Smoking and risk of negative outcomes among COVID-19 patients:
A systematic review and meta-analysis

Adinat Umnuaypornlert, Sukrit Kanchanasurakit, Don Eliseo III Lucero-Prisno,
Surasak Saokaew

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Table S1. Search algorithms

Database	No	Step search algorithm	Items found
Pubmed	#1	Search tobacco	129717
	#2	Search smok*	323837
	#3	Search (smok*) OR tobacco	377822
	#4	Search covid	8886
	#5	Search coronavirus	20634
	#6	Search sars cov	7399
	#7	Search ((sars cov) OR coronavirus) OR covid	17717
	#8	Search (((smok*) OR tobacco)) AND (((sars cov) OR coronavirus) OR covid)	833
Cochran	#1	covid	4
	#2	coronavirus	1
	#3	sars cov	3
	#4	#1 or #2 or #3	10
	#5	tobacco	98
	#6	smoking	118
	#7	#5 or #6	210
	#8	#4 and #7	51
Science Direct	#1	covid	4514
	#2	coronavirus	17501
	#3	sars cov	6721
	#4	#1 or #2 or #3	2110
	#5	tobacco	247618
	#6	smoking	455334
	#7	#5 or #6	91948
	#8	#4 and #7	102
Google scholar	#1	covid	37111
	#2	coronavirus	21090
	#3	sars cov	16882
	#4	#1 or #2 or #3	5290
	#5	tobacco	21900
	#6	smoking	33011
	#7	#5 or #6	5420
	#8	#4 and #7	28

Database	No	Step search algorithm	Items found
EMBASE	#1	covid	47101
	#2	coronavirus	22390
	#3	sars cov	16511
	#4	#1 or #2 or #3	3260
	#5	tobacco	21120
	#6	smoking	31521
	#7	#5 or #6	4520
	#8	#4 and #7	234

Table S2. Risk of bias assessment of 40 studies included in the meta-analysis by the Newcastle-Ottawa Scale

Author (Year)	Adequacy selection of case-control				Comparability of studies		Outcome assessment			Total NOS score
	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls	Study control for age and sex	Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	
Almazeedi S. (2020)	✹	✹	✹	✹	✹	-	✹	✹	-	7/9
Bahl A. (2020)	✹	✹	✹	✹	-	-	✹	✹	-	6/9
Bellan M. (2020)	✹	✹	✹	✹	✹	-	✹	✹	-	7/9
Bi X. (2020)	✹	✹	✹	✹	-	-	✹	✹	-	6/9
Borobia A. M. (2020)	✹	✹	✹	-	✹	-	✹	-	✹	6/9
Brenner E.J. (2020)	✹	✹	✹	✹	-	-	✹	✹	-	6/9
Castelnuovo A.D. (2020)	✹	✹	✹	✹	✹	-	✹	✹	-	7/9
CDC COVID19	-	✹	✹	✹	-	-	✹	✹	-	5/9

Author (Year)	Adequacy selection of case-control				Comparability of studies		Outcome assessment			Total NOS score
	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls	Study control for age and sex	Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	
response team (2020)										
Chand S. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Chen L. (2020)	✿	✿	✿	✿	✿	✿	✿	✿	-	8/9
Dashti H. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Grechukhina O. (2020)	✿	✿	✿	✿	-	-	✿	✿	✿	7/9
Gu T. (2020)	✿	✿	✿	✿	✿	✿	✿	✿	-	8/9
Guan W (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Hu L. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Huang C (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Kalligeros	✿	✿	✿	✿	✿	✿	✿	✿	-	8/9

Author (Year)	Adequacy selection of case-control				Comparability of studies		Outcome assessment			Total NOS score
	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls	Study control for age and sex	Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	
M. (2020)										
Kim E.S. (2020)	-	★	★	★	-	-	★	★	-	5/9
Kishaba T. (2020)	★	-	★	★	-	-	★	★	-	6/9
Klang E. (2020)	★	★	★	★	★	★	★	★	-	8/9
Langer-Gould A. (2020)	★	★	★	★	★	-	★	★	-	7/9
Li X. (2020)	★	★	★	★	-	-	★	★	-	6/9
Li YK. (2020)	★	★	★	★	-	-	★	★	-	6/9
Liu D. (2020)	-	-	★	★	★	-	★	★	★	
Liu J. (2020)	★	★	★	★	-	-	★	★	-	6/9
Monteiro	★	★	★	★	-	-	★	★	-	6/9

Author (Year)	Adequacy selection of case-control				Comparability of studies		Outcome assessment			Total NOS score
	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls	Study control for age and sex	Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	
A.C. (2020)										
Parra-Bracamonte G. M. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Shi Y. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Sun DW. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Torres-Macho J. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Wang R. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Yang X. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Yu Q.	✿	✿	✿	✿	✿	-	✿	✿	-	7/9

| Author (Year) | Adequacy selection of case-control | | | | Comparability of studies | | Outcome assessment | | | Total NOS score |
	Is the case definition adequate?	Representativeness of the cases	Selection of Controls	Definition of Controls	Study control for age and sex	Additional factors; controlled for ≥ 2 variables including DM, HT, CVD, ACEIs/ ARBs	Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-Response rate	
(2020)										
Yu T. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Zhan T. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Zhang JJ. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Zhao Z. (2020)	✿	✿	✿	✿	-	-	✿	✿	✿	7/9
Zheng Y. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Zhou F. (2020)	✿	✿	✿	✿	-	-	✿	✿	-	6/9
Zinellu A. (2020)	✿	✿	✿	✿	✿	-	✿	✿	-	7/9

Table S3. Description of outcomes in studies included in meta-analysis

Author (Year)	Outcomes	Definitions
Almazeedi S. (2020)	ICU/non-ICU	Assessment of Clinical Criteria for Sepsis Using the qSOFA score for sepsis; For the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)
Bahl A. (2020)	Dead/Alive	-
Bellan M. (2020)	Dead/Alive	-
Bi X. (2020)	Severe/non-severe	Severe having any of the three conditions: respiratory distress, respiratory rate > 30 breaths/min, in resting state, oxygen saturation is less than 93%, PaO2/ FiO2 ≤300 mmHg. Critical having one of the three conditions; shock incidence, respiratory failure and require mechanical ventilation, admission to ICU with other organ function failure.
Borobia A. M. (2020)	Dead/alive	-
Brenner E.J. (2020)	Dead/alive	-
Castelnuovo A.D. (2020)	Dead/Alive	-
CDC COVID19 response team (2020)	ICU/non ICU + non hospitalization	-
Chand S. (2020)	Dead/Alive	-
Chen L. (2020)	Dead/Alive	-
Dashti H. (2020)	Dead/Alive	-
Grechukhina (2020)	Severe/non-severe	Signs of severe pneumonia, ie, respiratory rate of 30/minute or more, blood oxygen saturation of < 95% {the threshold for O2 supplementation in pregnancy], severe

Author (Year)	Outcomes	Definitions
		respiratory distress, and critical (acute respiratory distress syndrome, sepsis, or septic shock)
Gu T. (2020)	ICU/non-ICU	-
Guan W (2020)	Severe/non-severe	Validated definition includes either one major criterion or three or more minor criteria **Minor criteria** Respiratory rate > 30 breaths/min PaO2/FIO2 ratio < 250 Multilobar infiltrates Confusion/disorientation Uremia (blood urea nitrogen level > 20 mg/dl) Leukopenia* (white blood cell count , 4,000 cells/ml) Thrombocytopenia (platelet count , 100,000/ml) Hypothermia (core temperature , 368C) Hypotension requiring aggressive fluid resuscitation **Major criteria** Septic shock with need for vasopressors Respiratory failure requiring mechanical ventilation *Due to infection alone (i.e., not chemotherapy induced).
Hu L. (2020)	Severe/non-severe	Diagnosis complied with the WHO interim guidance and the guidelines of COVID-19 diagnosis and treatment trial (5th edition), by the National Commission of the people's Republic of China.
Huang C (2020)	ICU/non-ICU	-

