

Supplementary Materials

Who should be prioritized for COVID-19 vaccination in China? A descriptive study

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Table S1. Characteristics of systematic reviews for persons at high risk of severe outcome of COVID-19

No.	Author	Title	Journal	Published date	Database	End date of included articles	Papers included in meta-analysis	Sample size included in meta-analysis	Rating scale	Quality of included articles
1	Zheng Z, Peng F, Xu B ¹	Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis	J Infect	2020/4/23	Pubmed, Embase, Web of Science, and CNKI	2020/3/20	13	3027	MINORS	The global ideal score being 24 for comparative studies. None of the studies was considered to be seriously flawed according to the MINORS assessment. The 13 included studies scored between 18 and 21. All studies were considered to have a low risk of bias for selection.
2	Singh AK, Gillies CL, Singh R ²	Prevalence of comorbidities and their association with mortality in patients with COVID-19: A Systematic Review and Meta-analysis	Diabetes Obes Metab	2020/6/23	Medline, Scopus and the World Health Organisation (WHO) website	2020/4/23	18	14,558	NOS	All studies scored at least seven, with the majority scoring eight

3	Wang X, Fang X, Cai Z ³	Comorbid Chronic Diseases and Acute Organ Injuries Are Strongly Correlated with Disease Severity and Mortality among COVID-19 Patients: A Systemic Review and Meta-Analysis	Research	2020/4/19	PubMed, Embase, Web of Science, medRxiv, and bioRxiv	2020/4/6	34	6,263	No	
4	Taylor E, Hofmeyr R, Torborg A ⁴	Risk factors and interventions associated with mortality or survival in adult covid-19 patients admitted to critical care: A systematic review and meta-analysis	South Afr J Anaesth Analg		MEDLINE (PubMed), CINAHL (via EBSCOHOST) Scopus (including Embase), Web of Science (all databases), Cochrane Central Register of Controlled Trials, and Proquest	2020/4/7	9	1853	mNOS	Overall, one study was of a high methodological quality with a score of 7 stars. The remaining eight included studies were considered to be of low methodological quality.

5	Wang B, Li R, Lu Z ⁵	Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis	Aging-US	2020/4/8	PubMed, Cochrane Library, Embase, Springer, Web of Science	2020/3/1	6	1558	NOS	All articles are of high quality because of NOS score no less than 6
6	Jain V, Yuan JM ⁶	Predictive symptoms and comorbidities for severe COVID-19 and intensive care unit admission: a systematic review and meta-analysis	Int J Public Health	2020/5/25	MEDLINE, EMBASE and Global Health	2020/3/5	7	1813	STROBE	Each paper was assigned an overall quality score based on the percentage of STROBE checklist criteria met (< 55% = -, 55–65% = +, > 65% = ++). Four articles are +, one is -, and two are ++.
7	Giannakoulis VG, Papoutsis E, Siempos I ⁷	Effect of cancer on clinical outcomes of patients with COVID-19: A meta-analysis of patient data	JCO Glob Oncol	2020/6/8	PubMed, medRxiv, COVID-19 Open Research Dataset (CORD-19)	2020/4/27	32	46499	Tool to Assess Risk of Bias in Cohort Studies	Five of the articles are low risk of bias
8	Tian, W, Jiang, W, Yao J ⁸	Predictors of mortality in hospitalized COVID-19 patients: A	J Med Virol	2020/5/22	PubMed, Google scholar, Web of Science, CNKI	2020/4/24	14	4659	AHRQ	8 is high, 5 is moderate, 1 is low

		systematic review and meta-analysis								
9	Li J, He X, Yuan Y ⁹	Meta-analysis investigating the relationship between clinical features, outcomes, and severity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia	Am J Infect Control	2020/6/12	PubMed, Embase, Cochrane Library, medRxiv	2020/4/14	12	2445	NOS	All articles are no less than 6
10	Wu Z, Tang Y, Cheng Q ¹⁰	Diabetes increases the mortality of patients with COVID-19: a meta-analysis	Acta Diabetol	2020/6/24	Medline via PubMed, EMBASE, Web of Science	2020/4/14	9	1471	NOS	All articles are of high quality because NOS score was no less than 6.
11	Xu L, Mao Y, Chen G ¹¹	Risk factors for 2019 novel coronavirus disease (COVID-19) patients progressing to critical illness: a systematic review and meta-analysis	Aging-US	2020/6/23	CNKI, Wanfang Database, Weipu Database, Chinese Biomedicine	2020/3/8	20	4062	AHRQ	All studies contained complete data sources, inclusion and exclusion criteria, and reasonable control of confounding factors. Nonetheless, only a few studies reported their quality control and management of missing data

					Literature Database (CBM-SinoMed), PubMed, Embase, Cochrane Central Register and Web of Science					
12	Ssentongo P, Ssentongo AE, Heilbrunn ES ¹²	The association of cardiovascular disease and other pre-existing comorbidities with COVID-19 mortality: A systematic review and meta-analysis	medRxiv	2020/5/23	MEDLINE, OVID, SCOPUS, medrxiv.org	2020/5/1	19	61,455	NOS	The median study quality score for studies was 9 out of 9, range=6-9
13	Bellou V, Tzoulaki I, Evangelou E ¹³	Risk factors for adverse clinical outcomes in patients with COVID-19: A systematic review and meta-analysis	medRxiv	2020/5/19	PubMed	2020/4/19	88	more than 1000	No	

14	Rahman A, Sathi NJ ¹⁴	Risk factors of the severity of COVID-19: A meta-analysis	medRxiv	2020/5/10	PubMed, Google Scholar, EMBASE, and Cochrane Library	2020/4/18	10	2272	No	
15	Khan M, Khan MN, Mustagir MG ¹⁵	Effects of underlying morbidities on the occurrence of deaths in COVID-19 patients: A systematic review and meta-analysis	medRxiv	2020/5/17	Medline, Web of Science, Scopus, CINAHL; reference list of the selected studies, relevant journal websites, and renowned pre-print servers (medRxiv, bioRxiv, SSRN)	2020/5/1	42	39,398	NOS	1 study scored 9, 13 studies scored 8, 11 studies scored 7, 13 studies scored 6, 4 studies scored 5

16	Soeroto AY, Soetedjo NN, Purwiga A ¹⁶	Association of BMI and Obesity with Composite poor outcome in COVID-19 adult patients A Systematic Review and Meta-Analysis	medRxiv	2020/6/29	PubMed,Em base	2020/5/4	9	1817	No	
17	Liu Y, Zhang Z, Pan X ¹⁷	The chronic kidney disease and acute kidney injury involvement in COVID-19 pandemic: A systematic review and meta-analysis	medRxiv	2020/5/2	PubMed, medRxiv, CNKI, WanFang	2020/4/13	36	6395	NOS	The NOS scores \geq 6 were considered high quality studies. The majority of included studies were poor quality except four studies whose NOS scores are 6. The NOS scores of other 31 trials are 5, and only one trial's NOS scores were 4.
18	Matsushita K, Ding N, Kou M ¹⁸	The relationship of COVID-19 severity with cardiovascular disease and its traditional risk factors: A systematic review and meta-analysis	medRxiv	2020/4/28	PubMed, Embase	2020/4/3	25	76638	NOS	The NOS score for cohorts studies ranges from 0 to 9;a score greater than 6 was considered high-quality.Most of these publications were considered high quality
19	Tabrizi R, Lankarani KB,	The role of comorbidities and clinical predictors of severe disease in	medRxiv		PubMed, Scopus, EMBASE, Web of	2020/3/12	17	3921	NOS	We considered the quality assessment threshold with a NOS scored \geq 7 being defined as good quality. Most paper's NOS score is over 5, except one paper.

	Nowrouzi-sohrabi P ¹⁹	COVID-19: a systematic review and meta-analysis			Science, Google Scholar					
20	Dorjee K, Kim H ²⁰	Epidemiological risk factors associated with death and severe disease in patients suffering from COVID-19: A comprehensive systematic review and meta-analysis	medRxiv	2020/6/20	Medline, Embase, Web of Science and the WHO COVID-19 database	2020/5/22	44	20594	NOS	
21	Hessami A, Shamshirian A, Heydari K ²¹	Cardiovascular diseases and COVID-19 mortality and intensive care unit admission: A systematic review and meta-analysis	medRxiv	2020/4/16	PubMed, Embase, Cochrane Library, Scopus, Web of Science, medRxiv, Science Direct search engine, journal websites	2020/3/31	16	3473	NOS	According to NOS tool for quality assessment, 16 studies earned the minimum eligibility score and entered into the meta-analysis for primary outcomes

22	Chen Y, Gong X, Wang L ²²	Effects of hypertension, diabetes and coronary heart disease on COVID-19 diseases severity: a systematic review and meta-analysis	medRxiv	2020/3/30	PubMed, Web of Science, China National Knowledge Infrastructure, WanFang and VIP	2020/3/6	9	1936	NOS	Except for 1 scored 5 points, other studies scored 6 points and above.
23	Parohan M, Yaghoubi S, Seraji A ²³	Risk factors for mortality in patients with Coronavirus disease 2019 (COVID-19) infection: a systematic review and meta-analysis of observational studies	Aging Male	2020/6/8	Web of Science, PubMed, Scopus, Cochrane Library and Google scholar	2020/5/1	14	31,354	NOS	In the present study, articles with the NOS score of 5 were considered as high quality publications
24	Ma C, Gu J, Hou P ²⁴	Incidence, clinical characteristics and prognostic factor of patients with COVID-19 a systematic review and meta-analysis	medRxiv	2020/3/20	PubMed, the Web of Science Core Collection, Embase, Cochrane	2020/2/19	30	53000	AHRQ	6 studies scored 10, 12 study scored 9, 5 studies scored 8, 3 studies scored 7, 3 studies scored 6, 1 study scored 5

					and MedRxiv					
25	Palaiodimos L, Chamorro-Pareja N, Karamanis D ²⁵	Diabetes is associated with increased risk for in-hospital mortality in patients with COVID-19 a systematic review and meta-analysis comprising 18,506 patients	medRxiv	2020/5/28	Medline, Embase, Google Scholar, and medRxiv	2020/5/10	14	18,506	QUIPS	No suggestive of publication bias
26	Jutzeler CR, Bourguignon L, Weis CV ²⁶	Comorbidities, clinical signs and symptoms, laboratory findings, imaging features, treatment strategies, and outcomes in adult and pediatric patients with COVID-19 A systematic review and meta-analysis	Travel Med Infect Dis	2020/8/4	EMBASE, PubMed/Medline, Scopus, and Web of Science	2020/3/28	148	12,149	No	
27	Islam MS, Barek MA, Aziz MA ²⁷	Association of age, sex, comorbidities, and clinical	medRxiv	2020/5/26	PubMed, ScienceDirect, SAGE	2020/5/17	85	67,299	NOS	only two studies being of moderate quality (score 5), others were of high quality (score ranges between 6-8)

		symptoms with the severity and mortality of COVID-19 cases a meta-analysis with 85 studies and 67299 cases								
28	Zaki N, Mohamed EA, Ibrahim S ²⁸	The influence of comorbidity on the severity of COVID-19 disease systematic review and analysis	medRxiv	2020/6/20	COVID-19 Open Research Dataset (CORD-19),PubMed, Europe PMC, and Google Scholar	2020/5/20	12	4101	No	
29	Cao G, Li P, Cheng Y ²⁹	A Risk Prediction Model for Evaluating the disease progression of COVID-19 pneumonia based on Meta-analysis and 214 Clinical Cases	SSRN		PubMed, Web of Science, and CNKI	2020/3/18	32	6061	NOS	no publication bias exists

30	Salunke AA, Nandy K, Pathak SK ³⁰	Coronavirus disease (COVID-19) in Cancer patients: A systematic review and Meta Analysis to evaluate severity and fatal outcomes	SSRN		PubMed, Cochrane Central Register of Clinical Trials	2020/4/16	13	3775	NOS	
31	Sreenivasan J, Khan MS, Anker SD ³¹	Cardiovascular Risk Factors and Complications in Patients Infected with COVID-19: A Systematic Review	SSRN		MEDLINE, SCOPUS and EMBASE	2020/3/30	10	1,427	New Castle Ottawa Scale	The majority of the studies had moderate-to-high risk of bias because of retrospective study design and lack of extended follow up
32	Biswas M, Rahaman S, Biswas TK ³²	Effects of Sex, Age and Comorbidities on the Risk of Infection and Death Associated with COVID-19: A Meta-Analysis of 47807 Confirmed Cases	SSRN		PubMed, Cochrane Library and Scinapse, important journal websites (New England Journal of Medicine; Journal of American	2020/3/24	21	47,807	NOS	The quality of the majority of included studies as assessed by the Newcastle Ottawa scale was of high quality (score ranges etween 6-8) with only one study was of moderate quality (score 5)

					Medical Association; Lancet; Nature; British Medical Journal					
33	Kumar A, Arora A, Sharma P ³³	Clinical Features of COVID-19 and Factors Associated with Severe Clinical Course: A Systematic Review and Meta-analysis	SSRN	2020/4/21	PubMed	2020/3/17	21	3496	the National Institute of Health (NIH) tools	all the included studies were of good quality.
34	Aggarwal G, Cheruiyot I, Aggarwal S ³⁴	Association of Cardiovascular Disease With Coronavirus Disease 2019 (COVID-19) Severity: A Meta-Analysis	Curr Probl Cardiol	2020/5/14	Pubmed, Embase, and Cochrane Central Register of Controlled Trials (CENTRAL)	2020/4/20	18	4858	NOS	
35	Tian Y, Qiu X, Wang C ³⁵	Cancer associates with risk and severe events of COVID-19:	International journal of cancer	2020/7/20	PubMed, Elsevier, Web of Science, CNK	2020/4/23	38	7,094	No	

