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, DNA, spike protein, chimpanzee adenovirus Oxford 1 (ChAdOx1) vector, preservative free, 5×10^{10} viral particles/0.5mL dosage, for intramuscular use
- ✓ UMLS:CPT:91303 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, DNA, spike protein, adenovirus type 26 (Ad26) vector, preservative free, 5×10^{10} viral particles/0.5mL dosage, for intramuscular use
- ✓ UMLS:CPT:91305 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 30 mcg/0.3 mL dosage, tris-sucrose formulation, for intramuscular use
- ✓ UMLS:CPT:91306 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 50 mcg/0.25 mL dosage, for intramuscular use

- ✓ UMLS:CPT:91307 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 10 mcg/0.2 mL dosage, diluent reconstituted, tris-sucrose formulation, for intramuscular use
- ✓ UMLS:CPT:91308 Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, mRNA-LNP, spike protein, preservative free, 3 mcg/0.2 mL dosage, diluent reconstituted, tris-sucrose formulation, for intramuscular use
- ✓ NLM:CVX:213 SARS-CoV-2 (COVID-19) Vaccine
- ✓ NLM:RXNORM:2479831 SARS-COV-2 (COVID-19) vaccine, vector non-replicating
- ✓ NLM:RXNORM:2468231 SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein
- ✓ UMLS:ICD10PCS:XW023S6 Introduction of COVID-19 Vaccine Dose 1 into Muscle, Percutaneous Approach, New Technology Group 6
- ✓ UMLS:ICD10PCS:XW023T6 Introduction of COVID-19 Vaccine Dose 2 into Muscle, Percutaneous Approach, New Technology Group 6
- ✓ UMLS:ICD10PCS:XW023U6 Introduction of COVID-19 Vaccine into Muscle, Percutaneous Approach, New Technology Group 6
- ✓ UMLS:ICD10PCS:XW013S6 Introduction of COVID-19 Vaccine Dose 1 into Subcutaneous Tissue, Percutaneous Approach, New Technology Group 6
- ✓ UMLS:ICD10PCS:XW013T6 Introduction of COVID-19 Vaccine Dose 2 into Subcutaneous Tissue, Percutaneous Approach, New Technology Group 6
- ✓ UMLS:ICD10PCS:XW013U6 Introduction of COVID-19 Vaccine into Subcutaneous Tissue, Percutaneous Approach, New Technology Group 6

Table S1. Risk of autoimmune diseases among COVID-19 patients compared to control subjects

Outcomes	Autoimmune diseases		Hazard ratio (95%CI)	
	COVID-19	Control	Crude	Adjusted ^a
Inflammatory arthritis				
Rheumatoid arthritis	2878	1044	3.01 (2.87-3.16)*	2.98 (2.78-3.20)*
Ankylosing spondylitis	243	82	3.01 (2.54-3.57)	3.21 (2.50-4.13)
Connective tissue disease				
Systemic lupus erythematosus	1189	429	3.26 (3.02-3.53)	2.99 (2.68-3.34)
Dermatopolymyositis	131	72	2.12 (1.71-2.63)	1.96 (1.47-2.61)
Systemic sclerosis	222	93	2.74 (2.31-3.26)	2.58 (2.02-3.28)
Sjogren's syndrome	727	301	2.91 (2.64-3.21)	2.62 (2.29-3.00)
Mixed connective tissue disease	139	48	3.35 (2.66-4.23)	3.14 (2.26-4.36)
Behçet's disease	45	21	2.92 (1.97-4.34)	2.32 (1.38-3.89)
Polymyalgia rheumatica	330	123	2.52 (2.19-2.90)	2.90 (2.36-3.57)
Vasculitis	800	444	1.99 (1.82-2.17)	1.96 (1.74-2.20)
Psoriasis	1967	734	3.09 (2.91-3.28)*	2.91 (2.67-3.17)
Intestinal related autoimmune				
Inflammatory bowel disease	7945	4863	1.85 (1.80-1.90)	1.78 (1.72-1.84)
Celiac disease	434	254	1.96 (1.74-2.20)	1.85 (1.59-2.16)
Type 1 DM	3263	1318	3.42 (3.26-3.59)*	2.68 (2.51-2.85)*
Mortality	6385	5769	1.14 (1.11-1.17)*	1.20 (1.16-1.24)*

* Proportionality <0.001; CI: Confidence interval.

Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

Table S2. Risk of autoimmune diseases among COVID-19 patients compared to control subjects (stratified by sex)

Outcomes	Hazard ratio (95%CI)			
	Male		Female	
	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis				
Rheumatoid arthritis	2.45 (2.22-2.71)*	2.61 (2.27-3.01)	3.17 (3.00-3.36)*	3.06 (2.82-3.32)
Ankylosing spondylitis	2.58 (2.01-3.32)	2.94 (2.02-4.30)	3.52 (2.81-4.40)	3.21 (2.33-4.42)
Connective tissue disease				
Systemic lupus erythematosus	2.17 (1.72-2.72)	2.05 (1.51-2.80)	3.31 (3.06-3.61)*	2.89 (2.57-3.24)*
Dermatopolymyositis	1.64 (1.08-2.49)	1.64 (0.94-2.85)	2.44 (1.90-3.13)	2.00 (1.44-2.79)
Systemic sclerosis	1.91 (1.25-2.90)	1.50 (0.87-2.57)	2.86 (2.37-3.46)	2.53 (1.95-3.29)
Sjogren's syndrome	2.19 (1.65-2.92)	2.80 (1.82-4.31)	2.91 (2.63-3.22)	2.81 (2.43-3.25)
Mixed connective tissue disease	2.09 (1.21-3.62)	2.11 (0.98-4.54)	3.63 (2.83-4.66)	3.29 (2.29-4.73)
Behçet's disease	2.50 (1.12-5.55)	1.47 (0.51-4.23)	3.31 (2.12-5.15)	2.82 (1.52-5.21)
Polymyalgia rheumatica	2.49 (1.99-3.13)	2.66 (1.93-3.68)	2.69 (2.25-3.22)	3.00 (2.30-3.92)
Vasculitis	2.21 (1.95-2.52)	2.15 (1.80-2.57)	2.47 (2.24-2.73)	2.29 (2.00-2.63)
Psoriasis	2.91 (2.65-3.19)	2.77 (2.42-3.16)	3.26 (3.02-3.52)*	3.11 (2.79-3.48)*
Intestinal related autoimmune				
Inflammatory bowel disease	1.82 (1.74-1.90)	1.81 (1.71-1.92)	1.92 (1.86-1.99)	1.84 (1.76-1.92)
Celiac disease	1.92 (1.53-2.41)	1.78 (1.31-2.41)	2.01 (1.76-2.30)	1.87 (1.56-2.23)
Type 1 DM	3.15 (2.95-3.37)*	2.78 (2.53-3.06)	3.96 (3.70-4.24)*	3.04 (2.77-3.33)*
Mortality	1.20 (1.15-1.24)*	1.24 (1.18-1.30)*	1.11 (1.07-1.16)*	1.15 (1.09-1.22)*

* Proportionality <0.001; CI: Confidence interval;
Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

Table S3. Risk of autoimmune diseases among COVID-19 patients compared to control subjects (stratified by age)