Author (Year)	Outcomes	Definitions
Kalligeros M. (2020)	ICU/non-ICU	-
Kim E.S. (2020)	Severe/non-severe	Need oxygen supplement therapy
Kishaba T. (2020)	Dead/Alive	-
Klang E. (2020)	Dead/Alive	-
Langer-Gould A. (2020)	Dead/Alive	-
Li X. (2020)	Severe, critically ill/non-severe	Validated definition includes either one major criterion or three or more minor criteria **Minor criteria** Respiratory rate > 30 breaths/min PaO2/FIO2 ratio < 250 Multilobar infiltrates Confusion/disorientation Uremia (blood urea nitrogen level > 20 mg/dl) Leukopenia* (white blood cell count , 4,000 cells/ml) Thrombocytopenia (platelet count , 100,000/ml) Hypothermia (core temperature , 368C) Hypotension requiring aggressive fluid resuscitation **Major criteria** Septic shock with need for vasopressors Respiratory failure requiring mechanical ventilation *Due to infection alone (i.e., not chemotherapy induced).
Li YK. (2020)	Severe/non-severe	Severe stage, 1 of the following criteria existed: (a) shortness of breath, respiratory rate

Author (Year)	Outcomes	Definitions
		≥30 times/min; (b) in resting state, oxygen saturation is less than 93%; (c) PaO2/ FiO2 ≤300 mmHg. CT imaging showed significant lesion progression >50% within 24 to 48 h; (d) Respiratory failure requiring mechanical ventilation; (e) Shock; (f) Complicated with other organ failure requiring ICU care.
Liu D. (2020)	Dead/Alive	-
Liu J. (2020)	Severe/mild	severe patients have 1 of the following conditions; (1) shortness of breath, respiratory rate ≥ 30 times/min (2) O2 sat resting rate ≤ 93% or (3) PaO2/FiO2 ≤ 300 mmHg
Monteiro A.C. (2020)	ICU/non-ICU	Any admission to the ICU or any intubation for respiratory failure, regardless of duration, was included in the rate of ICU admissions and intubations, respectively.
Parra-Bracamonte G. M. (2020)	Dead/alive	-
Shi Y. (2020)	Severe/mild	-
Sun DW. (2020)	Severe/non-severe	Severe patients have 1 of the following conditions; (1) shortness of breath, respiratory rate ≥ 30 times/min (2) O2 sat resting rate ≤ 93% or (3) PaO2/FiO2 ≤ 300 mmHg. Critically severe type was defined if any of the items was presented: Respiratory failure requiring mechanical ventilation; (e) Shock; (f) Complicated with other organ failure requiring ICU care.
Torres-Macho J. (2020)	Dead/Alive	-
Wang R. (2020)	Critical/non critical	Defined as the general office of national health commission China, version5 , 2020
Yang X. (2020)	Dead/alive	-
Yu Q. (2020)	Severe/non-severe	Admission to ICU, acute respiratory failure, and shock during hospitalization
Yu T. (2020)	with ARDs / without ARDs	Acute respiratory syndrome = O2 index (arterial partial pressure of O2/fraction of inspired

Author (Year)	Outcomes	Definitions
		O2 ≤ 300 mmHg
Zhan T. (2020)	Severe/non-severe	Severity was established based on respiratory functions on admission with one of the below criteria: (a) shortness of breath, respiratory frequency ≥ 30/min, (b) oxygen saturation ≤ 93% at rest and (c) PaO2/FiO2 ≤ 300 mmHg
Zhang JJ. (2020)	Severe/non-severe	Severity was established based on respiratory functions on admission with one of the below criteria: (a) shortness of breath, respiratory frequency ≥ 30/min, (b) oxygen saturation ≤ 93% at rest and (c) PaO2/FiO2 ≤ 300 mmHg
Zhao Z. (2020)	ICU/non-ICU	-
Zheng Y. (2020)	Severe or critical / ordinary	-
Zhou F. (2020)	Dead/alive	-
Zinellu A. (2020)	Dead/alive	-

Table S4. Description of participants of included studies.

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
Almazeedi S. (2020)	ICU/non-ICU	All patients admitted to JaberAl-AhmadAl-Sabah hospital in Kuwait, with a diagnosis of COVID-19, based on the World Health Organization (WHO) interim guidance and have been confirmed by laboratory testing using PCR testing,	Patients who had equivocal PCR test results or were suspected cases were excluded from the study.	54.8±11	37.1±16	Male	32 (3.6%)	856 (96.4%)	Hypertension	17 (9.6)	160 (90.4)
									Diabetes mellitus	18 (11.6)	137 (88.4)
									Dyslipidemia	7 (10.8)	58 (89.2)
									Asthma	6 (14.0)	37 (86.0)
									Coronary artery disease/ischemic heart disease	8 (19.5)	33 (80.5)
									Hypothyroidism	3 (12.0)	22 (88.0)
									Cancer	1 (7.1)	13 (92.9)
									Chronic renal disease	3 (27.3)	8 (72.7)
									Cerebrovascular disease	1 (14.3)	6 (85.7)
									Hepatitis	1 (16.7)	5 (83.3)
									Chronic obstructive pulmonary disease	2 (40.0)	3 (60.0)
									Recent surgery (30 days prior to initial presentation)	0 (0.0)	4 (100.0)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		between February 24th 2020 and the study's cutoff date of April 20th 2020 were included in the study							Immunodeficiency	0 (0.0)	1(0.0)
									Other	5 (15.6)	27 (84.4)
	Dead/alive			55.0±10.1	38.7±15.1	Male	16 (1.8%)	872 (98.2%)	Hypertension	8 (4.5)	169 (95.5)
									Diabetes mellitus	6 (3.9)	149 (96.1)
									Dyslipidemia	3 (4.6)	62 (95.4)
									Asthma	4 (9.3)	39 (90.7)
									Coronary artery disease/ischemic heart disease	5 (12.2)	36 (87.8)
									Hypothyroidism	1 (4.0)	24 (96.0)
									Cancer	0 (0.0)	14 (100.0)
									Chronic renal disease	3 (27.3)	8 (72.7)
									Cerebrovascular disease	0 (0.0)	7 (100.0)
									Hepatitis	1 (16.7)	5 (83.3)
									Chronic obstructive pulmonary disease	1 (20.0)	4 (80.0)
									Recent surgery (30 days prior to initial presentation)	0 (0.0)	4 (100.0)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
									Immunodeficiency	0 (0.0)	1 (100.0)
									Other	3 (9.4)	29 (90.6)
Bahl A. (2020)	Dead/alive	Patients over 18 years of age who were admitted with COVID-19 from March 1st through March 31st 2020 were included	Exclusions consisted of patients who left the hospital against medical advice, transfers to external hospitals, or if hospital course was ongoing beyond April 23,	73	59	Male	180 (55.0%)	590 (52.0%)	Asthma	30 (9.2)	124 (10.9)
									Cancer	44 (13.5)	110 (9.7)
									Coronary artery disease	59 (18.0)	104 (9.2)
									Chronic heart failure	37 (11.3)	63 (5.6)
									Chronic kidney disease	33 (10.1)	42 (3.7)
									Chronic obstructive pulmonary disease	48 (14.7)	84 (7.4)
									Cerebrovascular accident	30 (9.2)	58 (5.1)
									Diabetes mellitus	127 (38.8)	303 (26.7)
									End-stage renal disease	15 (4.6)	21 (1.9)
									Human immunodeficiency virus	1 (0.3)	7 (0.6)
									Hypertension	200 (61.2)	551 (48.6)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
			2020						Obstructive Sleep Apnea	29 (8.9)	90 (7.9)
									Pulmonary Hypertension	6 (1.8)	6 (0.5)
									Venous thromboembolism	29 (8.9)	52 (4.6)
Bellan M. (2020)	Dead/alive	From hospital administrative data revision, we selected all consecutive patients older than 18 years of age, admitted to the hospital afer Emergency Room evaluation, with a	-	77	65	Male	74	165	Arterial Hypertension	83	138
									Diabetes	31	58
									Ischemic cardiopathy	24	30
									Obesity	28	32
									COPD	21	39
									Active Malignancy	14	23
									Chronic liver disease	18	15
									Autoimmune disease	7	6
									Atrial fibrillation	5	6
									Interstitial lung disease	19	26
									Dementia	4	6