		A systematic review and meta-analysis			I, WanFang, VIP					
36	Guo L, Shi Z, Zhang Y ³⁶	Comorbid diabetes and the risk of disease severity or death among 8807 COVID-19 patients in China: A meta-analysis	Diabetes Res Clin Pract	2020/7/28	PubMed, Web of Knowledge, medRxiv, bioRxiv, CNKI, Wanfang	2020/5/30	9	8807	No	
37	Zhou Y, Yang Q, Chi J ³⁷	Comorbidities and the risk of severe or fatal outcomes associated with coronavirus disease 2019: A systematic review and meta-analysis	nt J Infect Dis	2020/7/30	PubMed, EMBASE, and the Cochrane Library	2020/4/25	34	16110	No	
38	Mantovani A, Byrne CD, Zheng MH, Targher G ³⁸	Diabetes as a risk factor for greater COVID-19 severity and in-hospital death: A meta-analysis of observational studies	Nutr Metab Cardiovasc Dis	2020/6/24	PubMed, Scopus and Web of Science	2020/5/15	83	78,874	NOS	11 studies scored 6, others scored 5

39	Fang X, Li S, Yu H ³⁹	Epidemiological, comorbidity factors with severity and prognosis of COVID-19 a systematic review and meta-analysis	Aging (Albany NY)	2020/7/14	Pubmed, medRxiv, bioRxiv	2020/4/5	61	15071	NOS	The NOS score ranged from 5 to 7, which means a moderate methodological quality
40	Li X, Guan B, Su T ⁴⁰	Impact of cardiovascular disease and cardiac injury on in-hospital mortality in patients with COVID-19: a systematic review and meta-analysis	Heart	2020/5/29	PubMed, Embase and Web of Science	2020/4/14	10	3118	NOS	The studies with 7 points or more were considered of high quality. 8 studies scored 7 or more, 2 studies scored 6.
41	Pranata R, Huang I, Lim MA ⁴¹	Impact of cerebrovascular and cardiovascular diseases on mortality and severity of COVID-19-systematic review, meta-analysis, and meta-regression	Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association	2020/5/16	PubMed, SCOPUS, EuropePMC, and Cochrane Central Database	2020/4/10	16	4448	No	

42	Hussain A, Mahawar K, Xia Z, Yang W, El-Hasani S ⁴²	Obesity and mortality of COVID-19. Meta-analysis	Obes Res Clin Pract	2020/7/15	PubMed, Embase, Google, Google Scholar, and Springer, Elsevier, the Lancet, AMJ, BMJ, and Oxford journals	2020/5/1	14	403535	NOS	4 studies scored 6 stars, 2 study scored 5 stars, 6 studies scored 4 stars, 2 studies scored 3 stars
43	Földi M, Farkas N, Kiss S ⁴³	Obesity is a risk factor for developing critical condition in COVID-19 patients: A systematic review and meta-analysis	Obesity reviews : an official journal of the International Association for the Study of Obesity	2020/7/21	Medline (via PubMed), Embase, Cochrane Central Register of Controlled Trials (CENTRAL), Scopus and Web of Science	2020/5/11	10	3279	QUIPS	
44	Figliozzi S, Masci PG, Ahmadi N ⁴⁴	Predictors of Adverse Prognosis in Covid-19: A	Eur J Clin Invest	2020/7/30	PubMed/Medline and Scopus	2020/4/24	51	29,653		Six studies were adjudicated of fair quality while the remaining ones were considered of good quality

		Systematic Review and Meta-analysis								
45	Kovalic AJ, Satapathy SK, Thuluvath PJ ⁴⁵	Prevalence of chronic liver disease in patients with COVID-19 and their clinical outcomes: a systematic review and meta-analysis	Hepatol Int	2020/7/30	MEDLINE/PubMed, EMBASE, and medRxiv	2020/5/16	74	23,424	No	
46	Nandy K, Salunke A, Pathak SK ⁴⁶	Coronavirus disease (COVID-19): A systematic review and meta-analysis to evaluate the impact of various comorbidities on serious events	Diabetes Metab Syndr	2020/7/8	PubMed, Cochrane Central Register of Clinical Trials	2020/4/28	16	3994	NOS	
47	Zhang J, Wu J, Sun X ⁴⁷	Association of hypertension with the severity and fatality of SARS-CoV-2 infection: A meta-analysis	Epidemiol Infect	2020/5/29	PubMed, Elsevier Science Direct, Web of science, Wiley Online Library and CNKI	2020/3/20	18	4505	NOS and STROBE	The methodological qualities of the included studies were similar. Nine studies had a moderate risk of participant comparability and confounding variables. Six, seven, and five studies had 6, 7, and 8 points of assessment score in the present analysis, respectively. In addition, no significant difference was observed between the

										results obtained from NOS and STROBE analysis
48	Huang I, Lim MA, Pranata R ⁴⁸	Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia - A systematic review, meta-analysis, and meta-regression	Diabetes Metab Syndr	2020/4/26	PubMed and EuropePMC	2020/4/8	30	6452	No	
49	Parveen R, Sehar N, Bajpai R ⁴⁹	Association of diabetes and hypertension with disease severity in covid-19 patients: A systematic literature review and exploratory meta-analysis	Diabetes Res Clin Pract	2020/7/3	PubMed, Medline, Cochrane and Google Scholar	2020/3/31	7	2018	NIH	The quality assessment indicated that most included studies were of acceptable quality.7 篇中国
50	Ofori-Asenso R, Ogundipe O, Agyeman AA ⁵⁰	Cancer is associated with severe disease in COVID-19 patients: a systematic review and meta-analysis	Ecancermedicallscience	2020/6/23	MEDLINE, EMBASE and ScienceDirect as well as websites of WHO and	2020/4/28	20	32404	NOS	

					key public health institutions					
51	Lu L, Zhong W, Bian Z ⁵¹	A comparison of mortality-related risk factors of COVID-19, SARS, and MERS: A systematic review and meta-analysis	J Infect	2020/7/4	MEDLINE, EPISTEMON IKOS, COCHRANE, China National Knowledge Infrastructure and WANFANG STATA	2020/4/11	10	11,818	NOS	The included studies scored between 5 and 9. None of the studies was considered to be poor quality.
52	Liu M, Gao Y, Zhang Y ⁵²	The association between severe or dead COVID-19 and autoimmune diseases: A systematic review and meta-analysis	J Infect	2020/6/6	PubMed, Embase, Web of Science and Cochrane Library	2020/5/8	6	2091		The range of quality scores was 5 to 8, with a median of 7 (7.17 ±1.17) .
53	Liu H, Chen S, Liu M ⁵³	Comorbid Chronic Diseases are Strongly Correlated with Disease Severity among	Aging Dis	2020/6/4	PubMed, Ovid MEDLINE, EMBASE, CDC, NIH	2020/4/25	24	10948	NOS	NOS scores of at lease six were considered high-quality literature. All scored 6 or more.

		COVID-19 Patients: A Systematic Review and Meta-Analysis			database and other sources such as Google, Google Scholar, and the AMED (Allied and Complementary Medicine) search engine					
54	Lippi G, Wong J, Henry BM. ⁵⁴	Hypertension in patients with coronavirus disease 2019 (COVID-19): a pooled analysis	Pol Arch Intern Med	2020/4/2	Scopus, Medline, and Web of Science d	2020/3/26	13	2893	No	
55	Aggarwal G, Lippi G, Lavie CJ ⁵⁵	Diabetes Mellitus Association with Coronavirus Disease 2019 (COVID-19) Severity and Mortality: A Pooled Analysis	Journal of diabetes	2020/7/18	PUBMED, EMBASE and Cochrane Central Register of Controlled Trials (CENTRAL)	2020/3/31	16	3182	No	

56	Zhao Q, Meng M, Kumar R ⁵⁶	The impact of COPD and smoking history on the severity of COVID-19: A systemic review and meta-analysis	J Med Virol	2020/4/16	PubMed, Web of Science, Cochrane, WanFang Database, and CNKI	2020/3/22	11	2002	MINORS	The overall quality of available literature was moderate with MINORS scores ranging from 10 to 13
57	Zhao J, Li X, Gao Y, Huang W. ⁵⁷	Risk factors for the exacerbation of patients with 2019 Novel Coronavirus: A meta-analysis	Int J Med Sci	2020/7/6	PubMed, Embase and Google scholar	2020/2/8	2	179	No	
58	Yang J, Zheng Y, Gou X ⁵⁸	Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis	Int J Infect Dis	2020/3/12	PubMed, EMBASE, and Web of Science	2020/2/25	7	1576	No	
59	Yang J, Hu J, Zhu C. ⁵⁹	Obesity aggravates COVID-19: a systematic review and meta-analysis	J Med Virol 2020	2020/7/1	Pubmed, Embase, WOS, Cochrane, CNKI, Wanfang,	2020/4/22	9	4444	NOS	The quality of study design among the selected studies was median, with a median quality score of 6.

					and Sinomed					
60	Wu J, Zhang J, Sun X ⁶⁰	Influence of diabetes mellitus on the severity and fatality of SARS-CoV-2 (COVID-19) infection	Diabetes Obes Metab	2020/6/5	PubMed, Embase, medRxiv, Cochrane library, and CNKI	03/20/2020	12	2455	NOS	All scored 6 or more.
61	Pranata R, Lim MA, Yonas E ⁶¹	Body Mass Index and Outcome in Patients with COVID-19: A Dose-Response Meta-Analysis	Diabetes Metab	2020/8/2	PubMed, Europe PMC, ProQuest, and the Cochrane Central Database	2020/5/28	12	34,390	NOS	The mean NOS was 8.3 ± 1.1, indicating a low risk of bias.
62	Kumar A, Arora A, Sharma P ⁶²	Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis	Diabetes Metab Syndr	2020/5/15	PubMed	2020/4/22	33	16003	NIH	Thus 32 studies (97%) were judged as good quality and remaining 1 study (3%) was judged as fair quality (scores 6-7). None of the included study was judged poor. The single study with fair quality was the paper published by the CDC, USA on the COVID-19 cases reported to it from all over the US. Thus, it was a registry data, rather than a hospital-based study.

63	Alqahtani JS, Oyelade T, Aldhahir AM ⁶³	Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis	PloS one	2020/5/12	MEDLINE and Google scholar	2020/3/24	15	2473	NOS	The risk of bias ranged from 0.4 to 2.7; nine studies scored ≥ 2 , which indicates low risk of bias
64	Liu M, Gao Y, Shi S, Chen Y, Yang K, Tian J ⁶⁴	Drinking no-links to the severity of COVID-19 a systematic review and meta-analysis	J Infect	2020/5/28	PubMed, EMBASE, Web of Science, CENTRAL, CNKI, CBM, Wanfang	2020/5/8	6	1998	No	
65	Gao Y, Chen Y, Liu M, Shi S, Tian J ⁶⁵	Impacts of immunosuppression and immunodeficiency on COVID-19 A systematic review and meta-analysis	J Infect	2020/5/15	PubMed, EMBASE, Web of Science, CENTRAL, CNKI, CBM, Wanfang Database	2020/4/25	8	4007	No	
66	Gao Y, Liu M, Chen Y, Shi	Association between tuberculosis and COVID-19 severity	J Med Virol	2020/7/21	EMBASE, PubMed, Web of	2020/5/12	6	2765	NOS	The included studies were rated six to eight stars according to the NOS scale

	S, Geng J, Tian J ⁶⁶	and mortality A rapid systematic review and meta- analysis			Science, the Cochrane Central Register of Controlled Trials (CENTRAL), Chinese Biomedical Literature Database (CBM),China National Knowledge Infrastructu re (CNKI), and Wanfang					
67	ElGohary GM, Hashmi S, Styczynski J ⁶⁷	The risk and prognosis of COVID- 19 infection in cancer patients A systematic review and meta-analysis	Hematolog y/Oncolog y and Stem Cell Therapy	2020/7/30	Medline (via PubMed), Scopus, and Web of Science	2020/5/27	22	11243	No	
68	Wu X, Liu L, Jiao J, Yang	Characterisation of clinical, laboratory	Annals of medicine	2020/8/11	Pubmed,Oth er databases	2020/4/1	41	5064	NOS	Quality assessment by the NOS indicates high-quality data for all including studies

	L, Zhu B, Li X ⁶⁸	and imaging factors related to mild vs. severe covid-19 infection a systematic review and meta-analysis								
69	Salunke AA, Nandy K, Pathak SK ⁶⁹	Impact of COVID -19 in cancer patients on severity of disease and fatal outcomes: A systematic review and meta-analysis	Diabetes Metab Syndr	2020/7/28	PubMed, Cochrane Central Register of Clinical Trials	2020/4/16	13	3775	NOS	our assessment of the studies included in the analysis shows that the quality of the evidence has been reasonably good.
70	Siepmann T, Sedghi A, Barlinn J ⁷⁰	Association of history of cerebrovascular disease with severity of COVID-19	Journal of Neurology	2020/8/6	PubMed, EMBASE, and Cochrane Library	2020/4/11	11	1805	Oxford Centre for Evidence-based Medicine Rating Scale	All included studies from published literature were consistently graded as level of evidence 4
71	Sanchez-Ramirez DC, Mackey D ⁷¹	Underlying respiratory diseases, specifically COPD, and smoking are associated with severe COVID-19 outcomes A	Respiratory Medicine	2020/7/30	PubMed, Web of Sciences, and Ovid MEDLINE	2020/4/15	22	13184	No	

		systematic review and meta-analysis								
72	Wu T, Zuo Z, Kang S ⁷²	Multi-organ Dysfunction in Patients with COVID-19 A Systematic Review and Meta-analysis	Aging and disease		EMBASE, PubMed, Web of Science, MedRxiv, and Biorxiv	2020/5/13	73	171108	Agency for Healthcare Research and Quality	the quality of the majority of studies included in the meta-analysis was moderate or high
73	Pate U, Malik P, Shah D ⁷³	Pre-existing cerebrovascular disease and poor outcomes of COVID-19 hospitalized patients a meta-analysis	Journal of Neurology	2020/8/8	PubMed, Web of Science, and Scopus	2020/4/30	11	4987	Newcastle-Ottawa Quality Assessment Scale and Cochrane Collaboration's tool	overall studies had moderate risk of bias
74	Sales-Peres SHdC, Azevedo-Silva Ljd, Bonatoa RCS ⁷⁴	Coronavirus (SARS-CoV-2) and the risk of obesity for critically illness and ICU admitted Meta-analysis of the epidemiological evidence	Obesity Research & Clinical Practice	2020/8/3	PubMed, SCOPUS, Embase, BVS/LILACS, Web of Science, SCIELO, and Google Scholar	2020/5/3	9	6577	NOS	The quality assessment of studies using NOS indicated moderate quality, with scores ranging from 6 to 8.