Outcomes	Hazard ratio (95%CI)					
	18-40y		41-64y		≥ 65y	
	Crude	Adjusted ^a	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis						
Rheumatoid arthritis	2.79 (2.41-3.23)	2.65 (2.16-3.25)	3.08 (2.86-3.31)*	2.91 (2.63-3.22)	3.65 (3.39-3.93)*	3.38 (3.02-3.78)
Ankylosing spondylitis	2.54 (1.85-3.49)	2.05 (1.34-3.14)	3.48 (2.73-4.42)	3.80 (2.65-5.44)	3.08 (2.20-4.31)	2.45 (1.53-3.94)
Connective tissue disease						
Systemic lupus erythematosus	2.74 (2.40-3.12)	2.51 (2.10-3.01)	3.60 (3.22-4.02)	3.45 (2.93-4.07)	3.44 (2.86-4.13)	2.68 (2.06-3.49)
Dermatopolymyositis	1.96 (1.24-3.11)	1.80 (0.93-3.49)	2.45 (1.80-3.32)	1.93 (1.30-2.87)	2.30 (1.56-3.41)	2.24 (1.29-3.88)
Systemic sclerosis	2.15 (1.34-3.48)	2.26 (1.17-4.36)	3.49 (2.73-4.45)	2.93 (2.09-4.11)	2.53 (1.90-3.36)	2.76 (1.79-4.25)
Sjogren's syndrome	2.05 (1.62-2.59)	1.66 (1.23-2.26)	3.55 (3.10-4.07)	3.25 (2.68-3.95)	2.98 (2.52-3.52)	2.95 (2.28-3.80)
Mixed connective tissue disease	2.39 (1.47-3.90)	1.96 (1.05-3.68)	3.99 (2.91-5.47)	3.48 (2.22-5.46)	3.50 (2.26-5.44)	2.82 (1.48-5.38)
Behçet's disease	3.02 (1.77-5.15)	2.82 (1.31-6.06)	3.22 (1.76-5.90)	3.06 (1.29-7.23)	1.86 (0.36-9.60)	0.39 (0.04-3.74)
Polymyalgia rheumatica	2.60 (1.22-5.55)	2.55 (0.90-7.24)	2.57 (1.94-3.41)	2.05 (1.40-2.99)	3.38 (2.86-3.98)	2.96 (2.32-3.78)
Vasculitis	2.32 (1.99-2.70)	2.63 (2.10-3.30)	2.37 (2.10-2.69)	2.08 (1.77-2.45)	2.76 (2.41-3.17)	2.38 (1.95-2.89)
Psoriasis	2.44 (2.17-2.74)	2.27 (1.93-2.66)	3.33 (3.05-3.62)*	3.52 (3.10-3.98)	3.73 (3.31-4.21)*	3.61 (2.99-4.36)
Intestinal related autoimmune						
Inflammatory bowel disease	1.84 (1.76-1.93)	1.78 (1.68-1.89)	1.87 (1.80-1.96)	1.75 (1.65-1.85)	2.10 (1.99-2.21)	1.85 (1.72-1.99)
Celiac disease	1.71 (1.44-2.02)	1.54 (1.24-1.92)	2.27 (1.88-2.74)	1.89 (1.49-2.41)	2.26 (1.68-3.05)	2.15 (1.41-3.28)
Type 1 DM	3.55 (3.27-3.85)	2.78 (2.49-3.11)	3.18 (2.96-3.43)*	2.59 (2.35-2.86)	4.18 (3.80-4.60)*	3.26 (2.84-3.74)
Mortality	1.01 (0.90-1.13)	0.97 (0.84-1.12)	1.22 (1.16-1.29)*	1.26 (1.18-1.35)*	1.41 (1.36-1.46)*	1.22 (1.17-1.28)*

* Proportionality <0.001; CI: Confidence interval;

Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI). Abbreviations: DM, diabetes mellitus

Table S4. Risk of autoimmune diseases among COVID-19 patients compared to control subjects (stratified by race)