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		confrmed diagnosis of SARS-CoV-2 infection by reverse-transcriptase polymerase chain reaction (RT-PCR) of a nasopharyngeal swab, between 1st March 2020 and 28th April 2020.							Chronic kidney disease	29 28	27 22
Bi X. (2020)	Severe/non-severe	One hundred and thirteen patients of COVID-19 were enrolled in Taizhou	-	54	44	Male	13 (59.1%)	51 (56.0%)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		Public Health Medical Center, Taizhou Hospital, Zhejiang Province, China, from January 23 to February 4, 2020.									
Borobia A.M. (2020)	Dead/alive	Study included 18 years and older, who were hospitalized in the ward of La Paz university hoapital with a diagnosis of covid-19 and	Patients discharged from the emergency department after stay of less than 24 h were not considere	82.5	56	Male	286 (62.2%)	788 (44.6%)	Arterial hypertension	318 (69.1)	602 (34.1)
									Chronic heart disease	195 (42.4)	234 (13.3)
									Diabetes mellitus	157 (34.1)	224 (12.7)
									Rheumatological disease	80 (17.4)	188 (10.6)
									Solid malignant disease	93 (20.2)	159 (9.0)
									Obesity	66 (14.3)	176 (10.0)
									Chronic Kidney		

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		who either died or were discharged by 19 April. Data of patients were extracted from the electronic prescription system.	d hospitalized and were not included in this analysis.						Disease COPD	94 (20.4)	80 (4.5)
									Other chronic lung disease	65 (14.1)	88 (5.0)
									Hematological malignant disease	49 (10.7)	94 (5.3)
									Asthma	46 (10.0)	87 (4.9)
									Liver disease	17 (3.7)	98 (5.5)
									HIV infection	23 (5.0)	66 (3.7)
										4 (0.9)	9 (0.5)
renner E.J. (2020)	Dead/alive	We created the Surveillance Epidemiology of Coronavirus Under Research Exclusion for Inflammatory Bowel	-	-	-	Male	11 (4%)	514 (89%)	Any condition	192 (36.6)	
									Cardiovascular disease (eg, CAD, heart failure, arrhythmia)	38 (7.2)	
									Diabetes	29 (5.5)	
									Lung disease (eg, asthma, COPD)	44 (8.4)	
									Hypertension	63 (12.0)	
									Cancer	10 (1.9)	
									History of stroke	4 (0.8)	

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		Disease (SECURE-IBD) database to monitor outcomes of COVID-19 occurring in pediatric and adult patients with IBD. SECURE-IBD							Chronic renal disease (eg, CKD) Chronic liver disease (eg, PSC, NAFLD, cirrhosis) Other	10 (1.9) 26 (5.0) 53 (10.1)	
Castelnuovo A.D. (2020)	Dead/alive	Data for the present analyses were provided by 30 hospitals distributed throughout Italy. Each hospital provided data	77 Patients were excluded from the analysis because of missing data ()	-	-	Male	469 (19.5%)	-	Hypertension Diabetes Myocardial infarction Heart failure Cancer Lung disease Obesity	461 (23.7) 203 (27.5) 140 (36.1) 165 (38.3) 128 (32.1) 167 (29.6) 69 (18.4)	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		from hospitalised adult (18 years of age) patients who all had a positive test result for the SARSCoV-2 virus at any time during their hospitalisation from February 19th to May 23rd, 2020. The follow-up continued through May 29th, 2020.									
CDC COVID19	ICU/non ICU + non	A total of US states and	-	≥19		-	-	-	Diabetes mellitus Chronic lung	784 (10.9) 656 (9.2)	

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
response team (2020)	hospitalization	territories have reported 122,653 US CPVID-19 cases to CDC, including 7,162 for whom data on underlying health conditions and other known risk factors for severe outcomes from respiratory infections were reported.							disease Cardiovascular disease immunocompromised conditions Chronic renal disease Pregnancy Neurologic disorder, neurodevelopmental, intellectual disability Chronic liver disease Other chronic disease	647 (9.0) 264 (3.7) 213 (3.0) 143 (2.0) 52 (0.7) 41 (0.6) 1,182 (16.5)	
Chand S. (2020)	Dead/alive	Consecutive adult patients aged 18 years	-	60.6	55.6	Male	60.4 (11.9%)	54.1 (11.7%)	None Cirrhosis Diabetes	22 (14) 1 (0.6) 73 (46.5)	35 (24.5) 1 (0.7) 61 (42.7)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		and older admitted to 9 ICUs within the 3 main hospitals comprising Montefiore Medical Center (Bronx, NY) with documented SARS-CoV-2 infection were identified and their electronic medical records manually reviewed for extraction of							Hypertension	115 (73.2)	85 (59.4)
									Asthma	17 (10.8)	22 (15.4)
									Chronic obstructive pulmonary disease	11 (7)	6 (4.2)
									Coronary Artery disease	24 (15.3)	17 (11.9)
									ESRD on hemodialysis	12 (7.6)	4 (2.8)
									CKD	22 (14.0)	17 (11.9)
									HIV	2 (1.3)	3 (2.1)
									Heart Failure with reduced ejection fraction	11 (7)	5 (3.5)
									Heart Failure with preserved ejection fraction	7 (4.5)	1 (0.7)
									Cancer	13 (8.3)	5 (3.5)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		relevant demographic and medical data									
Chen L. (2020)	Dead/alive	Between February 4 and February 18, 2020 persons with clinical symptoms and a lung computed tomography (CT) scan consistent with COVID-19 were diagnosed as having COVID-19 without	Subjects in whom we could not confirm SARS-CoV-2-infection by a qRT-PCR, IgM/IgG assay, or either were excluded from the study	-	-	Female	55 (26%)	870 (53%)	Atherosclerotic cardio and cerebro-vascular disease Hypertension Diabetes COPD Cancer Chronic kidney disease Gastro-intestinal disease Auto-immune disease Psychiatric disorders	63 (30) 104 (50) 59 (28) 12 (6) 17 (8) 20 (10) 16 (8) 1 (1) 1 (1)	205 (12) 475 (29) 203 (12) 49 (3) 52 (3) 25 (2) 82 (5) 9 (1) 6 (0.5)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		confirmation of SARS-CoV-2-infection by quantitative reverse transcript polymerase chain reaction (qRT-PCR). After hospitalization subjects were tested by qRT-PCR to confirm the diagnosis and monitor their course. Beginning 4 March, 2020, anti- SARS-									