75	Hariyanto TI, Kurniawan A ⁷⁵	Dyslipidemia is associated with severe coronavirus disease 2019 (COVID-19) infection	Diabetes & Metabolic Syndrome: Clinical Research & Reviews	2020/8/1	PubMed	2020/7/9	7	6922	No	
76	Yin T, Li Y, Ying Y, Luo Z ⁷⁶	Association of Comorbidity with COVID-19 in Chinese Population: Analysis of Risk Factors of the COVID-19 Severity	SSRN		PubMed, Web of Science, and CNKI	2020/5/28	19	2491	No	

Table S2. Age distribution of COVID-19 cases

Reference	Location	Study period	Study population	Data source	No. participants	Proportions of COVID-19 cases by age (years) (%)				Age-stratified incidence of COVID-19 cases (per 100,000 population)			
						<20	20-39	40-59	60+	<20	20-39	40-59	60+
						Pan A (JAMA) ⁷⁷	Wuhan, China	2019/12/8-2020/3/8	All reported lab-confirmed COVID-19 cases	Notifiable Disease Report System	32,583	1.6	18.3
COVID-19 National Incident Room Surveillance Team of Australia (Commun Dis Intell) ^{78*}	Australia	2020/1/13-2020/5/17	All reported lab-confirmed COVID-19 cases	National Notifiable Diseases Surveillance System	7,075	4.6	35.7	29.3	30.3	5.0	35.0	31.8	39.4
Stokes EK (MWR Morb Mortal Wkly Rep) ⁷⁹	United States	2020/1/22-2020/5/30	All reported lab-confirmed COVID-19 cases	Reported to US CDC	1,320,488	5.3	30.1	34.5	30.2	85.0	445.7	546.2	547.7
Cruz CJP (PLoS One) ⁸⁰	Hong Kong, China	2020/1/23-2020/4/16	All reported lab-confirmed COVID-19 cases	Centre for Health Protection of the Hong	1,017	14.6	45.8	24.6	15.0	12.7	24.8	10.9	9.2

				Kong Department of Health									
Gujski M (Med Sci Monit) ⁸¹	Poland	2020/3/3-2020/3/27	All reported lab-confirmed COVID-19 cases	Chief Sanitary Inspectorate	1,157	7.5	30.2	37.6	24.9	1.2	3.2	4.2	3.0
Mazumder A (F1000Research) ^{82*}	India	2020/3/1-2020/4/14	Among 10,939 lab-confirmed COVID-19 cases, those with age information were included	State government and central government agencies	1,161	9.4	43.2	31.0	16.5	0.0	0.1	0.1	0.1
Jung C Y (Int J Infect Dis) ^{83*}	South Korea	2020/1/24-2020/4/9	All reported lab-confirmed COVID-19 cases	Korea Centers for Disease Control and Prevention	10237	4.7	38.5	31.4	25.4	5.2	28.4	19.5	21.9
BULUT C (Turk J Med Sci) ^{84*}	Spain	2020/1/31-2020/4/6	All reported lab-confirmed COVID-19 cases	Spanish Ministry of Health	88,190	0.8	15.2	34.0	50.0	8.3	134.1	200.0	351.4
National Health Service ^{85*}	United Kingdom	2020/1/30-2020/8/4	All reported lab-confirmed COVID-19 cases, those without age information were included	National Health Service	260,695	4.0	25.2	29.9	41.0	66.7	378.3	441.4	640.6

Robert Koch Institute ^{86*}	Germany	2020/1/3- 2020/8/6	All reported lab- confirmed COVID- 19 cases	Robert Koch Institute Information System	212,594	8.4	29.6	33.5	28.5	115.5	311.5	301.5	253.0
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* These studies reported the number of COVID-19 cases, but did not report age-specific incidence rates. We obtained the country-specific population size by age groups from UN mid-year population estimates for 2020 (<https://population.un.org/wpp/Download/Standard/Population/>) (accessed July 15, 2020). Age-stratified cumulative incidence was then calculated by dividing the number of COVID-19 cases over the number of populations in each age group. The reported number of COVID-19 cases and population size were shown in Table S5.

Table S3. Data used to estimate the COVID-19 incidence rate

Reference	No. participants	Number of COVID-19 cases by age group				Population by age group (thousand)*			
		<20	20-39	40-59	60+	<20	20-39	40-59	60+
COVID-19 National Incident Room Surveillance Team of Australia (Commun Dis Intel) ⁷⁸	7,075	/	/	/	2,144	6,439	7,094	6,414	5,553
Mazumder A (F1000Research) ⁸²	1,161	109	502	360	192	487,064	455,538	297,792	139,610
Jung C Y (Int J Infect Dis) ⁸³	10,237	481	3,947	3,206	2,603	9,331	13,878	16,434	11,864
BULUT C (Turk J Med Sci) ⁸⁴	88,190	741	13,390	29,998	44,061	8,924	9,989	15,023	12,524
National Health Service ⁸⁵	260,695	10,471	65,513	77,866	106,845	15,698	17,317	17,642	16,678
Robert Koch Institute ⁸⁶	212,594	17,914	/	/	/	15,812	20,249	23,732	23,991

*We obtained the country-specific population size by age groups from UN mid-year population estimates for 2020 (<https://population.un.org/wpp/Download/Standard/Population/>) (accessed July 15, 2020).

Figure S1. Risk factors of severe outcome of COVID-19, obtained from published systematic reviews

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Figure S2. Risk factors of severe outcome of COVID-19, obtained from preprinted systematic reviews

(The figure is very large, so we put it at the end of the document)

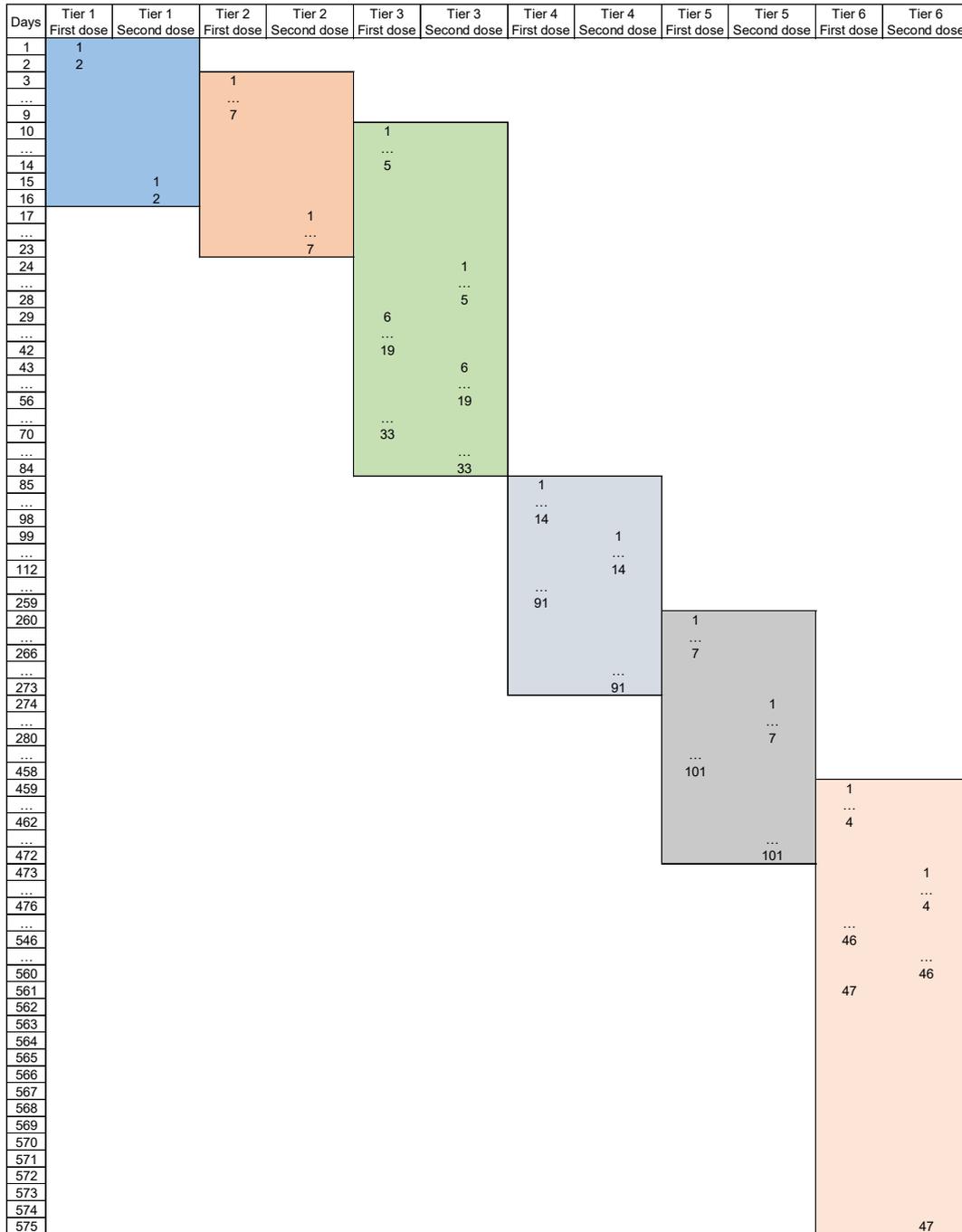


Figure S3. Schematic diagram of vaccinating 60% of target populations by Tiers, given 3 million doses administered per day and a two-dose vaccination schedule with a two-week interval

Numbers in the colored boxes denote the accumulative days to vaccinate the target

population in a separate Tier. Note: overlaps of vaccination exist between adjacent tiers. For instance, there will be 13 “blank days” to vaccinate Tier 1 population due to a two-week interval between two doses administered. To avoid wastage, Tier 2 and 3 could be vaccinated in these “blank days”.

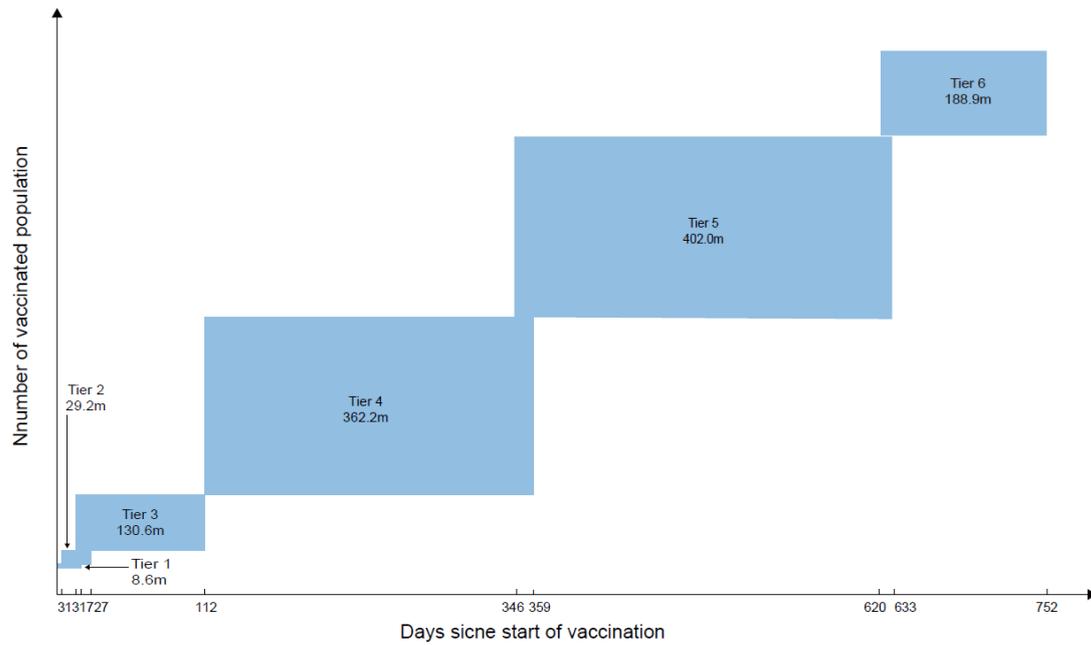


Figure S4. Sensitivity analyses on days needed to vaccinate 80% of the target population, stratified by vaccination tier, under the assumption that three million doses are administered per day. Note that values reported within the square denote 80% of the population size in each tier; m denotes million.