Outcomes	Hazard ratio (95%CI)					
	White		Black/African American		Asian	
	Crude	Adjusted ^a	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis						
Rheumatoid arthritis	3.11 (2.94-3.29)	3.02 (2.78-3.28)*	3.09 (2.74-3.48)*	2.95 (2.49-3.50)	2.46 (1.60-3.76)	2.12 (1.18-3.81)
Ankylosing spondylitis	3.14 (2.61-3.78)	2.75 (2.12-3.58)	3.06 (1.81-5.17)	3.18 (1.49-6.79)	3.38 (1.03-11.1)	2.20 (0.40-12.0)
Connective tissue disease						
Systemic lupus erythematosus	3.15 (2.83-3.51)	3.14 (2.68-3.68)	3.35 (2.95-3.81)*	3.04 (2.53-3.65)	2.96 (1.73-5.08)	3.56 (1.53-8.29)
Dermatopolymyositis	2.28 (1.73-3.00)	1.99 (1.37-2.89)	2.15 (1.43-3.23)	1.73 (1.04-2.89)	4.83 (1.47-15.8)	1.10 (0.28-4.40)
Systemic sclerosis	2.84 (2.32-3.49)	2.38 (1.80-3.15)	1.74 (1.15-2.63)	1.46 (0.86-2.47)	3.35 (1.02-11.0)	5.42 (0.63-46.4)
Sjogren's syndrome	3.11 (2.78-3.47)	2.74 (2.35-3.21)	2.86 (2.25-3.63)	2.74 (1.95-3.84)	2.41 (1.21-4.79)	1.66 (0.68-4.06)
Mixed connective tissue disease	3.42 (2.53-4.62)	4.49 (2.72-7.42)	3.57 (2.41-5.29)	3.12 (1.79-5.42)	1.39 (0.14-13.3)	NA
Behçet's disease	3.45 (2.12-5.61)	2.25 (1.19-4.25)	2.69 (1.12-6.50)	2.92 (0.78-11.0)	1.35 (0.14-13.0)	NA
Polymyalgia rheumatica	2.92 (2.51-3.39)	3.46 (2.75-4.37)	1.62 (0.99-2.63)	1.17 (0.61-2.23)	1.35 (0.37-4.98)	0.83 (0.19-3.69)
Vasculitis	2.40 (2.19-2.63)	2.21 (1.95-2.51)	2.49 (2.04-3.05)	2.11 (1.62-2.75)	1.58 (0.79-3.18)	2.21 (0.67-7.33)
Psoriasis	3.31 (3.10-3.54)	3.22 (2.92-3.54)	2.95 (2.34-3.71)	3.36 (2.37-4.76)	2.45 (1.58-3.80)	1.65 (0.94-2.90)
Intestinal related autoimmune						
Inflammatory bowel disease	1.94 (1.88-2.00)	1.88 (1.80-1.96)	1.85 (1.73-1.99)	1.78 (1.62-1.95)	1.52 (1.19-1.95)	1.51 (1.08-2.11)
Celiac disease	2.21 (1.96-2.50)	2.07 (1.75-2.44)	1.39 (0.75-2.60)	1.71 (0.74-3.95)	1.87 (0.71-4.92)	2.21 (0.55-8.85)
Type 1 DM	3.72 (3.51-3.94)*	2.90 (2.67-3.14)*	3.08 (2.79-3.39)*	2.50 (2.20-2.85)*	3.19 (2.08-4.88)	2.57 (1.38-4.80)
Mortality	1.09 (1.06-1.13)*	1.15 (1.10-1.20)*	1.29 (1.21-1.38)*	1.40 (1.29-1.52)*	1.66 (1.32-2.09)	1.94 (1.39-2.69)

* Proportionality <0.001; CI: Confidence interval;

Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

Table S5. Sensitivity analysis (stratified by inpatient/outpatient)

Outcomes	Hazard ratio (95%CI)			
	Inpatient		Outpatient	
	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis				
Rheumatoid arthritis	0.97 (0.77-1.21)	1.02 (0.76-1.37)	3.48 (3.30-3.67)*	3.07 (2.85-3.31)*
Ankylosing spondylitis	0.54 (0.20-1.46)	0.78 (0.22-2.77)	3.52 (2.94-4.22)	3.44 (2.65-4.47)
Connective tissue disease				
Systemic lupus erythematosus	0.78 (0.54-1.13)	0.82 (0.51-1.32)	3.99 (3.66-4.34)*	3.11 (2.77-3.50)*
Dermatopolymyositis	0.69 (0.28-1.70)	0.97 (0.30-3.19)	2.89 (2.28-3.67)	2.11 (1.54-2.91)
Systemic sclerosis	0.26 (0.06-1.06)	0.21 (0.05-0.97)	3.21 (2.67-3.87)	2.76 (2.14-3.56)
Sjogren's syndrome	0.78 (0.43-1.39)	0.76 (0.35-1.61)	3.01 (2.72-3.33)*	2.49 (2.18-2.86)
Mixed connective tissue disease	0.54 (0.13-2.22)	0.78 (0.13-4.66)	3.89 (3.05-4.98)	3.16 (2.24-4.45)
Behçet's disease	NA	NA	3.81 (2.49-5.82)	3.04 (1.69-5.48)
Polymyalgia rheumatica	1.05 (0.55-2.00)	1.06 (0.45-2.50)	2.81 (2.42-3.27)	2.31 (1.89-2.82)
Vasculitis	0.92 (0.67-1.26)	0.94 (0.62-1.44)	2.92 (2.67-3.19)	2.49 (2.21-2.81)
Psoriasis	1.26 (0.96-1.66)	1.60 (1.07-2.40)	3.30 (3.10-3.52)*	3.11 (2.84-3.41)*
Intestinal related autoimmune				
Inflammatory bowel disease	0.79 (0.71-0.89)	0.76 (0.65-0.87)	2.14 (2.08-2.20)*	1.93 (1.86-2.01)*
Celiac disease	NA	NA	2.07 (1.84-2.34)	1.81 (1.55-2.11)
Type 1 DM	1.12 (0.95-1.32)	0.86 (0.70-1.06)	5.20 (4.91-5.51)*	3.66 (3.39-3.95)*
Mortality	1.39 (1.32-1.47)*	1.37 (1.27-1.48)*	1.81 (1.75-1.88)*	1.75 (1.67-1.83)*