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		CoV-2 IgM and/or IgG antibodies were assayed at Union Hospital and Wuhan Central Hospital by the centers to confirm the diagnosis and to evaluate suspected cases of COVID-19 which were qRT-PCR-negative									
Dashti H. (2020)	Dead/alive	The list of investigated and recorded	-	78	62	Female	215 (42.2%)	1616 (47.5%)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		risk markers from medical history of patients varied, which could be due to the complexity and challenges associated with extracting phenotypes from electronic health records (EHR) data were analyzed.									
Grechukhina O.	Severe/non-severe	Subjects were identified	-	30.5	30	Female	6 (-)	135(-)	Pregestational Diabetes	1	6

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
(2020)		using electronic health record. Ambulatory and inpatients testing was included. All pregnant and postpartum women with positive SARS-CoV-2 reverse transcription polymerase chain reaction test between March 3, 2020, and May 11, 2020, from 3 Yale New Haven							Chronic hypertension Heart disease Asthma	2 0 2	12 7 16

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		Health hospitals.									
Gu T. (2020)	ICU/non-ICU Dead	We extracted the EHR data for patients tested for COVID-19 at the University of Michigan Medicine Health System, also known as Michigan Medicine (MM), from March 10, 2020 to April 22, 2020. To understand how selection bias factored	-	47		Male	138(60.8%)	-	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		into our sample, in addition to comparing COVID-19 positive patients with those testing negative, we created two sets of controls from the MM database.									
Guan W (2020)	Severe/non-severe	The medical records for hospitalized patients and outpatients with Laboratory	-	52	45	Female	73 (42.2%)	386 (41.8%)	Any Chronic obstructive pulmonary disease Diabetes Hypertension Coronary heart	67 (38.7) 6 (3.5) 28 (16.2) 41 (23.7)	194 (21.0) 6 (0.6) 53 (5.7) 124 (13.4)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		confirmed COVID-19 were reviewed							disease	10 (5.8)	17 (1.8)
									Cerebrovascular disease	4 (2.3)	11 (1.2)
									Hepatitis B infection	1 (0.6)	22 (2.4)
									Cancer	3 (1.7)	7 (0.8)
									Chronic renal disease	3 (1.7)	5 (0.5)
									Immunodeficiency	0 (0.0)	2 (0.2)
Hu L. (2020)	Severe/non-severe	We analyzed the initial clinical presentation and baseline laboratory test results, as well as clinical course, of 323 hospitalized patients with	-	67	56	Male	91 (53.8%)	75 (49.7%)	Cirrhosis	0 (0)	3 (2)
									Hypertension	66 (38.5)	39 (25.8)
									Diabetes	33 (19.18)	14 (9.3)
									Malignancy	5 (2.90)	0 (0)
									Cerebrovascular disease	3 (1.74)	4 (2.6)
									Chronic obstructive pulmonary disease	6 (1.48)	0 (0)
									Chronic kidney disease	3 (1.74)	4 (2.6)
									Chronic liver		

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		COVID-19 in Wuhan, to identify risk factors associated with clinical outcomes for improving management guidelines.							disease	2 (1.16)	3 (2)
									Cardiovascular and cerebrovascular disease	33 (19.18)	8 (5.3)
									Digestive system disease		
									Endocrine system disease	14 (8.14)	8 (5.3)
									Nervous system disease	11 (6.40)	4 (2.6)
									Respiratory system disease	5 (2.90)	5 (3.3)
										21 (12.21)	8 (5.3)
Huang C (2020)	Severe/non-severe	All patients with suspected 2019-nCoV were admitted to designated hospital in Wuhan.	-	49	49	Male	11 (85%)	19 (68%)	Diabetes mellitus	1 (8)	7 (25)
									Hypertension	2 (15)	4 (14)
									Cardiovascular disease	3 (23)	3 (11)
									Chronic obstructive pulmonary disease	1 (8)	0 (0.0)
									Malignancy		

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		Infection confirmed by real-time RT-PCR and next generation sequencing.							Chronic liver disease	0 (0.0) 0 (0.0)	1 (4) 1 (4)
Kalligeros M. (2020)	ICU/non-ICU	All consecutive adult (≥18 years old) patients who had a laboratory-confirmed (using a reverse transcriptase–polymerase chain reaction assay) SARS-CoV-2 infection and	-	61.5	57	Male	29 (65.9%)	34 (57.6%)	Cancer Chronic renal Cirrhosis Diabetes Heart disease Hypertension Lung disease Transplant	6 (13.6) 4 (9.1) 0 (0) 21 (47.7) 14 (31.8) 31 (70.4) 11 (25.0) 1 (2.2)	3 (5.0) 7 (11.8) 3 (5.0) 17 (28.8) 11 (18.6) 35 (59.3) 9 (15.2) 1 (1.6)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		who were admitted to Rhode Island Hospital, The Miriam Hospital, or Newport Hospital in Rhode Island between February 17 and April 5, 2020, were considered eligible for inclusion									
Kim E.S. (2020)	Severe/non-severe	28 hospitalized patients with confirmed COVID-19. All cases	-	42.6±13.4		Male	15 (53.6)		Diabetes mellitus without complication Asthma Liver disease, mild Malignancy	2 (7.1) 1 (3.6) 1 (3.6) 1 (3.6)	

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		confirmed by real-time polymerase chain reaction.							Obesity (Body mass index > 30kg/m^2)	5 (17.9)	
Kishaba T. (2020)	Dead/alive	Data from critical COVID-19 pneumonia patients at the Okinawa Chubu Hospital who required mechanical ventilation were used.	-	75	73	Male	2	3	-	-	-
Klang E. (2020)	Dead/alive	We retrospective analyzed data (in younger or	-	≤ 50		Male	45 (75.0%)	352 (68.8%)	Coronary artery disease Heart failure Hypertension	6 (10) 10 (16.7) 24 (40.0)	26 (5.1) 25 (4.9) 151 (29.5)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		older than 50) from a large academic hospital system in New York city between March 1st and May 17th, 2020. Data were extracted from electronics medical records.							Diabetes Hyperlipidemia Chronic kidney disease Cancer	24 (40.0) 11 (18.3) 17 (28.3) 9 (15.0)	129 (25.2) 63 (12.3) 53 (10.4) 30 (5.9)
Langer-Gould A. (2020)	Dead/alive	Patients treated with tocilizumab or anakinra were confirmed by electronic databases.	Patients were excluded if they received tocilizumab or	61.9	58.1	Male	27 (81.8)	37 (77.1)	Obesity Diabetes Hypertension Asthma/COPD	19 18 26 2	36 27 32 7

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		COVID19-CS was defined clinically by increasing O2 requirements and bilateral infiltrates on chest X-ray or CT.	anakinra for other indication, the dose and/or duration of treatment were not inadequet and not related to adverse even.								
Li X. (2020)	Severe/non-severe	All case with COVID-19 enrolled in this study were diagnosed on the basis of WHO interim		65	56	Male	153(56.9%)	126 (45.2%)	Chronic obstructive pulmonary disease	13 (4.8)	4 (1.4)
									Asthma	3 (1.1)	2 (0.7)
									Tuberculosis	4 (1.5)	5 (1.8)
									Diabetes mellitus	52 (19.3)	31 (11.1)
									Hypertension	104 (38.7)	62 (22.2)
									Coronary heart	28 (10.4)	6 (2.2)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		guidance and the diagnostic and treatment guideline for COVID-19 by the Chinese National Health Committee. (version 5)							disease Hepatitis B Chronic kidney disease Tumor	 2 (0.7) 6 (2.2) 14 (5.5)	 3 (1.1) 4 (1.4) 10 (3.9)
Li YK. (2020)	Severe/non-severe	25 cases of COVID-19 (including; 13 hospitalized patients and 12 health care staff) were enrolled in the study. All of them had traceable positive	-	51		Male	6 (66.67%)	6 (37.5%)	Hypertension Diabetes Chronic obstructive pulmonary disease Coronary heart disease	1 1 4 1	1 0 1 3
	Dead/alive						4 (80.0%)	8 (40%)	Hypertension Diabetes	1 1	1 0