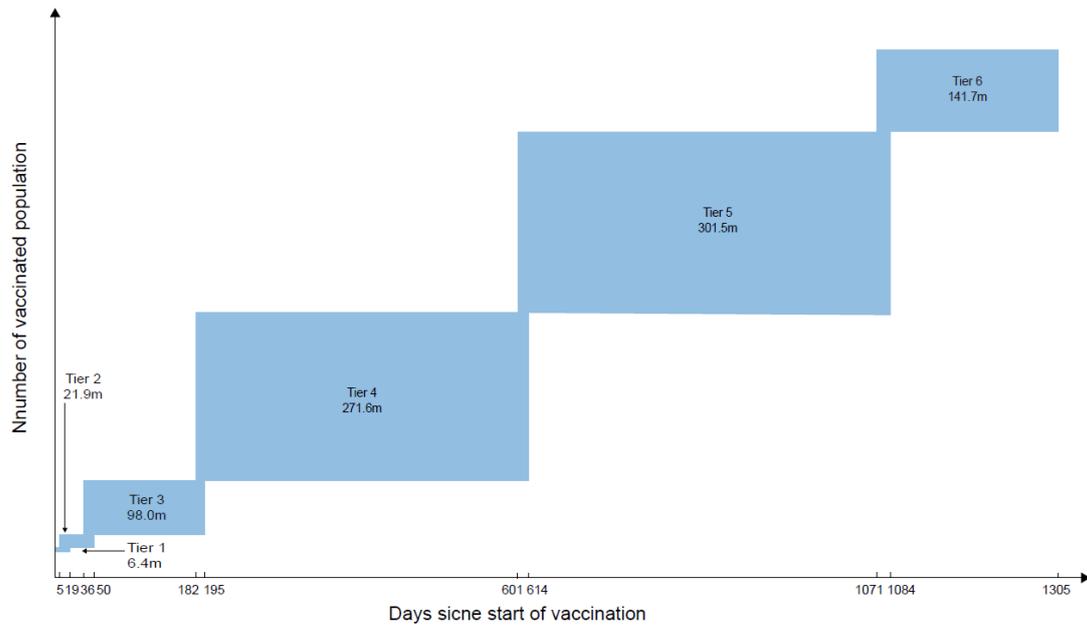


Figure S5. Sensitivity analyses on days needed to vaccinate 60% of the target population, stratified by vaccination tier, under the assumption that 1.3 million doses are administered per day. Note that values reported within the square denote 60% of the population size in each tier; m denotes million.

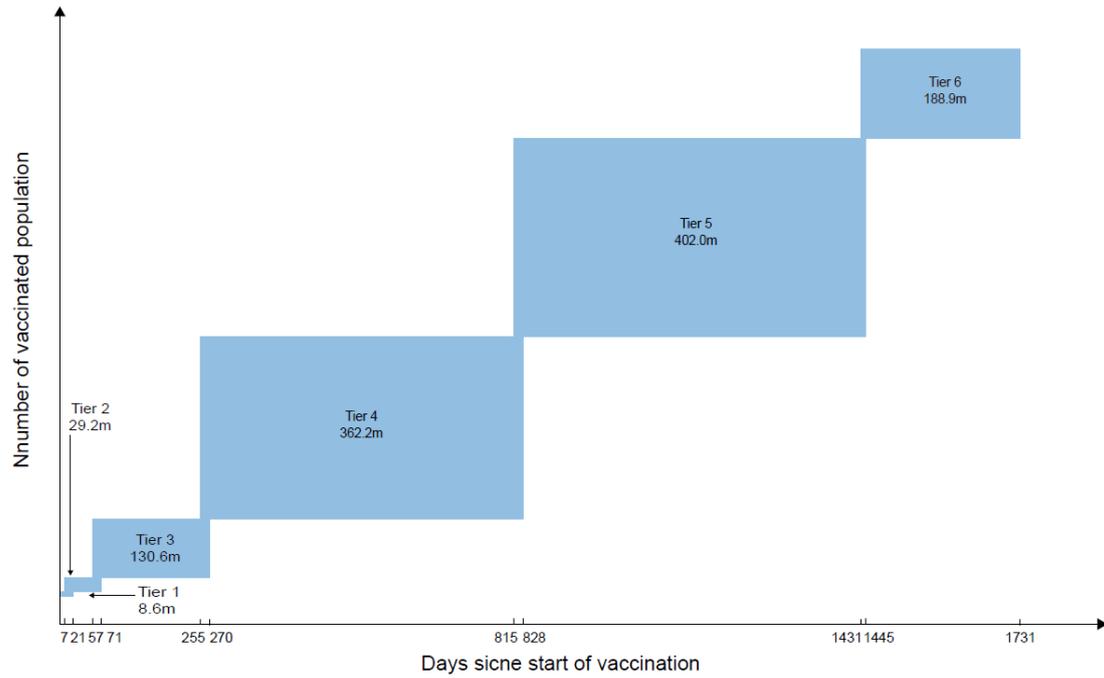


Figure S6. Sensitivity analyses on days needed to vaccinate 80% of the target population, stratified by vaccination tier, under the assumption that 1.3 million doses are administered per day. Note that values reported within the square denote 80% of the population size in each tier; m denotes million.

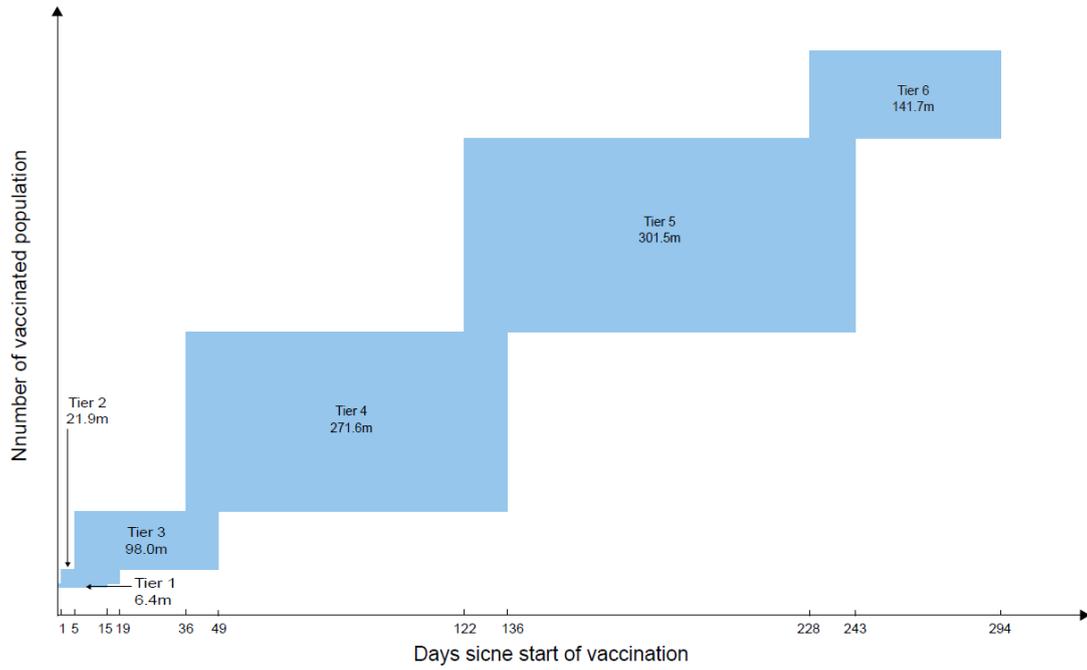


Figure S7. Sensitivity analyses on days needed to vaccinate 60% of the target population, stratified by vaccination tier, under the assumption that 6 million doses are administered per day. Note that values reported within the square denote 60% of the population size in each tier; m denotes million.

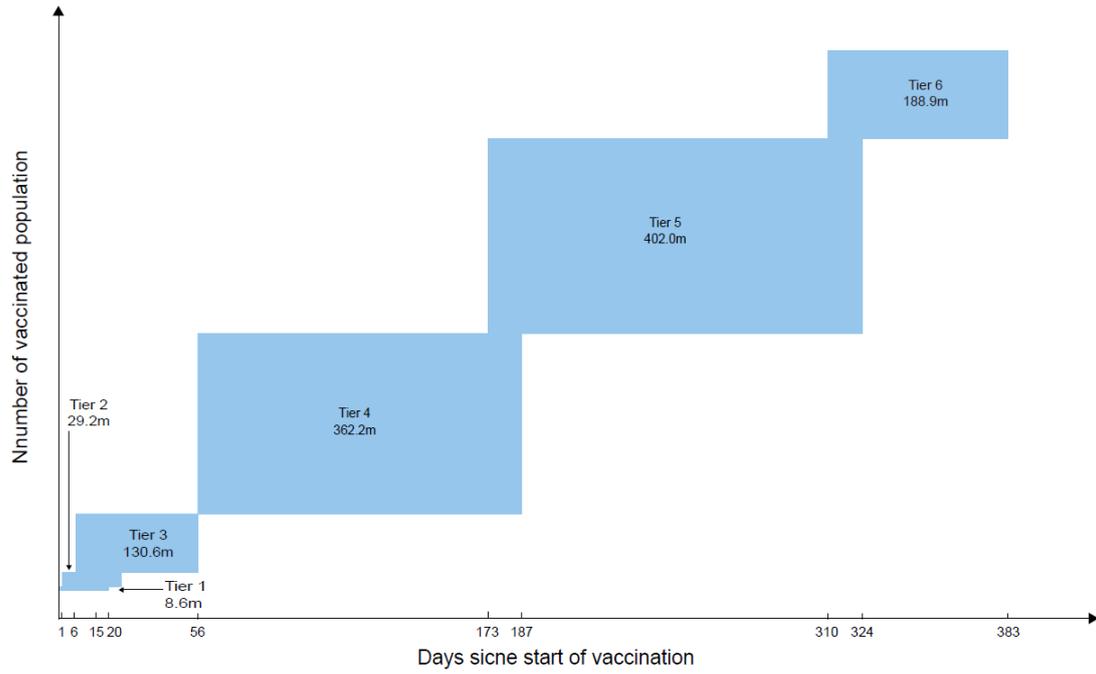


Figure S8. Sensitivity analyses on days needed to vaccinate 80% of the target population, stratified by vaccination tier, under the assumption that 6 million doses are administered per day. Note that values reported within the square denote 80% of the population size in each tier; m denotes million.

More detailed methods

Essential workers

Healthcare workers are essential in maintaining an effective healthcare system, not only for COVID-19 but also for other healthcare needs. They often have a high risk of infection due to occupational exposure. For instance, healthcare workers performing endotracheal intubation had a higher risk of SARS-CoV-2 infection than other healthcare workers (OR: 4.33, 95%CI 1.16-16.07) since they had higher exposure associated with aerosol-generating procedures.⁸⁷ Public health staff also play a crucial role in the COVID-19 response, with responsibilities including, but not limited to, case detection, isolation, tracing and testing of close contacts, surveillance, and health communication.

An additional category of essential workers includes staff in nursing homes and social welfare institutions, who provide care for older adults and disabled persons in institutional settings, where COVID-19 outbreaks could be devastating⁸⁸. Police is necessary for the society to function and in China is also responsible for implementing a set of public health measures such as tracing of cases and close contacts, and isolation. In addition to maintaining national security, the military also plays a key role in COVID-19 response, as they can provide medical care and support the implementation of prevention and control strategies. Further, community network members are needed to assist in local pandemic response such as mass screening, and provide support for vulnerable populations such as seniors, those living alone, and households complying with voluntary quarantine when a household member is ill. The energy (electricity, oil, fuel, and natural gas), water, food, and transportation sectors maintain production, processing, distribution and sale of essential supplies for the population. These personnel are critical to providing essential goods and services, and thus need to work even during periods of community restrictions, social distancing, or closure orders.

High-risk individuals

To meet the secondary goal of the vaccination program, individuals who are at increased risk for severe outcome of COVID-19 could be considered a priority target population for vaccination. We conducted a narrative literature review in PubMed, Embase, Web of Science, medRxiv, and bioRxiv for systematic reviews written in English, to identify the risk factors of severe illness associated with COVID-19. We searched for ('severe' OR 'severity' OR 'critical' OR 'hospitaliz*' OR 'ICU' OR 'death*' OR 'mortality' OR 'fatal') AND ('risk factor*') AND ('2019-nCov' OR 'COVID-19' OR 'COVID 19' OR '2019 novel coronavirus' OR 'coronavirus disease 2019' OR 'SARS-CoV-2' OR 'SARS CoV 2' OR 'severe acute respiratory syndrome coronavirus 2').