* Proportionality <0.001; CI: Confidence interval;
Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

Table S6. Sensitivity analysis (stratified by different network)

Outcomes	Hazard ratio (95%CI)			
	EMEA network		Global network	
	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis				
Rheumatoid arthritis	0.44 (0.30-0.67)	0.60 (0.39-0.91)	2.22 (2.12-2.33)*	2.46 (2.30-2.63)*
Ankylosing spondylitis	0.13 (0.03-0.54)	0.15 (0.03-0.64)	2.10 (1.79-2.47)	2.16 (1.74-2.68)
Connective tissue disease				
Systemic lupus erythematosus	0.52 (0.23-1.18)	0.68 (0.28-1.64)	2.44 (2.26-2.63)*	2.47 (2.22-2.74)
Dermatopolymyositis	0.15 (0.04-0.63)	0.17 (0.04-0.75)	1.50 (1.22-1.84)	1.41 (1.09-1.83)
Systemic sclerosis	0.66 (0.30-1.45)	0.99 (0.40-2.43)	1.97 (1.67-2.32)	1.91 (1.55-2.37)
Sjogren's syndrome	0.89 (0.49-1.63)	1.10 (0.54-2.26)	2.17 (1.98-2.39)*	2.39 (2.10-2.72)
Mixed connective tissue disease	NA	NA	2.46 (1.97-3.07)	2.35 (1.74-3.16)
Behçet's disease	1.06 (0.10-11.7)	0.55 (0.05-6.06)	2.42 (1.66-3.52)	2.37 (1.42-3.96)
Polymyalgia rheumatica	0.14 (0.03-0.57)	0.19 (0.06-0.66)	1.87 (1.63-2.14)	2.39 (1.97-2.90)
Vasculitis	0.18 (0.10-0.32)	0.28 (0.16-0.51)	1.67 (1.54-1.80)	1.65 (1.49-1.82)
Psoriasis	0.44 (0.28-0.72)	0.50 (0.31-0.80)	2.29 (2.16-2.43)*	2.32 (2.14-2.51)*
Intestinal related autoimmune				
Inflammatory bowel disease	0.60 (0.48-0.76)	0.65 (0.52-0.82)	1.42 (1.38-1.46)	1.51 (1.46-1.56)
Celiac disease	1.18 (0.39-3.51)	0.94 (0.32-2.81)	1.55 (1.38-1.74)	1.80 (1.55-2.09)
Type 1 DM	1.04 (0.77-1.41)	1.28 (0.91-1.78)	2.60 (2.48-2.72)*	2.38 (2.24-2.53)*
Mortality	0.50 (0.43-0.58)	0.61 (0.53-0.72)	0.91 (0.88-0.94)*	1.04 (1.01-1.08)*

* Proportionality <0.01; CI: Confidence interval

Global network: including countries (# of HCOs): Australia (1), Brazil (5), Bulgaria (1), Germany (1), India (1), Italy (1), Lithuania (1), Malaysia (1), Poland (2), Singapore (1), Spain (3), Taiwan (1), United Kingdom (8), USA (47)

EMEA (Europe, Middle East and Africa) network: including countries (# of HCOs): Bulgaria (1), Germany (1), Italy (1), Lithuania (1), Malaysia (1), Poland (2), Spain (3), United Kingdom (8)

Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

Table S7. Sensitivity analysis (with/without accounting for competing risks)