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		exposure history, with a spatiotemporal correlation of close contact and health care staff.							Chronic obstructive pulmonary disease	3	2
									Coronary heart disease	1	3
Liu D. (2020)	Dead/alive	We carefully monitored reports of patients infected with COVID-19 on Weibo between January 20 and February 15, 2020, and confirmed case by the follow up	-	72	61	Female	31 (37.3)	243 (47.6)	Hypertension	8 (9.8)	79 (15.5)
									Diabetes	8 (9.8)	49 (9.6)
									Chronic heart disease	9 (11.0)	61 (12.0)
									Chronic lung disease	3 (3.7)	22 (4.3)
									Cerebrovascular disease	2 (2.4)	13 (2.5)
									Chronic kidney disease	2 (2.4)	26 (5.1)
									Chronic liver disease	14 (2.4)	0 0()
									Chronic respiratory disease	1 (1.2)	11 (2.2)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		telephone call. 1 month later, we checked the clinical outcomes of patients and other acquired information. Only patients who had a defined outcome (died or recovered) were included in the study.							Cancer	1 (1.2)	16 (3.1)
Liu J. (2020)	Severe/non-severe	40 confirmed COVID-19 were enrolled. All medical records information was obtained.	-	59.7±10.1	43.2±13.9	Male	7 (53.8%)	8 (29.6%)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
Monteiro A.C. (2020)	Severe/non-severe	Hospitalized patients at RR-UCLA and SM-UCLA > 18 years old with positive SARS-CoV-2 PCR testing from either nasal swab or mini-bronchoalveolar lavage (BAL) testing were included. Data for patients who tested positive for SARS-CoV-2 was manually	-	58	64	Male	19 (68%)	55 (65%)	Obesity	17 (61)	23 (27)
									Hypertension	17 (61)	39 (46)
									Diabetes	19 (68)	53 (63)
									Chronic obstructive pulmonary disease	2 (7)	4 (5)
									Coronary artery disease	3 (11)	14 (17)
									Cancer	2 (7)	13 (15)
									Asthma	4 (14)	9 (11)
									Atrial fibrillation	1 (4)	10 (12)
									Chronic kidney disease	3 (11)	16 (19)
									Transplant recipient	1 (4)	6 (7)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		extracted from the electronic health record and included in a database.									
Parra-Bracamonte G. M. (2020)	Dead/alive	Information from 475 monitoring units all along the country from the public and private health sectors. Positive cases were extracted and edited. Data from 331,298 patients diagnosed positively to	-	-	-	Male	25015 (65.3%)	153137 (52.3%)	Hypertension Obesity Diabetes Cardiopathy Chronic obstructive pulmonary disease Asthma Immunosuppressed Chronic kidney disease	16,409 (42.8) 9504 (24.8) 14,295 (37.3) 2037 (5.3) 1839 (4.8) 777 (2.0) 1061 (2.8) 2588 (6.8)	49,761 (17.0) 53,955 (18.4) 39,417 (13.5) 5314 (1.8) 3619 (1.2) 8206 (2.8) 3135 (1.1) 4307 (1.5)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		COVID-19, from the first positive case registered on January 13 to July 17, 2020 (database accessed in July 18, 2020), were analyzed									
Shi Y. (2020)	Severe/non-severe	487 patients in Zhejiang Province of China were reviewed medical records, laboratory findings, and pulmonary CT scan with		56	45	Male	36 (73.5%)	223 (50.9%)	Hypertension Diabetes Cardiovascular disease Malignancy Chronic liver disease Chronic renal disease Others	26 (53.1) 7 (14.3) 4 (8.2) 2 (4.1) 2 (4.1) 2 (4.1) 5 (10.2)	73 (16.7) 22 (5.0) 7 (1.6) 3 (0.7) 20 (4.6) 5 (1.1) 27 (6.1)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		COVID-19.									
Sun DW. (2020)	Severe/non-severe	Patients included in this study were 2019-nCoV positive based on nucleic acid detection, from the intensive care unit (ICU) of Tongji hospital affiliated to Huazhong University of Science and Technology. The primary cohort included 45	-	67	61	Male	24 (53.33%)	5 (41.67%)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		cases of severe type, who were admitted by our assisting team initially on 10th Feb 2020, serving as study group. 12 cases of no-severe type were admitted into this first-aiding hospital by our team on 8th Mar 2020, serving as control group.									
Torres-Macho J.	Dead/alive	The study population	-	82	63	Male	222 (68.7%)	882 (54%)	Chronic Heart Disease	132 (41.2)	283 (17.8)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
(2020)		comprised all patients admitted to hospital with a confirmed diagnosis of COVID-19 based on a positive result in the SARS-CoV-2 reverse transcriptase-polymerase chain reaction assay between 2nd March and 31st May 2020. Samples were obtained via nasopharyngeal swabs.							Hypertension	226 (70.6)	765 (48)
									Chronic Pulmonary Disease	69 (21.8)	169 (10.7)
									Asthma		
									Stage 4 Chronic Kidney Disease	18 (5.6)	138 (8.7)
									Liver Cirrhosis	42 (13.2)	68 (4.3)
									Solid Neoplasm (Active)	9 (2.8)	22 (1.4)
									Hematologic Neoplasm (Active)	39 (12.3)	42 (2.6)
									HIV Infection	13 (4)	21 (1.3)
									Obesity	0 (0)	11 (0.7)
									Diabetes	45 (17.3)	239 (17.8)
									Dyslipidemia	99 (31)	337 (21.2)
									Inflammatory Disease	97 (53.6)	347 (33.8)
									Dementia	25 (7.8)	74 (4.7)
									Malnutrition	37 (11.7)	71 (4.5)
										14 (5.2)	26 (1.8)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
Wang R. (2020)	Severe/non-severe	Patients who were diagnosed with COVID-19 at No.2 hospital were enrolled in the study. These patients confirmed by a positive result for real-time RT-PCR in the respiratory tract samples.		49.40±13.64	39.47±14.84	Male	16 (64%)	55 (55%)	Cardiovascular disease	18 (14.4)	
									Digestive system disease	8 (6.4)	
									Endocrine system disease	10 (8.0)	
									Rheumatic immune disease	1 (0.8)	
									Respiratory system disease	2 (1.6)	
									Hematological system disease	1 (0.8)	
									Nervous system disease	1 (0.8)	
									Malignant tumor	1 (0.8)	
									HIV infection	1 (0.8)	
Yang X. (2020)	Dead/alive	Patients were diagnosed as SARS-pneumonia, according to WHO interim	-	64.6	51.9	Male	21 (66%)	14 (70%)	Chronic cardiac disease	3 (9)	2 (10)
									Chronic pulmonary disease	2 (6)	2 (10)
									Cerebrovascular disease	7 (22)	0