Pregnant women were additionally included in the list of high-risk groups. We estimated the number of women who are pregnant in one year as the sum of all live births, still births, fetal deaths, and abortions in that year. The number of live births was obtained from China Health Statistical Yearbook (CHSY) in 2019.⁸⁹ The number of still births and fetal deaths were estimated as the product of the number of perinatal deaths and the fraction of those deaths which are still births and fetus deaths (68.59%).⁹⁰ We estimated the number of abortions by dividing the number of induced abortions by the proportion of induced abortions (88.54%).⁹¹

Individuals at high risks of symptomatic COVID-19 infections

A second narrative literature review was conducted to assess the risk of symptomatic COVID-19 infection, using the search query, ('2019-nCov' OR 'COVID-19' OR 'COVID 19' OR '2019 novel coronavirus' OR 'coronavirus disease 2019' OR 'SARS-CoV-2' OR 'SARS CoV 2' OR 'severe acute respiratory syndrome coronavirus 2') AND ('incidence' OR 'attack rate' OR 'morbidity') AND ('age profile' OR 'age group' OR 'age range' OR 'age structure' OR 'age composition' OR 'age spectrum').

References

1. Zheng Z, Peng F, Xu B, et al. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis. *J Infect* 2020.
2. Singh AK, Gillies CL, Singh R, et al. Prevalence of co-morbidities and their association with mortality in patients with COVID-19: A systematic review and meta-analysis. *Diabetes Obes Metab* 2020.
3. Wang X, Fang X, Cai Z, et al. Comorbid Chronic Diseases and Acute Organ Injuries Are Strongly Correlated with Disease Severity and Mortality among COVID-19 Patients: A Systemic Review and Meta-Analysis. *Research (Washington, DC)* 2020; **2020**: 2402961.
4. Taylor E, Hofmeyr R, Torborg A, Tonder CV, Anaesthesia BBJSAJo, Analgesia. Risk factors and interventions associated with mortality or survival in adult COVID-19 patients admitted to critical care: a systematic review and meta-analysis. *South Afr J Anaesth Analg* 2020; **26**(3): 116-27.
5. Wang B, Li R, Lu Z, Huang Y. Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. *Aging (Albany NY)* 2020; **12**(7): 6049-57.
6. Jain V, Yuan JM. Predictive symptoms and comorbidities for severe COVID-19 and intensive care unit admission: a systematic review and meta-analysis. *Int J Public Health* 2020; **65**(5): 533-46.
7. Giannakoulis VG, Papoutsi E, Siempos I. Effect of Cancer on Clinical Outcomes of Patients With COVID-19: A Meta-Analysis of Patient Data. *JCO Glob Oncol* 2020; **6**: 799-808.
8. Tian W, Jiang W, Yao J, et al. Predictors of mortality in hospitalized COVID-19 patients: A systematic review and meta-analysis. *J Med Virol* 2020.
9. Li J, He X, Yuan Y, et al. Meta-analysis investigating the relationship between clinical features, outcomes, and severity of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pneumonia. *AM J INFECT CONTROL* 2020.
10. Wu ZH, Tang Y, Cheng Q. Diabetes increases the mortality of patients with COVID-19: a meta-analysis. *Acta Diabetol* 2020: 1-6.
11. Xu L, Mao Y, Chen G. Risk factors for 2019 novel coronavirus disease (COVID-19) patients progressing to critical illness: a systematic review and meta-analysis. *Aging (Albany NY)* 2020; **12**(12): 12410-21.
12. Ssentongo P, Ssentongo AE, Heilbrunn ES, Ba DM, Chinchilli VM. The association of cardiovascular disease and other pre-existing comorbidities with COVID-19 mortality: A systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/23/2020.05.10.20097253.full.pdf> (accessed).
13. Bellou V, Tzoulaki I, Evangelou E, Belbasis L. Risk factors for adverse clinical outcomes in patients with COVID-19: A systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/19/2020.05.13.20100495.full.pdf> (accessed).
14. Rahman A, Sathi NJ. Risk Factors of the Severity of COVID-19: a Meta-Analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/10/2020.04.30.20086744.full.pdf> (accessed).

15. Khan M, Khan MN, Mustagir MG, Rana J, Islam MS, Kabir MI. Effects of underlying morbidities on the occurrence of deaths in COVID-19 patients: A systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/17/2020.05.08.20095968.full.pdf> (accessed).
16. Soeroto AY, Soetedjo NN, Purwiga A, et al. Association of BMI and Obesity with Composite poor outcome in COVID-19 adult patients: A Systematic Review and Meta-Analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/06/29/2020.06.28.20142240.full.pdf> (accessed).
17. Liu Y, Zhang Z, Pan X, et al. The Chronic Kidney Disease and Acute Kidney Injury Involvement in COVID-19 Pandemic: A Systematic Review and Meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/02/2020.04.28.20083113.full.pdf> (accessed).
18. Matsushita K, Ding N, Kou M, et al. The relationship of COVID-19 severity with cardiovascular disease and its traditional risk factors: A systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/04/28/2020.04.05.20054155.full.pdf> (accessed).
19. Tabrizi R, Lankarani KB, Nowrouzi-sohrabi P, et al. The role of comorbidities and clinical predictors of severe disease in COVID-19: a systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/04/25/2020.04.21.20074633.full.pdf> (accessed).
20. Dorjee K, Kim H. Epidemiological Risk Factors Associated with Death and Severe Disease in Patients Suffering From COVID-19: A Comprehensive Systematic Review and Meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/06/20/2020.06.19.20135483.full.pdf> (accessed).
21. Hessami A, Shamshirian A, Heydari K, et al. Cardiovascular Diseases and COVID-19 Mortality and Intensive Care Unit Admission: A Systematic Review and Meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/10.1101/2020.04.12.20062869v2> (accessed).
22. Chen Y, Gong X, Wang L, Guo J. Effects of hypertension, diabetes and coronary heart disease on COVID-19 diseases severity: a systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/03/30/2020.03.25.20043133.full.pdf> (accessed).
23. Parohan M, Yaghoubi S, Seraji A, Javanbakht MH, Sarraf P, Djalali M. Risk factors for mortality in patients with Coronavirus disease 2019 (COVID-19) infection: a systematic review and meta-analysis of observational studies. *Aging Male* 2020: 1-9.
24. Zhao X, Zhang B, Li P, et al. Incidence, clinical characteristics and prognostic factor of patients with COVID-19: a systematic review and meta-analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/03/20/2020.03.17.20037572.full.pdf> (accessed).
25. Palaiodimos L, Chamorro-Pareja N, Karamanis D, et al. Diabetes is associated with increased risk for in-hospital mortality in patients with COVID-19: a systematic review and meta-analysis comprising 18,506 patients. *medRxiv*, 2020. <https://www.medrxiv.org/content/10.1101/2020.05.26.20113811v1> (accessed).

26. Jutzeler CR, Bourguignon L, Weis CV, et al. Comorbidities, clinical signs and symptoms, laboratory findings, imaging features, treatment strategies, and outcomes in adult and pediatric patients with COVID-19: A systematic review and meta-analysis. *Travel Med Infect Dis* 2020; 101825.
27. Islam MS, Barek MA, Aziz MA, Aka TD, Jakaria M. Association of age, sex, comorbidities, and clinical symptoms with the severity and mortality of COVID-19 cases: a meta-analysis with 85 studies and 67299 cases. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/05/26/2020.05.23.20110965.full.pdf> (accessed).
28. Zaki N, Mohamed EA, Ibrahim S, Khan G. The influence of comorbidity on the severity of COVID-19 disease: systematic review and analysis. *medRxiv*, 2020. <https://www.medrxiv.org/content/medrxiv/early/2020/06/20/2020.06.18.20134478.full.pdf> (accessed).
29. Cao G, Li P, Cheng Y, et al. A risk prediction model for evaluating the disease progression of covid-19 pneumonia based on meta-analysis and 214 clinical cases. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3569869 (accessed).
30. Salunke AA, Nandy K, Pathak SK, et al. Coronavirus Disease (COVID-19) in Cancer Patients_ A Systematic Review and Meta-Analysis to Evaluate Severity and Fatal Outcomes. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3590492 (accessed).
31. Sreenivasan J, Khan MS, Anker SD, et al. Cardiovascular Risk Factors and Complications in Patients Infected with COVID-19_ A Systematic Review. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3569855 (accessed).
32. Biswas M, Rahaman S, Biswas TK, Haque Z, Ibrahim B. Effects of Sex, Age and Comorbidities on the Risk of Infection and Death Associated with COVID-19_ A Meta-Analysis of 47807 Confirmed Cases. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3566146 (accessed).
33. Kumar A, Arora A, Sharma P, et al. Clinical Features of COVID-19 and Factors Associated with Severe Clinical Course: A Systematic Review and Meta-analysis. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3566166 (accessed).
34. Aggarwal G, Cheruiyot I, Aggarwal S, et al. Association of Cardiovascular Disease With Coronavirus Disease 2019 (COVID-19) Severity: A Meta-Analysis. *Curr Probl Cardiol* 2020; **45**(8): 100617.
35. Tian Y, Qiu X, Wang C, et al. Cancer associates with risk and severe events of COVID-19: A systematic review and meta-analysis. *International journal of cancer* 2020.
36. Guo L, Shi Z, Zhang Y, et al. Comorbid diabetes and the risk of disease severity or death among 8807 COVID-19 patients in China: A meta-analysis. *Diabetes Res Clin Pract* 2020; **166**: 108346.
37. Zhou Y, Yang Q, Chi J, et al. Comorbidities and the risk of severe or fatal outcomes associated with coronavirus disease 2019: A systematic review and meta-analysis. *Int J Infect Dis* 2020.
38. Mantovani A, Byrne CD, Zheng MH, Targher G. Diabetes as a risk factor for greater COVID-19 severity and in-hospital death: A meta-analysis of observational studies. *Nutr Metab Cardiovasc Dis* 2020; **30**(8): 1236-48.
39. Fang X, Li S, Yu H, et al. Epidemiological, comorbidity factors with severity and prognosis of

- COVID-19: a systematic review and meta-analysis. *Aging (Albany NY)* 2020; **12**(13): 12493-503.
40. Li X, Guan B, Su T, et al. Impact of cardiovascular disease and cardiac injury on in-hospital mortality in patients with COVID-19: a systematic review and meta-analysis. *Heart* 2020; **106**(15): 1142-7.
41. Pranata R, Huang I, Lim MA, Wahjoepramono EJ, July J. Impact of cerebrovascular and cardiovascular diseases on mortality and severity of COVID-19-systematic review, meta-analysis, and meta-regression. *Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association* 2020; **29**(8): 104949.
42. Hussain A, Mahawar K, Xia Z, Yang W, El-Hasani S. Obesity and mortality of COVID-19. Meta-analysis. *Obes Res Clin Pract* 2020.
43. Földi M, Farkas N, Kiss S, et al. Obesity is a risk factor for developing critical condition in COVID-19 patients: A systematic review and meta-analysis. *Obesity reviews : an official journal of the International Association for the Study of Obesity* 2020.
44. Figliozzi S, Masci PG, Ahmadi N, et al. Predictors of Adverse Prognosis in Covid-19: A Systematic Review and Meta-analysis. *Eur J Clin Invest* 2020: e13362.
45. Kovalic AJ, Satapathy SK, Thuluvath PJ. Prevalence of chronic liver disease in patients with COVID-19 and their clinical outcomes: a systematic review and meta-analysis. *Hepatol Int* 2020: 1-9.
46. Nandy K, Salunke A, Pathak SK, et al. Coronavirus disease (COVID-19): A systematic review and meta-analysis to evaluate the impact of various comorbidities on serious events. *Diabetes Metab Syndr* 2020; **14**(5): 1017-25.
47. Zhang J, Wu J, Sun X, et al. Association of hypertension with the severity and fatality of SARS-CoV-2 infection: A meta-analysis. *Epidemiol Infect* 2020; **148**: e106.
48. Huang I, Lim MA, Pranata R. Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia - A systematic review, meta-analysis, and meta-regression. *Diabetes Metab Syndr* 2020; **14**(4): 395-403.
49. Parveen R, Sehar N, Bajpai R, Agarwal NB. Association of diabetes and hypertension with disease severity in covid-19 patients: A systematic literature review and exploratory meta-analysis. *Diabetes Res Clin Pract* 2020; **166**: 108295.
50. Ofori-Asenso R, Ogundipe O, Agyeman AA, et al. Cancer is associated with severe disease in COVID-19 patients: a systematic review and meta-analysis. *Ecancermedicalscience* 2020; **14**: 1047.
51. Lu L, Zhong W, Bian Z, et al. A comparison of mortality-related risk factors of COVID-19, SARS, and MERS: A systematic review and meta-analysis. *J Infect* 2020.
52. Liu M, Gao Y, Zhang Y, Shi S, Chen Y, Tian J. The association between severe or dead COVID-19 and autoimmune diseases: A systematic review and meta-analysis. *J Infect* 2020.
53. Liu H, Chen S, Liu M, Nie H, Lu H. Comorbid Chronic Diseases are Strongly Correlated with Disease Severity among COVID-19 Patients: A Systematic Review and Meta-Analysis. *Aging Dis* 2020; **11**(3): 668-78.
54. Lippi G, Wong J, Henry BM. Hypertension in patients with coronavirus disease 2019 (COVID-19): a pooled analysis. *Pol Arch Intern Med* 2020; **130**(4): 304-9.
55. Aggarwal G, Lippi G, Lavie CJ, Henry BM, Sanchis-Gomar F. Diabetes Mellitus Association with Coronavirus Disease 2019 (COVID-19) Severity and Mortality: A Pooled Analysis. *Journal of diabetes* 2020.
56. Zhao Q, Meng M, Kumar R, et al. The impact of COPD and smoking history on the severity of