Outcomes	Hazard ratio (95%CI)			
	Original model		Accounting for competing risks	
	Crude	Adjusted ^a	Crude	Adjusted ^a
Inflammatory arthritis				
Rheumatoid arthritis	3.01 (2.87-3.16)*	2.98 (2.78-3.20)*	1.41 (1.38-1.44)*	1.45 (1.41-1.50)*
Ankylosing spondylitis	3.01 (2.54-3.57)	3.21 (2.50-4.13)	1.17 (1.13-1.20)*	1.21 (1.17-1.25)*
Connective tissue disease				
Systemic lupus erythematosus	3.26 (3.02-3.53)	3.00 (2.68-3.34)	1.27 (1.24-1.30)*	1.30 (1.26-1.35)*
Dermatopolymyositis	2.12 (1.71-2.63)	1.96 (1.47-2.61)	1.15 (1.12-1.18)*	1.20 (1.15-1.24)*
Systemic sclerosis	2.74 (2.31-3.26)	2.58 (2.02-3.28)	1.16 (1.13-1.19)*	1.20 (1.16-1.25)*
Sjogren's syndrome	2.91 (2.64-3.21)	2.62 (2.29-3.00)	1.21 (1.18-1.25)*	1.26 (1.22-1.30)*
Mixed connective tissue disease	3.35 (2.66-4.23)	3.14 (2.26-4.36)	1.15 (1.12-1.19)*	1.20 (1.16-1.24)*
Behçet's disease	2.92 (1.97-4.34)	2.32 (1.38-3.89)	1.14 (1.11-1.18)*	1.19 (1.14-1.23)*
Polymyalgia rheumatica	2.52 (2.19-2.90)	2.90 (2.36-3.57)	1.17 (1.14-1.20)*	1.22 (1.18-1.26)*
Vasculitis	1.99 (1.82-2.17)	1.96 (1.74-2.20)	1.22 (1.19-1.26)*	1.26 (1.22-1.30)*
Psoriatic	3.09 (2.91-3.28)*	2.91 (2.67-3.17)	1.34 (1.31-1.37)*	1.38 (1.34-1.43)*
Intestinal related autoimmune				
Inflammatory bowel disease	1.85 (1.80-1.90)	1.78 (1.72-1.84)	1.46 (1.44-1.49)*	1.47 (1.43-1.50)*
Celiac disease	1.96 (1.74-2.20)	1.85 (1.59-2.16)	1.17 (1.14-1.20)*	1.21 (1.17-1.25)*
Type 1 DM	3.42 (3.26-3.59)*	2.68 (2.51-2.85)*	1.48 (1.44-1.51)*	1.46 (1.42-1.51)*
Mortality	1.14 (1.11-1.17)*	1.20 (1.16-1.24)*	1.14 (1.11-1.17)*	1.18 (1.14-1.23)*

* Proportionality <0.001; CI: Confidence interval;

Crude: before matching; Adjusted: after matching.

a. Propensity score matching was performed based on age at index, sex, race, adverse socioeconomic status (problem related to housing and economic circumstances, problems related to employment and unemployment, problems related to education and literacy, occupational exposure to risk factors), and comorbidities (type 2 diabetes, vitamin D deficiency, hyperlipidemia, asthma, depression, chronic kidney disease, sleep disorder, psychoactive substance use, and BMI).