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		guidance and who were critically ill.							Diabetes	7 (22)	2 (10)
									Malignancy	1 (3)	1 (5)
									Dementia	1 (3)	0
									Malnutrition	0	0
Yu Q. (2020)	Severe/non-severe	We enrolled patients with laboratory-confirmed COVID-19 in Jiangsu province between 10 January and 18 February 2020. Laboratory confirmation was based on a positive result on high-throughput	We excluded patients aged < 18 years old or with missing clinical or CT records on admission.	57.2	45.0	Male	41 (64)	183 (51)	Hypertension	20(31)	50(14)
									Coronary heart disease	4(6)	3(1)
									Cardiac dysfunction III-IV	1(2)	1(0.3)
									Liver dysfunctionb	1(2)	1(0.3)
									Diabetes	9(14)	17(5)
									Chronic kidney disease	1(2)	3(2)
									Malignant tumor	1(2)	4(1)
									Stoke	1(2)	2(0.6)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		sequencing or real-time reverse-transcriptase–polymerase-chain-reaction (RT-PCR) assay of nasal and pharyngeal swab specimens.									
Yu T. (2020)	Severe/non-severe	95 infected COVID-19 were enrolled. Diagnostic standard was polymerase chain reaction detection of target genes 2019 n-CoV.	-	45.92	35.73	Male	14 (58.3)	39 (54.9)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		Clinical, laboratories, radiologic results, and treatment outcomes data were obtained.									
Zhan T. (2020)	Severe/non-severe	This study included all hospitalized patients who were admitted to the Third Hospital of Wuhan (one of the designated facilities for hospitalization of patients with COVID-	-	64	52	Male	73 (49.3%)	113 (43.9%)	-	-	-

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		19) from 12 January to 8 March 2020 and diag- nosed with COVID-19 according to a pos- itive result of high- throughput sequencing or real-time reverse- transcriptase polymerase chain reaction assay using nasal or pharyngeal swab specimens.									
Zhang JJ.	Severe/non-	All 242	Patients	64	51.5	Male	33 (56.9%)	38 (46.3%)	Hypertension	22 (37.9)	20 (24.4)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
(2020)	severe	hospitalized patients in a hospital of Wuhan, clinically diagnosed as "viral pneumonia" based on their clinical symptoms with typical changes in chest radiology and were living in Wuhan during the outbreak period of COVID-19.	absent of or with negative SARS-CoV-2 test results were excluded from this study.						Diabetes	8 (13.8)	9 (11.0)
									Fatty liver and abnormal liver function	4 (6.9)	4 (5.0)
									Chronic gastritis and gastric ulcer	2 (3.4)	5 (6.1)
									Coronary heart disease	4 (6.9)	3 (3.7)
									Hyperlipidemia	2 (3.4)	5 (6.1)
									Cholelithiasis	4 (6.9)	2 (2.4)
									Arrhythmia	4 (6.9)	1 (1.2)
									Thyroid disease	4 (6.9)	1 (1.2)
									Electrolyte imbalance	4 (6.9)	0
									Urolithiasis	1 (1.7)	2 (2.4)
									Stroke	2 (3.4)	1 (1.2)
									Chronic renal insufficiency	2 (3.4)	0
									Aorta sclerosis	1 (1.7)	1 (1.2)
									Secondary pulmonary tuberculosis	2 (3.4)	0

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
									Chronic obstructive pulmonary disease	2 (3.4)	0
Zhao Z. (2020)	Severe/non-severe	Hospitalized patients who were diagnosed by positive RT-PCR for SARS-CoV-2 were included in this study.	Patients who were still hospitalized because their outcomes unknown at the time, thus risking grouping them incorrectly. Patients who were younger than 18	60	58	Male	136 (69.7%)	222 (55.8%)	Diabetes	58 (29.7)	104 (26.1)
									Hypertension	96 (49.2)	170 (42.7)
									Asthma	16 (8.2)	25 (6.3)
									COPD	11 (5.6)	25 (6.3)
									Coronary artery disease	22 (11.3)	46 (11.6)
									Heart failure	10 (5.1)	10 (2.5)
									Cancer	9 (4.6)	25 (6.3)
									Immunosuppression	12 (6.2)	22 (5.5)
									Chronic Kidney disease	16 (8.2)	28 (7.1)
	Dead/alive			77	58	Male	53 (64.6%)	222 (55.8%)	Diabetes	25 (30.5)	104 (26.1)
									Hypertension	52 (63.4)	170 (42.7)
									Asthma	3 (3.7)	25 (6.3)
									COPD	15 (18.3)	25 (6.3)
									Coronary artery disease	25 (30.5)	46 (11.6)

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
			years of age, and those with incomplete past medical history were also excluded.						Heart failure Cancer Immunosuppression Chronic Kidney disease	22 (26.8) 7 (8.5) 8 (9.8) 14 (17.1)	10 (2.5) 25 (6.3) 22 (5.5) 28 (7.1)
Zheng Y. (2020)	Severe/non-severe	73 patients diagnosed with COVID -19 in Taihe hospital were identified as the research subjects. Epidemiological history, clinical manifestation, imaging	-	43		Male	40 (54.8%)		Cardiovascular disease Endocrine disease Respiratory disease Digestive system disease Malignant tumor Other	12 (16.4) 4 (5.5) 4 (5.5) 3 (4.1) 1 (1.4) 8 (11.0)	

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		detection and Q-PCR of the respiratory specimens as tools to confirm positive cases.									
Zhou F. (2020)	Dead/alive	All adult inpatients ≥ 18 years old with laboratory confirmed COVID-19 were enrolled in the study.	-	69	52	Male	38 (70%)	81 (59%)	Hypertension Diabetes mellitus Coronary heart disease Chronic obstructive pulmonary disease Carcinoma Chronic kidney disease Other	26 (48) 17 (31) 13 (24) 4 (7) 0 (0.0) 2 (4) 11 (20)	32 (23) 19 (14) 2 (1) 2 (1) 2 (1) 0 (0.0) 11 (8)
Zinellu (2020)	Dead/alive	105 consecutive	-	79.5	68	Male	20 (71.4%)	27 (54%)	Cardiovascular disease	6	40

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		COVID-19 patients admitted to the Respiratory Disease and Infectious Disease Units of the University Hospital of Sassari and the Pneumology Unit of the Santissima Trinità Hospital of Cagliari, Sardinia, Italy, between 15 March and							Respiratory disease Kidney disease Diabetes Cancer Autoimmunity	20 25 21 24 27	62 65 62 65 72

Author, Year	Outcomes	Criteria		Age of participants (years old)		Sex of participants			Comorbidity of participants		
		Inclusion	Exclusion	Interventions	Comparators	Sex	Interventions	Comparators	Diseases	Interventions (%)	Comparators (%)
		15 May 2020. COVID-19 was confirmed by reverse transcription-polymerase chain reaction (RT-PCR) in all cases									

Table S5. Meta-regression analysis of the heterogeneous findings

Moderator	Outcome: Severe			Outcome: Dead		
	OR	95% CI	p-value	OR	95% CI	p-value
Hypertension	1.31	0.48-3.55	0.579	1.22	0.67-2.20	0.492
Diabetes Mellitus	0.55	0.20-1.53	0.232	0.99	0.62-1.60	0.973
Age over 65 years [a]	NA	NA	NA	1.00	0.57-1.74	0.998

OR, Odds ratio; 95% CI, 95% confidence interval; NA, not available
[a] reference was age less than 65 years