- COVID-19: A systemic review and meta-analysis. *J Med Virol* 2020.
57. Zhao J, Li X, Gao Y, Huang W. Risk factors for the exacerbation of patients with 2019 Novel Coronavirus: A meta-analysis. *Int J Med Sci* 2020; **17**(12): 1744-50.
58. Yang J, Zheng Y, Gou X, et al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: a systematic review and meta-analysis. *Int J Infect Dis* 2020; **94**: 91-5.
59. Yang J, Hu J, Zhu C. Obesity aggravates COVID-19: a systematic review and meta-analysis. *J Med Virol* 2020.
60. Wu J, Zhang J, Sun X, et al. Influence of diabetes mellitus on the severity and fatality of SARS-CoV-2 (COVID-19) infection. *Diabetes Obes Metab* 2020.
61. Pranata R, Lim MA, Yonas E, et al. Body Mass Index and Outcome in Patients with COVID-19: A Dose-Response Meta-Analysis. *Diabetes Metab* 2020.
62. Kumar A, Arora A, Sharma P, et al. Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis. *Diabetes Metab Syndr* 2020; **14**(4): 535-45.
63. Alqahtani JS, Oyelade T, Aldhahir AM, et al. Prevalence, Severity and Mortality associated with COPD and Smoking in patients with COVID-19: A Rapid Systematic Review and Meta-Analysis. *PloS one* 2020; **15**(5): e0233147.
64. Liu M, Gao Y, Shi S, Chen Y, Yang K, Tian J. Drinking no-links to the severity of COVID-19: a systematic review and meta-analysis. *J Infect* 2020; **81**(2): e126-e7.
65. Gao Y, Chen Y, Liu M, Shi S, Tian J. Impacts of immunosuppression and immunodeficiency on COVID-19: A systematic review and meta-analysis. *J Infect* 2020; **81**(2): e93-e5.
66. Gao Y, Liu M, Chen Y, Shi S, Geng J, Tian J. Association between tuberculosis and COVID-19 severity and mortality: A rapid systematic review and meta-analysis. *J Med Virol* 2020.
67. ElGohary GM, Hashmi S, Styczynski J, et al. The risk and prognosis of COVID-19 infection in cancer patients: A systematic review and meta-analysis. *Hematology/Oncology and Stem Cell Therapy* 2020.
68. Wu X, Liu L, Jiao J, Yang L, Zhu B, Li X. Characterisation of clinical, laboratory and imaging factors related to mild vs. severe covid-19 infection: a systematic review and meta-analysis. *Annals of medicine* 2020: 1-11.
69. Salunke AA, Nandy K, Pathak SK, et al. Impact of COVID -19 in cancer patients on severity of disease and fatal outcomes: A systematic review and meta-analysis. *Diabetes Metab Syndr* 2020; **14**(5): 1431-7.
70. Siepmann T, Sedghi A, Barlinn J, et al. Association of history of cerebrovascular disease with severity of COVID-19. *J Neurol* 2020.
71. Sanchez-Ramirez DC, Mackey D. Underlying respiratory diseases, specifically COPD, and smoking are associated with severe COVID-19 outcomes: A systematic review and meta-analysis. *Respir Med* 2020; **171**: 106096.
72. Deng M, Ye M, Xiao X, et al. Multi-organ Dysfunction in Patients with COVID-19: A Systematic Review and Meta-analysis. *Aging and disease* 2020; **11**(4).
73. Patel U, Malik P, Shah D, Patel A, Dhamoon M, Jani V. Pre-existing cerebrovascular disease and poor outcomes of COVID-19 hospitalized patients: a meta-analysis. *J Neurol* 2020: 1-8.
74. Sales-Peres SHC, de Azevedo-Silva LJ, Bonato RCS, Sales-Peres MC, Pinto A, Santiago Junior JF. Coronavirus (SARS-CoV-2) and the risk of obesity for critically illness and ICU admitted: Meta-analysis of the epidemiological evidence. *Obes Res Clin Pract* 2020.
75. Hariyanto TI, Kurniawan A. Dyslipidemia is associated with severe coronavirus disease 2019

- (COVID-19) infection. *Diabetes Metab Syndr* 2020; **14**(5): 1463-5.
76. Yin T, Li Y, Ying Y, Luo Z. Association of comorbidity with COVID-19 in Chinese population Analysis of risk factors of the COVID-19 severity. *SSRN*, 2020. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3624220 (accessed).
77. Pan A, Liu L, Wang C, et al. Association of Public Health Interventions With the Epidemiology of the COVID-19 Outbreak in Wuhan, China. *JAMA* 2020; **323**(19): 1915-23.
78. COVID-19, Australia: Epidemiology Report 16 (Reporting week to 23:59 AEST 17 May 2020). *Commun Dis Intell (2018)* 2020; **44**.
79. Stokes EK, Zambrano LD, Anderson KN, et al. Coronavirus Disease 2019 Case Surveillance - United States, January 22-May 30, 2020. *MMWR Morb Mortal Wkly Rep* 2020; **69**(24): 759-65.
80. Cruz CJP, Ganly R, Li Z, Gietel-Basten S. Exploring the young demographic profile of COVID-19 cases in Hong Kong: Evidence from migration and travel history data. *PloS one* 2020; **15**(6): e0235306.
81. Gujski M, Raciborski F, Jankowski M, Nowicka PM, Rakocy K, Pinkas J. Epidemiological Analysis of the First 1389 Cases of COVID-19 in Poland: A Preliminary Report. *Med Sci Monit* 2020; **26**: e924702.
82. Mazumder A, Arora M, Bharadiya V, et al. SARS-CoV-2 epidemic in India: epidemiological features and in silico analysis of the effect of interventions. *F1000Res* 2020; **9**: 315.
83. Jung CY, Park H, Kim DW, Choi YJ, Kim SW, Chang TI. Clinical Characteristics of Asymptomatic Patients with COVID-19: A Nationwide Cohort Study in South Korea. *Int J Infect Dis* 2020.
84. Bulut C, Kato Y. Epidemiology of COVID-19. *Turk J Med Sci* 2020; **50**(SI-1): 563-70.
85. The weekly surveillance report in England. August 7, 2020 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/907429/COVID19_Weekly_Report_04_August_New_caveat.pdf (accessed August 7 2020).
86. Coronavirus Disease 2019 (COVID-19) Daily Situation Report of the Robert Koch Institute. August 6, 2020. https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Situationsberichte/2020-08-06-en.pdf?_blob=publicationFile (accessed August 6 2020).
87. Chatterjee P, Anand T, Singh KJ, et al. Healthcare workers & SARS-CoV-2 infection in India: A case-control investigation in the time of COVID-19. *Indian J Med Res*; **151**(5): 459-67.
88. Kimball A, Hatfield KM, Arons M, et al. Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility - King County, Washington, March 2020. *MMWR Morb Mortal Wkly Rep* 2020; **69**(13): 377-81.
89. China Statistical Yearbook 2019. July 15, 2020. <http://www.stats.gov.cn/tjsj/ndsj/2019/indexch.htm> (accessed July 15 2020).
90. Wang YP, iang J, Zhu J, Zhou GX, Miao L, L. D. Ananalysis of the perinatal death and related male/female ratio of hospital delivery in China during 1988-1992. *J Pract Obstet Gynecol* 2001; **17**: 173-4.
91. Liu B, Gao ES. Risk factors for spontaneous abortion of Chinese married women at reproductive age. *China Public Health* 2002; **18**(7): 890-2.