Abbreviations: DM, diabetes mellitus

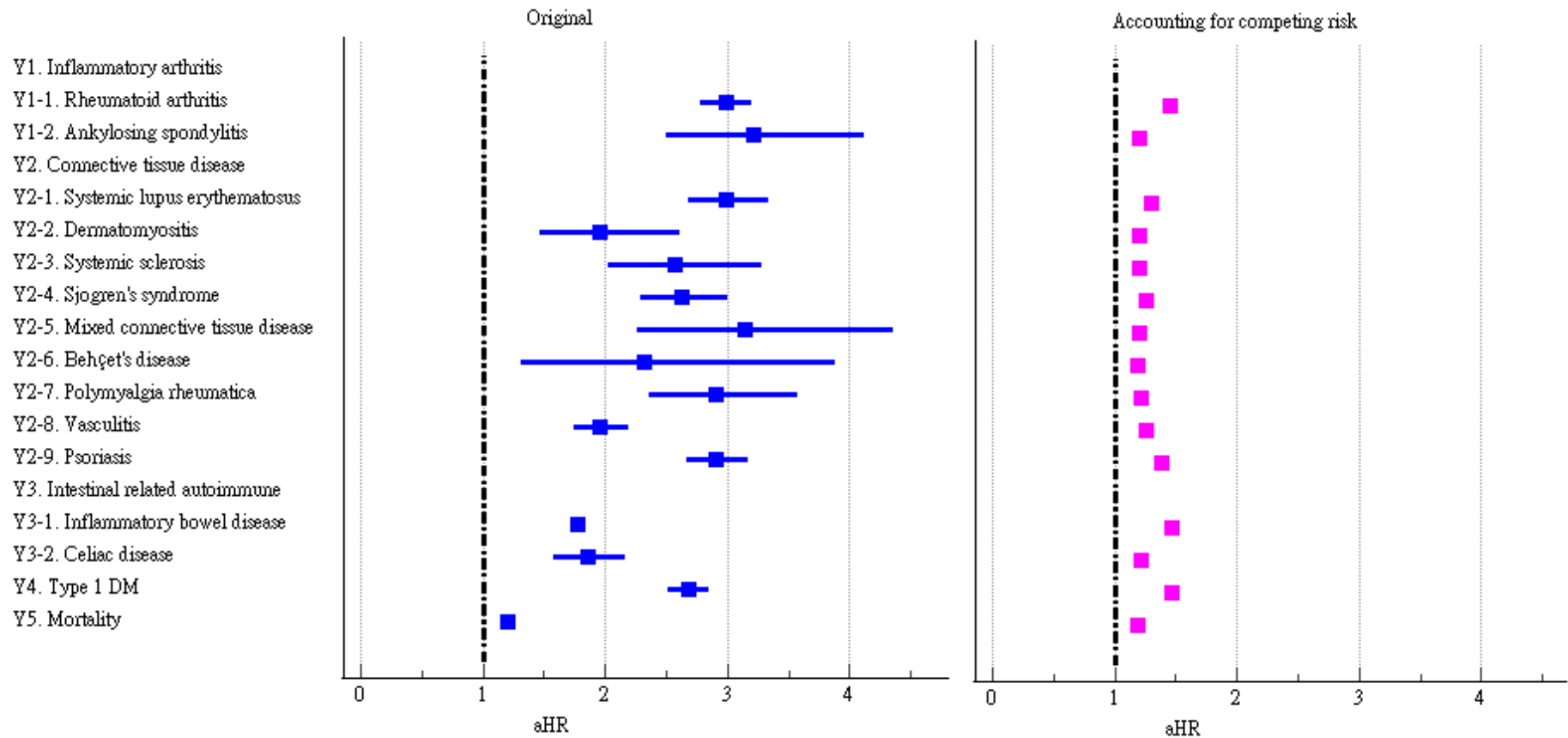


Figure S1. Forest plot of outcomes (with/without accounting for competing risks)

Abbreviations: DM, diabetes mellitus

Table S8. Results of the goodness-of-fit test between the case group of this study and the official COVID-19 laboratory-confirmed cases from the CDC COVID-19 data tracker

Variables	COVID-19 cohort_ present study	COVID-19 cohort_ official data ^a	Chi-square ^b .	Effect size ^c Pearson's r (95% CI)
Gender				
Female	510200 (57.4%)	29920075 (52.6%)	4793.781***	0.0735 (0.0714-0.0755)
Male	377971 (42.5%)	253300764 (44.6%)		
Age group				
18-64y	706636 (83.1%)	48828562 (85.9%)	5586.137***	0.081 (0.0789-0.0832)
65+y	143917 (16.9%)	80055276 (14.1%)		
Ethnicity				
Hispanic/ Latino	81184 (09.1%)	5643316 (09.9%)	748.867***	0.0289 (0.0268-0.0309)
Others	817101 (90.9%)	51190522 (90.1%)		

a. Data source: Centers for Disease Control and Prevention, CDC, COVID-19 data tracker (<https://covid.cdc.gov/covid-data-tracker/#cases-deaths-trends-by-demographic>), age \geq 18y;

b. Chi-Square Calculator for Goodness of Fit: <https://www.socscistatistics.com/tests/goodnessoffit/default2.aspx>

c. Practical Meta-Analysis Effect Size Calculator: <https://www.campbellcollaboration.org/escalc/html/EffectSizeCalculator-R5.php>