Table S6. Excluded studies

Reference	Reason for exclusion	Reference	Reason for exclusion
Abate B.B.[1]	Other study design	Münzel T.[2]	Other study design
Abohamr S.I.[3]	Other study design	Nasrolahi A.[4]	Other study design
Abohamr S.I.[5]	Duplicates participants	Naziroğlu T.[6]	Other study design
Abrams E.M.[7]	Other study design	Onisoyonivosekume D.[8]	Other study design
Acheampong D.O.[9]	Other study design	Pan J.[10]	Inappropriate outcomes
Adrish M.[11]	Inappropriate outcomes	Patanavanich R.[12]	Other study design
Aksu K.[13]	Inappropriate comparison	Patel U.[14]	Other study design
Alguwaihes A.M.[15]	Inappropriate comparison	Patterson T.J.[16]	Other study design
Almalki Z.S.[17]	Inappropriate outcomes	Pettigrew S.[18]	Inappropriate outcomes
Alomari S.O.[19]	Inappropriate outcomes	Polverino F.[20]	Inappropriate outcomes
Andreu-Mondon M.[21]	Other study design	Popova L.[22]	Other study design
Balaban Kocas B.[23]	Inappropriate outcomes	Purkayastha A.[24]	Inappropriate outcomes
Baldock T.E.[25]	Other study design	Radwan N.M.[26]	Other study design
Barlow P.[27]	Other study design	Risso D.[28]	Inappropriate outcomes
Best J.H.[29]	Inappropriate comparison	Rodriguez J.A.[30]	Other study design
Brendish N.J.[31]	Inappropriate outcomes	Rodriguez-Leor O.[32]	Inappropriate comparison
Castillo-López I.Y.[33]	Other study design	Salah H.M.[34]	Other study design
Chene G.[35]	Other study design	Scholz J.R.[36]	Other study design
Colaneri M.[37]	Inappropriate comparison	Schultze A.[38]	Inappropriate comparison
Costantino F.[39]	Inappropriate outcomes	Seiler N.K.[40]	Inappropriate comparison
Crisan-Dabija R.[41]	Other study design	Shahzad Hasan S.[42]	Other study design
Di Lecce V.[43]	Inappropriate outcomes	Sharma P.[44]	Inappropriate outcomes
Di Vincenzo A.[45]	Other study design	Shastri M.D.[46]	Other study design
Dorjee K.[47]	Other study design	Shatla M.M.[48]	Inappropriate outcomes
Dratcu L.[49]	Other study design	Shoar S.[50]	Other study design
Feyaerts A.F.[51]	Other study design	Shukla S.D.[52]	Inappropriate comparison
Fillmore N.R.[53]	Inappropriate comparison	Siddiqi K.[54]	Other study design
Fisman D.N.[55]	Inappropriate comparison	Sifat A.E.[56]	Other study design
Gaiha S.M.[57]	Inappropriate outcomes	Simons D.[58]	Other study design

Reference	Reason for exclusion	Reference	Reason for exclusion
Gallo O.[59]	Other study design	Sims O.T.[60]	Inappropriate outcomes
Gandhi S.A.[61]	Other study design	Sinclair R.G.[62]	Inappropriate comparison
Ghinai I.[63]	Inappropriate outcomes	Singh S.[64]	Other study design
González-Rubio J.[65]	Other study design	Soule E.K.[66]	Inappropriate outcomes
Grover S.[67]	Other study design	Streck J.M.[68]	Inappropriate comparison
Gu T.[69]	Duplicates participants	Takagi H.[70]	Other study design
Gupta A.K.[71]	Other study design	Talavera B.[72]	Inappropriate outcomes
Hashmi S.K.[73]	Other study design	Toussie D.[74]	Inappropriate comparison
He S.[75]	Inappropriate comparison	Tran T.V.[76]	Inappropriate comparison
Holman N.[77]	Inappropriate comparison	Tzu-Hsuan Chen D.[78]	Inappropriate outcomes
Horii T.[79]	Other study design	Underner M.[80]	Other study design
Hu J.[81]	Inappropriate outcomes	Urigo C.[82]	Other study design
Ieng S.M.[83]	Inappropriate comparison	Uvais N.A.[84]	Other study design
Ioannidis J.[85]	Other study design	Veldtman G.R.[86]	Inappropriate outcomes
Islam M.Z.[87]	Inappropriate comparison	Vila-Córcoles A.[88]	Inappropriate comparison
Izquierdo J.L.[89]	Inappropriate comparison	Volino-Souza M.[90]	Inappropriate comparison
Jourdes A.[91]	Inappropriate comparison	Vuolo M.[92]	Inappropriate outcomes
Landoni G.[93]	Other study design	Wang Z.[94]	Inappropriate comparison
Lang A.E.[95]	Other study design	Wenzl T.[96]	Other study design
Lang A.E.[97]	Other study design	Xiang J.[98]	Inappropriate comparison
Li J.[99]	Other study design	Xiong G.L.[100]	Inappropriate outcomes
Liu J.[101]	Inappropriate outcomes	Yue L.[102]	Other study design
Lu J.[103]	Inappropriate outcomes	Zajacova A.[104]	Other study design
Marvisi M.[105]	Inappropriate comparison	Zayet S.[106]	Other study design
McRobbie H.[107]	Other study design	Zeng L.[108]	Other study design
Meini S.[109]	Inappropriate comparison	Zhao Q.[110]	Other study design
Mesas A.E.[111]	Other study design	Zhou W.[112]	Inappropriate outcomes