Author	Risk factors	Clinical outcomes	No. included papers	Sample size	Indicator	Estimate (95%CI)
Figliozzi S	Age≥50	Fatal	/	407686	OR	33.75 (16.17, 70.46)
Figliozzi S	Age≥60	Fatal	/	558069	OR	23.46 (13.58, 40.52)
Parohan M	Age≥65yrs	Fatal	6	3088	OR	4.59 (2.61, 8.04)
Zheng Z	Age≥65yrs	Critical/fatal	2	1273	OR	6.01 (3.95, 9.16)
Figliozzi S	Age≥70	Fatal	8	587790	OR	13.19 (7.72, 22.55)
Figliozzi S	Age (continuous)	Composite outcome	/	1285	OR	1.03 (1.00, 1.06)
Hussain A	>70yrs	Fatal	6	46248	OR	0.17 (0.15, 0.19)
Lu L	Advanced age	Fatal	9	10228	OR	6.45 (3.86, 10.77)
Singh AK	Chronic kidney disease	Severe	2	8261	RR	3.86 (2.32, 6.40)
Wang X	Chronic kidney disease	Severe	11	3676	RR	2.22 (1.14, 4.31)
Wang B	Chronic kidney disease	Severe	4	1439	RR	2.51 (0.93, 6.78)
Zhou Y	Chronic kidney disease	Severe	5	/	OR	2.37 (1.05, 5.37)
Fang X	Chronic kidney disease	Severe	15	4861	RR	2.27 (1.55, 3.32)
Wu T	Chronic kidney disease	Severe	15	/	OR	1.84 (1.47, 2.30)
Yin T	Chronic kidney disease	Severe	10	/	OR	3.00 (1.58, 5.70)
Zhou Y	Chronic kidney disease	ICU	3	/	OR	3.04 (2.19, 4.23)
Singh AK	Chronic kidney disease	Fatal	1	701	RR	1.84 (1.03, 3.30)
Tian W	Chronic kidney disease	Fatal	6	1087	OR	9.41 (3.23, 27.40)
Zhou Y	Chronic kidney disease	Fatal	2	/	OR	7.73 (1.29, 46.18)
Fang X	Chronic kidney disease	Fatal	5	2219	RR	7.10 (3.14, 16.02)
Nandy K	Chronic kidney disease	Composite outcome	5	1602	OR	5.32 (1.86, 15.19)
Fang X	Lithiasis	Severe	2	308	RR	3.03 (0.73, 12.58)
Zhou Y	Chronic respiratory disease	Severe	13	/	OR	4.17 (2.67, 6.50)
Liu H	Chronic respiratory disease	Severe	10	/	OR	3.83 (2.15, 6.80)
Zhou Y	Chronic respiratory disease	ICU	3	/	OR	3.32 (2.55, 4.32)
Zhou Y	Chronic respiratory disease	Fatal	4	/	OR	4.06 (1.77, 9.31)
Lu L	Chronic respiratory disease	Fatal	5	2307	OR	4.75 (2.37, 9.52)
Zheng Z	Chronic respiratory disease	Critical/fatal	7	1752	OR	5.15 (2.51, 10.57)
Singh AK	COPD	Severe	6	9056	RR	2.62 (2.31, 2.97)
Wang B	COPD	Severe	6	1558	OR	5.97 (2.49, 14.29)
Xu L	COPD	Severe	5	623	OR	3.56 (1.33, 9.54)
Jain V	COPD	Severe	3	19	OR	6.42 (2.44, 16.90)
Fang X	COPD	Severe	14	6609	RR	4.20 (2.82, 6.25)
Zhao Q	COPD	Severe	10	1863	OR	4.38 (2.34, 8.20)
Alqahtani JS	COPD	Severe	7	1259	RR	1.88 (1.40, 2.40)
Catherine R	COPD	Severe	6	1997	RR	5.10 (3.08, 8.45)
Wu X	COPD	Severe	6	710	OR	6.92 (2.84, 16.82)
Sanchez-Ramirez DC	COPD	Severe	/	/	OR	5.80 (3.90, 8.50)
Wu T	COPD	Severe	17	/	OR	3.70 (2.93, 4.68)
Yin T	COPD	Severe	13	/	OR	4.25 (2.48, 7.27)
Fang X	COPD	Invasive ventilation	2	3370	RR	6.53 (2.70, 15.84)
Li J	COPD	ICU	7	915	OR	5.08 (2.68, 9.63)
Jain V	COPD	ICU	3	17	OR	17.80 (6.56, 48.20)
Fang X	COPD	ICU	4	3549	RR	5.61 (2.68, 11.76)
Zhao J	COPD	ICU	2	179	RR	7.65 (1.24, 47.13)
Singh AK	COPD	Fatal	1	187	RR	1.53 (1.03, 2.28)
Parohan M	COPD	Fatal	7	23765	OR	3.53 (1.79, 6.96)
Tian W	COPD	Fatal	4	450	OR	2.09 (0.49, 8.90)
Fang X	COPD	Fatal	4	3677	RR	5.31 (2.63, 10.71)
Nandy K	COPD	Fatal	3	342	OR	3.43 (0.49, 23.94)
Zhao Q	COPD	Fatal	2	243	OR	1.93 (0.59, 7.43)
Alqahtani JS	COPD	Fatal	2	167	RR	1.10 (0.60, 1.80)
Fang X	COPD	Composite outcome	2	3370	RR	8.52 (4.36, 16.65)
Figliozzi S	COPD	Composite outcome	17	13544	OR	2.63 (1.55, 4.44)
Nandy K	COPD	Composite outcome	8	1939	OR	6.66 (3.09, 14.34)
Fang X	Tuberculosis	Severe	2	592	RR	2.74 (0.72, 10.40)
Gao Y	Tuberculosis	Severe	4	2383	OR	2.10 (0.61, 7.18)
Gao Y	Tuberculosis	Fatal	2	234	OR	1.40 (0.10, 18.93)
Fang X	Respiratory system disease	Severe	18	7522	RR	3.25 (2.48, 4.27)
Yang J	Respiratory system disease	Severe	4	1425	OR	2.46 (1.76, 3.44)
Fang X	Respiratory system disease	ARDS	2	1889	RR	2.44 (1.20, 4.97)
Fang X	Respiratory system disease	Invasive ventilation	3	3415	RR	4.34 (2.04, 9.26)
Fang X	Respiratory system disease	ICU	4	3549	RR	4.66 (2.59, 8.40)
Fang X	Respiratory system disease	Fatal	7	4472	RR	3.22 (2.12, 4.90)
Catherine R	Respiratory system disease	Fatal	4	742	RR	3.03 (0.61, 15.04)
Fang X	Respiratory system disease	Composite outcome	2	3370	OR	8.52 (4.36, 16.65)
Wu X	Respiratory system disease	Severe	7	791	RR	4.45 (1.97, 10.06)
Sanchez-Ramirez DC	Respiratory system disease	Severe	21	12976	OR	4.21 (2.90, 6.00)
Fang X	Coronary heart disease	Severe	8	3899	RR	2.03 (1.39, 2.15)
Li J	Coronary heart disease	ICU	8	1050	OR	2.66 (1.71, 4.15)
Fang X	Coronary heart disease	Fatal	5	2452	RR	3.61 (1.45, 6.91)
Fang X	Coronary heart disease	Composite outcome	2	3370	RR	3.36 (2.15, 5.25)
Singh AK	Cardiovascular disease	Severe	7	9191	RR	2.55 (1.85, 3.51)
Wang X	Cardiovascular disease	Severe	23	5097	OR	3.84 (2.90, 5.07)
Wang B	Cardiovascular disease	Severe	4	1418	OR	2.93 (1.73, 4.96)
Xu L	Cardiovascular disease	Severe	7	906	OR	2.76 (1.39, 5.45)
Jain V	Cardiovascular disease	Severe	3	53	OR	2.70 (1.52, 4.80)
Aggarwal G	Cardiovascular disease	Severe	13	3812	OR	3.14 (2.32, 4.24)
Zhou Y	Cardiovascular disease	Severe	14	/	OR	3.05 (2.26, 4.11)
Fang X	Cardiovascular disease	Severe	18	6841	RR	2.74 (2.03, 3.70)
Pranata R	Cardiovascular disease	Severe	6	1337	OR	2.25 (1.51, 3.36)
Liu H	Cardiovascular disease	Severe	8	/	OR	4.18 (2.87, 6.09)
Yang J	Cardiovascular disease	Severe	4	1452	OR	3.42 (1.88, 6.22)
Wu X	Cardiovascular disease	Severe	13	2089	OR	3.16 (2.19, 4.56)
Wu T	Cardiovascular disease	Severe	15	/	OR	3.54 (2.68, 4.68)
Yin T	Cardiovascular disease	Severe	13	/	OR	3.56 (2.35, 5.40)
Fang X	Cardiovascular disease	ARDS	3	2090	RR	2.26 (1.43, 3.58)
Fang X	Cardiovascular disease	Invasive ventilation	3	3415	RR	2.90 (1.63, 5.15)
Jain V	Cardiovascular disease	ICU	3	75	OR	4.44 (2.64, 7.47)
Zhou Y	Cardiovascular disease	ICU	4	/	OR	2.97 (2.40, 3.68)
Fang X	Cardiovascular disease	ICU	5	3747	RR	2.74 (1.92, 3.92)
Zhao J	Cardiovascular disease	ICU	2	179	RR	2.28 (1.13, 4.58)
Singh AK	Cardiovascular disease	Fatal	2	/	RR	1.88 (1.41, 2.51)
Parohan M	Cardiovascular disease	Fatal	9	24180	OR	3.72 (1.77, 7.83)
Tian W	Cardiovascular disease	Fatal	12	1842	OR	3.81 (2.11, 6.85)
Aggarwal G	Cardiovascular disease	Fatal	3	566	OR	11.08 (2.59, 47.32)
Zhou Y	Cardiovascular disease	Fatal	4	/	OR	5.92 (2.66, 13.19)
Fang X	Cardiovascular disease	Fatal	11	4860	RR	2.67 (1.60, 4.43)
Li X	Cardiovascular disease	Fatal	8	2515	OR	4.85 (3.06, 7.70)
Pranata R	Cardiovascular disease	Fatal	6	1170	RR	2.25 (1.53, 3.29)
Nandy K	Cardiovascular disease	Fatal	2	243	OR	4.69 (0.22, 101.51)
Zheng Z	Cardiovascular disease	Critical/fatal	10	2422	OR	5.19 (3.25, 8.29)
Fang X	Cardiovascular disease	Composite outcome	2	3370	RR	3.09 (2.09, 4.57)
Figliozzi S	Cardiovascular disease	Composite outcome	19	12717	OR	3.15 (2.26, 4.41)
Nandy K	Cardiovascular disease	Composite outcome	8	1874	OR	4.58 (2.81, 7.47)
Wang B	Cardiovascular disease	Severe	3	1299	OR	3.89 (1.64, 9.22)
Singh AK	Cerebrovascular disease	Severe	1	1099	RR	1.73 (0.74, 4.05)
Zhou Y	Cerebrovascular disease	Severe	6	/	OR	2.24 (1.26, 3.98)
Fang X	Cerebrovascular disease	Severe	12	5756	RR	2.77 (1.70, 4.52)
Pranata R	Cerebrovascular disease	Severe	7	2585	OR	1.88 (1.00, 3.51)
Wu X	Cerebrovascular disease	Severe	7	1213	RR	3.34 (1.29, 8.69)
Siepmann T	Cerebrovascular disease	Severe	5	/	OR	1.44 (1.22, 1.71)
Wu T	Cerebrovascular disease	Severe	14	/	OR	2.53 (1.84, 3.49)
Yin T	Cerebrovascular disease	Severe	8	/	OR	3.48 (1.96, 6.21)
Fang X	Cerebrovascular disease	ARDS	5	1889	RR	3.15 (1.23, 8.04)
Fang X	Cerebrovascular disease	Invasive ventilation	2	3370	RR	3.98 (1.77, 8.93)
Li J	Cerebrovascular disease	ICU	4	806	OR	2.68 (1.29, 5.57)
Zhou Y	Cerebrovascular disease	ICU	1	/	OR	20.20 (2.34, 174.44)
Fang X	Cerebrovascular disease	ICU	3	3508	RR	5.12 (2.86, 9.17)
Siepmann T	Cerebrovascular disease	ICU	3	/	RR	2.79 (1.83, 4.24)
Pate U	Cerebrovascular disease	ICU	7	/	OR	1.54 (1.25, 1.62)
Tian W	Cerebrovascular disease	Fatal	6	948	OR	4.92 (1.54, 15.68)
Singh AK	Cerebrovascular disease	Fatal	1	/	OR	2.48 (2.14, 2.86)
Zhou Y	Cerebrovascular disease	Fatal	1	/	RR	13.27 (0.71, 249.04)
Fang X	Cerebrovascular disease	Fatal	6	3771	RR	4.61 (2.51, 8.47)
Pranata R	Cerebrovascular disease	Fatal	5	936	RR	2.38 (1.92, 2.96)
Catherine R	Cerebrovascular disease	Fatal	3	353	RR	36.88 (8.50, 160.04)
Siepmann T	Cerebrovascular disease	Fatal	6	/	RR	2.18 (1.75, 2.70)
Pate U	Cerebrovascular disease	Fatal	8	/	OR	1.45 (1.22, 1.72)
Fang X	Cerebrovascular disease	Composite outcome	2	3370	RR	4.10 (2.34, 7.18)
Figliozzi S	Cerebrovascular disease	Composite outcome	/	2595	OR	2.93 (1.64, 5.24)
Fang X	Cardiovascular/cerebrovascular disease	Severe	6	3057	RR	2.31 (1.31, 4.08)
Singh AK	Hypertension	Severe	6	2029	RR	1.66 (1.32, 2.09)
Wang X	Hypertension	Severe	33	6208	OR	2.92 (2.35, 3.64)
Wang B	Hypertension	Severe	6	1558	OR	2.29 (1.69, 3.10)
Jain V	Hypertension	Severe	3	212	OR	1.97 (1.40, 2.77)
Xu L	Hypertension	Severe	10	1083	OR	2.31 (1.68, 3.18)
Zhou Y	Hypertension	Severe	17	/	OR	2.75 (2.08, 3.64)
Fang X	Hypertension	Severe	23	7739	RR	2.09 (1.74, 2.52)
Zhang J	Hypertension	Severe	12	2389	OR	2.27 (1.80, 2.86)
Parveen R	Hypertension	Severe	3	1374	OR	2.69 (1.27, 5.73)
Liu H	Hypertension	Severe	9	/	OR	2.84 (2.22, 3.63)
Lippi G	Hypertension	Severe	11	/	OR	2.49 (1.98, 3.12)
Yang J	Hypertension	Severe	4	1418	OR	2.36 (1.46, 3.83)
Catherine R	Hypertension	Severe	8	2163	RR	2.15 (1.64, 2.81)
Wu X	Hypertension	Severe	18	2510	OR	2.63 (1.79, 3.88)
Wu T	Hypertension	Severe	22	/	OR	2.40 (2.08, 2.78)
Yin T	Hypertension	Severe	18	/	OR	2.21 (1.79, 2.74)
Fang X	Hypertension	ARDS	3	2090	RR	1.90 (1.57, 2.30)
Fang X	Hypertension	Invasive ventilation	3	3415	RR	2.35 (1.92, 2.89)
Jain V	Hypertension	ICU	3	214	OR	3.65 (2.22, 5.99)
Li J	Hypertension	ICU	8	1050	OR	2.25 (1.71, 2.95)
Zhou Y	Hypertension	ICU	3	/	OR	5.34 (1.52, 18.71)
Fang X	Hypertension	ICU	5	3747	RR	2.31 (1.97, 2.70)
Parveen R	Hypertension	ICU	2	179	OR	0.42 (0.22, 0.81)
Zhao J	Hypertension	ICU	2	179	RR	2.34 (1.21, 4.51)
Singh AK	Hypertension	Fatal	3	/	RR	1.52 (0.86, 2.71)
Taylor EH	Hypertension	Fatal	3	534	OR	4.17 (2.90, 5.99)
Parohan M	Hypertension	Fatal	8	23814	OR	2.70 (1.40, 5.24)
Tian W	Hypertension	Fatal	11	4263	OR	2.53 (2.07, 3.09)
Zhou Y	Hypertension	Fatal	4	/	OR	3.45 (2.23, 5.34)
Fang X	Hypertension	Fatal	11	4860	RR	1.74 (1.31, 2.30)
Li X	Hypertension	Fatal	7	2463	OR	3.67 (2.31, 5.83)
Zhang J	Hypertension	Fatal	6	2116	OR	3.48 (1.72, 7.08)
Parveen R	Hypertension	Fatal	2	465	OR	0.50 (0.34, 0.73)
Lu L	Hypertension	Fatal	6	3342	OR	3.25 (2.15, 4.91)
Lippi G	Hypertension	Fatal	2	/	OR	2.42 (1.51, 3.90)
Catherine R	Hypertension	Fatal	5	722	RR	2.09 (1.65, 2.64)
Zheng Z	Hypertension	Critical/fatal	10	2527	OR	2.72 (1.60, 4.64)
Fang X	Hypertension	Composite outcome	2	3370	RR	2.20 (1.44, 3.36)
Figliozzi S	Hypertension	Composite outcome	35	9360	OR	2.25 (1.80, 2.82)
Nandy K	Hypertension	Composite outcome	8	1861	OR	2.95 (2.21, 3.94)
Catherine R	Any heart condition	Severe	7	2147	RR	4.09 (2.45, 6.84)
Catherine R	Any heart condition	Fatal	5	769	RR	3.95 (1.03, 15.20)
Singh AK	Diabetes	Severe	7	9191	RR	2.11 (1.40, 3.19)
Wang X	Diabetes	Severe	31	6104	OR	2.61 (2.05, 3.33)
Wang B	Diabetes	Severe	6	1558	OR	2.47 (1.67, 3.66)
Jain V	Diabetes	Severe	3	105	OR	3.12 (1.00, 9.75)
Xu L	Diabetes	Severe	10	1083	OR	3.04 (2.01, 4.60)
Zhou Y	Diabetes	Severe	17	/	OR	2.73 (1.95, 3.82)

Author	Risk factors	Clinical outcomes	No. included papers	Sample size	Indicator	Estimate (95%CI)
Ma C	Age≥50yrs	Severe	5	5414	OR	2.61 (2.29, 2.98)
Biswas M	Age≥50yrs	Fatal	6	2268	RR	8.69 (4.14, 18.27)
Bellou V	Age>50yrs	Severe/Critical	6	810	OR	4.50 (2.53, 8.01)
Kumar A	Age>60yrs	Severe	21	3394	OR	4.82 (2.83, 8.24)
Bellou V	Age>60yrs	Severe/Critical	5	1793	OR	4.13 (2.73, 6.26)
Dorjee K	Age≥65yrs	Fatal	12	9528	RR	3.77 (2.94, 4.82)
Bellou V	Age>65yrs	Severe/Critical	4	1566	OR	4.29 (2.11, 8.72)
Bellou V	Age>65yrs	Fatal	3	1059	OR	3.82 (2.56, 5.71)
Liu Y	Chronic kidney disease	Severe	13	3225	OR	3.28 (2.00, 5.37)
Tabrizi R	Chronic kidney disease	Severe	6	/	OR	6.38 (3.23, 12.59)
Dorjee K	Chronic kidney disease	Severe	14	/	RR	1.67 (1.30, 2.16)
Ma C	Chronic kidney disease	Severe	4	1620	OR	6.02 (2.19, 16.51)
Bellou V	Chronic kidney disease	ICU	3	366	OR	1.20 (0.13, 10.82)
Bellou V	Chronic kidney disease	Severe/Critical	8	2338	OR	2.23 (1.12, 4.42)
Ssentongo P	Chronic kidney disease	Fatal	4	3134	RR	2.36 (0.97, 5.77)
Bellou V	Chronic kidney disease	Fatal	4	983	OR	4.26 (0.62, 29.09)
Dorjee K	Chronic kidney disease	Fatal	8	/	RR	2.02 (1.30, 3.13)
Bellou V	Chronic kidney disease	Composite outcome	3	1849	OR	4.79 (2.26, 10.17)
Cao G	Kidney disease	Severe	11	2746	OR	5.44 (2.81, 10.54)
Zaki N	Kidney disease	Severe	6	2627	OR	2.24 (1.01, 4.99)
Islam MS	Kidney disease	Fatal	9	1977	OR	5.62 (3.34, 9.46)
Biswas M	Kidney disease	Fatal	3	1342	RR	3.59 (1.49, 8.67)
Khan MA	Kidney disease	Fatal	21	21945	OR	3.02 (2.60, 3.51)
Sreenivasan J	Kidney disease	Composite outcome	3	469	OR	5.12 (1.18, 22.19)
Bellou V	Chronic respiratory disease	Severe/Critical	5	1145	OR	2.11 (1.22, 3.64)
Bellou V	Chronic respiratory disease	Fatal	3	1039	OR	2.97 (1.58, 5.59)
Ma C	COPD	Severe	6	2283	OR	5.32 (2.61, 10.85)
Zaki N	COPD	Severe	7	1703	OR	3.24 (1.66, 6.32)
Cao G	COPD	Severe	18	3979	OR	4.17 (2.86, 6.08)
Kumar A	COPD	Severe	13	2395	OR	4.37 (2.52, 7.59)
Tabrizi R	COPD	Severe	8	/	OR	4.07 (2.30, 7.22)
Bellou V	COPD	Severe/Critical	7	1852	OR	4.44 (2.46, 8.02)
Bellou V	COPD	Fatal	4	1199	OR	3.65 (1.25, 10.64)
Ssentongo P	COPD	Fatal	7	11763	RR	1.76 (0.92, 3.36)
Dorjee K	COPD	Fatal	9	2770	RR	1.97 (1.59, 2.43)
Sreenivasan J	COPD	Composite outcome	4	552	OR	7.49 (2.50, 22.45)
Khan MA	Respiratory system disease	Fatal	28	32398	OR	2.02 (1.80, 2.26)
Ma C	Respiratory system disease	Fatal	/	/	RR	3.43 (2.42, 4.86)
Islam MS	Respiratory system disease	Fatal	18	6371	OR	2.68 (1.75, 4.09)
Biswas M	Respiratory system disease	Fatal	4	46014	RR	4.14 (1.82, 9.39)
Chen Y	Coronary heart disease	Severe	6	1720	OR	2.85 (1.68, 4.84)
Zaki N	Coronary heart disease	Severe	9	2924	OR	2.97 (1.99, 4.45)
Shamshirian A	Coronary heart disease	ICU	3	/	OR	4.19 (1.27, 13.80)
Bellou V	Coronary heart disease	Severe/Critical	7	1212	OR	3.42 (1.64, 7.15)
Ssentongo P	Coronary heart disease	Fatal	5	10149	RR	2.00 (1.58, 2.27)
Bellou V	Coronary heart disease	Fatal	3	490	OR	6.32 (2.15, 18.53)
Biswas M	Coronary heart disease	Fatal	4	1543	RR	3.84 (1.64, 8.99)
Tabrizi R	Cardiovascular disease	Severe	9	/	OR	2.44 (1.64, 3.63)
Dorjee K	Cardiovascular disease	Severe	10	29806	OR	4.97 (3.76, 6.58)
Ma C	Cardiovascular disease	Severe	5	2197	OR	3.22 (1.49, 6.97)
Zaki N	Cardiovascular disease	Severe	8	2623	OR	2.89 (1.90, 4.40)
Cao G	Cardiovascular disease	Severe	10	3004	OR	4.02 (2.41, 6.60)
Shamshirian A	Cardiovascular disease	ICU	6	/	OR	4.17 (2.52, 6.88)
Bellou V	Cardiovascular disease	ICU	3	547	OR	3.44 (1.62, 7.32)
Bellou V	Cardiovascular disease	Severe/Critical	9	2713	OR	3.50 (2.63, 4.65)
Bellou V	Cardiovascular disease	Severe/Critical	8	1522	OR	2.84 (1.55, 5.20)
Bellou V	Cardiovascular disease	Fatal	5	1747	OR	3.36 (1.39, 8.10)
Ssentongo P	Cardiovascular disease	Fatal	9	48424	RR	2.35 (1.44, 3.84)
Bellou V	Cardiovascular disease	Fatal	5	871	OR	2.98 (1.40, 6.35)
Khan MA	Cardiovascular disease	Fatal	33	33382	OR	3.32 (2.79, 3.95)
Dorjee K	Cardiovascular disease	Fatal	16	5027	RR	1.99 (1.72, 2.38)
Shamshirian A	Cardiovascular disease	Fatal	4	/	OR	1.95 (1.17, 3.24)
Islam MS	Cardiovascular disease	Fatal	20	47685	OR	4.67 (3.22, 6.77)
Islam MS	Cardiovascular disease	Fatal	13	2183	OR	5.84 (3.63, 9.39)
Bellou V	Cardiovascular disease	Composite outcome	3	1849	OR	3.31 (1.82, 5.99)
Sreenivasan J	Cardiovascular disease	Composite outcome	2	278	OR	8.30 (1.24, 55.37)
Rahman A	Hypertension	Severe	9	2220	RR	1.79 (1.57, 2.04)
Matsushita K	Hypertension	Severe	8	24943	OR	2.87 (2.09, 3.93)
Tabrizi R	Hypertension	Severe	10	/	OR	2.35 (1.83, 3.02)
Dorjee K	Hypertension	Severe	23	/	RR	1.62 (1.37, 1.92)
Chen Y	Hypertension	Severe	9	1936	OR	2.30 (1.76, 3.00)
Ma C	Hypertension	Severe	10	2511	OR	2.06 (1.61, 2.62)
Zaki N	Hypertension	Severe	11	3532	OR	2.43 (1.71, 3.45)
Cao G	Hypertension	Severe	26	4912	OR	2.53 (1.89, 3.37)
Kumar A	Hypertension	Severe	13	2490	OR	2.30 (1.84, 2.89)
Kumar A	Hypertension	Severe	13	2490	OR	2.30 (1.84, 2.89)
Bellou V	Hypertension	ICU	4	407	OR	3.03 (0.73, 12.57)
Shamshirian A	Hypertension	ICU	9	/	OR	2.69 (1.55, 4.67)
Bellou V	Hypertension	Severe/Critical	13	3127	OR	2.83 (2.03, 3.95)
Ssentongo P	Hypertension	Fatal	9	49625	RR	1.89 (1.58, 2.27)
Bellou V	Hypertension	Fatal	6	1470	OR	2.48 (1.59, 3.86)
Dorjee K	Hypertension	Fatal	14	9755	RR	1.84 (1.66, 2.03)
Shamshirian A	Hypertension	Fatal	7	/	OR	1.92 (1.34, 2.74)
Islam MS	Hypertension	Fatal	19	47797	OR	3.16 (2.51, 3.97)
Biswas M	Hypertension	Fatal	4	46163	RR	2.63 (2.32, 2.98)
Sreenivasan J	Hypertension	Composite outcome	6	814	OR	2.46 (1.37, 4.42)
Cao G	Cardiac disease	Severe	21	4430	OR	4.11 (3.15, 5.35)
Kumar A	Cardiac disease	Severe	13	2381	OR	3.88 (2.30, 6.54)
Sreenivasan J	Cardiac disease	Composite outcome	6	814	OR	5.82 (2.44, 13.85)
Biswas M	Cardio-cerebrovascular disease	Fatal	3	45823	RR	5.06 (4.13, 6.20)
Ssentongo P	Heart failure	Fatal	3	10887	RR	2.66 (1.58, 4.48)
Shamshirian A	Heart failure	Fatal	3	/	OR	11.73 (5.17, 26.60)
Tabrizi R	Stroke	Severe	4	/	OR	3.94 (0.88, 17.59)
Ssentongo P	Stroke	Fatal	3	2335	RR	2.72 (0.90, 8.21)
Rahman A	Diabetes	Severe	10	2240	RR	1.57 (1.25, 1.98)
Matsushita K	Diabetes	Severe	9	29580	OR	3.20 (2.26, 4.53)
Tabrizi R	Diabetes	Severe	9	/	OR	3.54 (1.79, 7.01)
Dorjee K	Diabetes	Severe	25	/	RR	1.50 (1.32, 1.71)
Chen Y	Diabetes	Severe	9	1936	OR	2.67 (1.91, 3.74)
Ma C	Diabetes	Severe	10	2511	OR	2.48 (1.82, 3.40)
Zaki N	Diabetes	Severe	11	3532	OR	2.27 (1.46, 3.53)
Cao G	Diabetes	Severe	28	5047	OR	43.00 (1.98, 2.97)
Kumar A	Diabetes	Severe	14	2542	OR	3.11 (1.99, 4.88)
Bellou V	Diabetes	ICU	4	407	OR	2.06 (0.77, 5.50)
Bellou V	Diabetes	Severe/Critical	12	2902	OR	2.04 (1.54, 2.70)
Ssentongo P	Diabetes	Fatal	12	49452	RR	1.37 (0.85, 2.20)
Bellou V	Diabetes	Fatal	7	1720	OR	1.89 (1.07, 3.36)
Dorjee K	Diabetes	Fatal	16	9807	RR	1.51 (1.37, 1.68)
Palaodimos L	Diabetes	Fatal	/	14425	OR	1.65 (1.35, 1.96)
Islam MS	Diabetes	Fatal	21	47864	OR	2.45 (1.82, 3.30)
Biswas M	Diabetes	Fatal	5	46215	RR	3.34 (2.79, 4.00)
Sreenivasan J	Diabetes	Composite outcome	6	814	OR	2.46 (1.37, 4.42)
Bellou V	Diabetes	Composite outcome	3	1849	OR	1.66 (1.15, 2.40)
Gao Y	Cancer	Severe	13	3450	OR	2.84 (1.75, 4.62)
Cao G	Cancer	Severe	15	2987	OR	1.73 (1.07, 2.78)
Bellou V	Cancer	ICU	3	288	OR	0.91 (0.28, 3.02)
Su Q	Cancer	ICU	6	2447	OR	1.83 (0.82, 4.08)
Salunke AA	Cancer	ICU	4	1314	OR	2.88 (1.18, 7.01)
Bellou V	Cancer	Severe/Critical	11	3401	OR	2.20 (1.28, 3.79)
Ssentongo P	Cancer	Fatal	4	46716	RR	1.93 (1.15, 3.24)
Bellou V	Cancer	Fatal	5	1400	OR	1.88 (0.75, 4.72)
Khan MA	Cancer	Fatal	20	8826	OR	2.22 (1.63, 3.03)
Su Q	Cancer	Fatal	3	2956	OR	4.87 (1.52, 15.59)
Gao Y	Cancer	Fatal	6	2671	OR	2.60 (1.28, 5.26)
Islam MS	Cancer	Fatal	17	47201	OR	2.16 (1.41, 3.33)
Salunke AA	Cancer	Fatal	5	1417	OR	2.25 (0.71, 7.10)
Sreenivasan J	Cancer	Composite outcome	3	469	OR	1.54 (0.58, 4.09)
Khan MA	Chronic liver disease	Fatal	14	12097	OR	1.44 (1.21, 1.71)
Islam MS	Liver disease	Fatal	8	1350	OR	2.81 (1.31, 6.01)
Tabrizi R	Immunodeficiency/Immunosuppression	Severe	3	/	OR	1.08 (0.18, 6.26)
Soeroto AY	BMI ≥30	Composite outcome	3	476	OR	1.89 (1.03, 3.34)