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Figures

Figure S1. Funnel plot of included studies (Severity; all age group, and ≤ 65 years old)
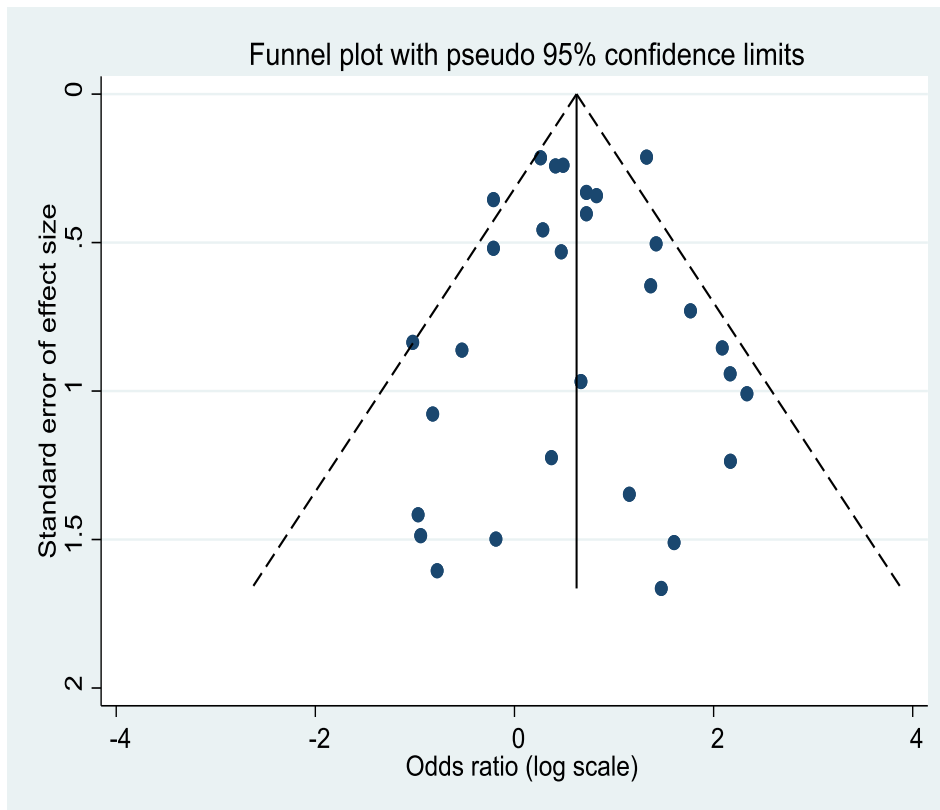
Figure S2. The graph from Egger's test of included studies in the meta-analysis (Severity; all age group, and ≤ 65 years old)
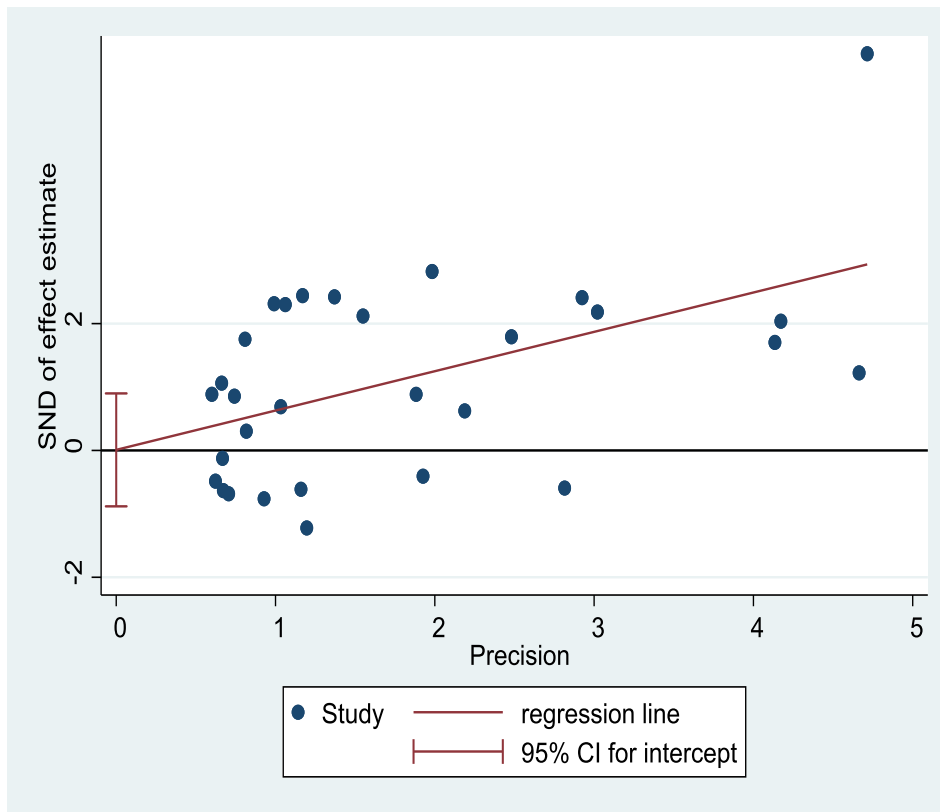
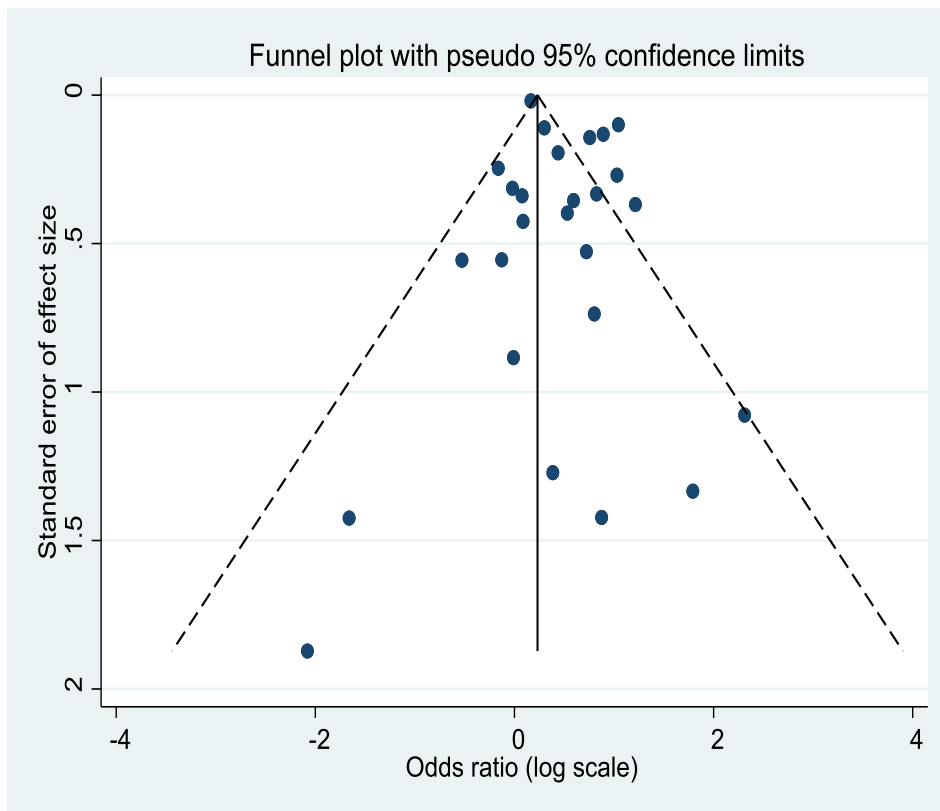**Figure S3.** Funnel plot of included studies (Dead; all age group)

Funnel plot with pseudo 95% confidence limits

Figure S4. The graph from Egger's test of included studies in the meta-analysis (Dead; all age group)

Figure S5. Funnel plot of included studies (Dead; ≤65 years old)
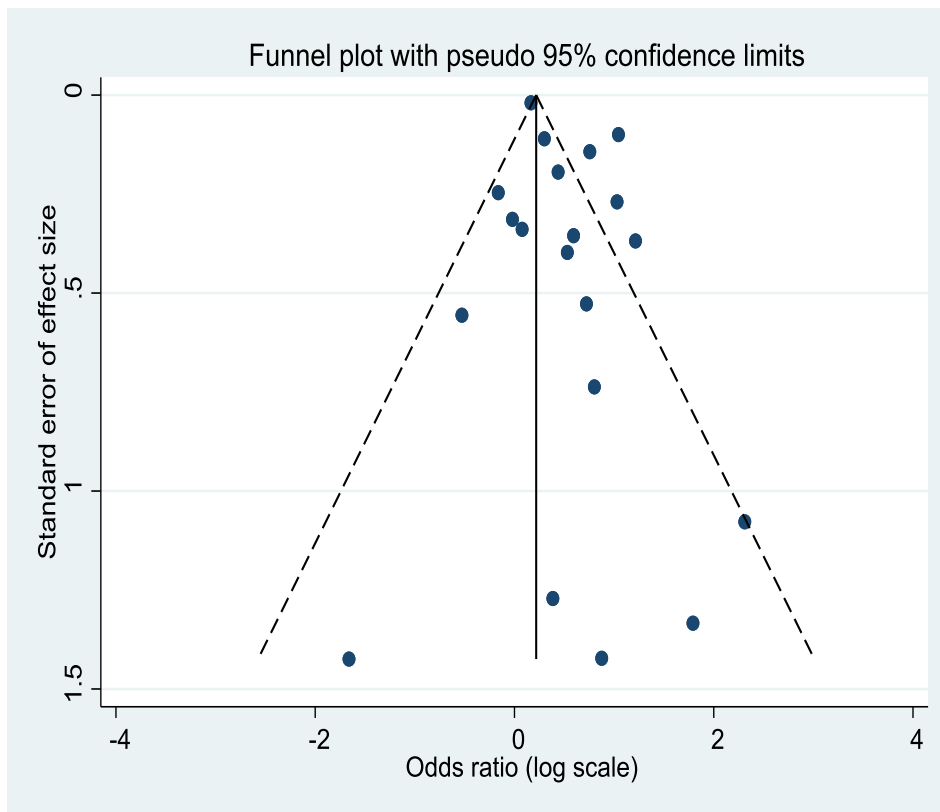
Figure S6. The graph from Egger's test of included studies in the meta-analysis (Dead; ≤65 years old)