Effectiveness of homologous or heterologous immunization regimens with inactivated COVID-19 vaccine against SARS-CoV-2: a systematic review and meta-analysis

Supplementary materials

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Supplement table 1. Search strategy.

No.	Terms	N
PubMed		
#1	COVID-19[MeSH Terms] OR SARS-CoV-2[MeSH Terms] OR COVID-19 OR SARS-CoV-2 OR COVID19 OR COVID-2019 OR 2019-nCoV OR 2019nCoV OR CoV 2 OR CoV2 OR SARS-CoV-2019 OR SARS-CoV-19 OR SARSCoV2 OR SARS2 OR coronavir* OR corona virus OR nCoV	324,230
#2	CoronaVac OR Picovacc OR Sinovac OR Sinopharm OR Covilo OR HB02 OR WIV04 OR BBIBP* OR BIBP* OR WIBP* OR inactivated OR killed OR inactive	511,933
#3	effic* OR effec*	11,850,474
#4	vaccines [MeSH Terms]) OR (vaccin*	492,799
#5	**#1 AND #2 AND #3 AND #4**	1,576
Web of Science		
#1	TI=(COVID-19 OR SARS-CoV-2 OR COVID19 OR COVID-2019 OR 2019-nCoV OR 2019nCoV OR CoV 2 OR CoV2 OR SARS-CoV-2019 OR SARS-CoV-19 OR SARSCoV2 OR SARS2 OR coronavir* OR corona virus OR nCoV) OR AB=(COVID-19 OR SARS-CoV-2 OR COVID-19 OR SARS-CoV-2 OR COVID19 OR COVID-2019 OR 2019-nCoV OR 2019nCoV OR CoV 2 OR CoV2 OR SARS-CoV-2019 OR SARS-CoV-19 OR SARSCoV2 OR SARS2 OR coronavir* OR corona virus OR nCoV)	460,863
#2	TI= (inactivated OR killed OR inactive OR CoronaVac OR Picovacc OR Sinovac OR BBIBP* OR BIBP* OR WIBP* OR Sinopharm OR Covilo OR HB02 OR WIV04) OR AB= (inactivated OR killed OR inactive OR CoronaVac OR Picovacc OR Sinovac OR BBIBP* OR BIBP* OR WIBP* OR Sinopharm OR Covilo OR HB02 OR WIV04)	771,950
#3	TI= (effic* OR effec*) OR AB= (effic* OR effec*)	40,173,678
#4	TI= (vaccin*) OR AB= (vaccin*)	578,375
#5	**#1 AND #2 AND #3 AND #4**	1,467
Embase		
#1	‘coronavirus disease 2019’/exp	264,990
#2	‘severe acute respiratory syndrome coronavirus 2’/exp	78,371
#3	(‘COVID-19’:ti OR ‘SARS-CoV-2’:ti OR ‘COVID-19’:ti OR ‘SARS-CoV-2’:ti OR ‘COVID19’:ti OR ‘COVID-2019’:ti OR ‘2019-nCoV’:ti OR ‘2019nCoV’:ti OR ‘CoV 2’:ti OR ‘CoV2’:ti OR ‘SARS-CoV-2019’:ti OR ‘SARS-CoV-19’:ti OR ‘SARSCoV2’:ti OR ‘SARS2’:ti OR ‘coronavir*’:ti OR ‘corona virus’:ti OR ‘nCoV’:ti) OR (‘COVID-19’:ab OR ‘SARS-CoV-2’:ab OR ‘COVID-19’:ab OR ‘SARS-CoV-2’:ab OR ‘COVID19’:ab OR ‘COVID-2019’:ab OR ‘2019-nCoV’:ab OR ‘2019nCoV’:ab OR ‘CoV 2’:ab OR ‘CoV2’:ab OR ‘SARS-CoV-2019’:ab OR ‘SARS-CoV-19’:ab OR ‘SARSCoV2’:ab OR ‘SARS2’:ab OR ‘coronavir*’:ab OR ‘corona virus’:ab OR ‘nCoV’:ab)	332,021

#4	#1 OR #2 OR #3	359,393
#5	‘inactivated vaccine’/exp	7,209
#6	‘coronavac’/exp	1,278
#7	‘covilo’/exp	525
#8	‘wibp-corv vaccine’/exp	66
#9	(‘inactivated’:ti OR ‘killed’:ti OR ‘inactive’:ti OR ‘CoronaVac’:ti OR ‘Picovacc’:ti OR ‘Sinovac’:ti OR ‘BBIBP*’:ti OR ‘BIBP*’:ti OR ‘WIBP*’:ti OR ‘Sinopharm’:ti OR ‘Covilo’:ti OR ‘HB02’:ti OR ‘WIV04’:ti) OR (‘inactivated’:ab OR ‘inactive’:ab OR ‘killed’:ab OR ‘CoronaVac’:ab OR ‘Picovacc’:ab OR ‘Sinovac*’:ab OR ‘BBIBP*’:ab OR ‘BIBP*’:ab OR ‘WIBP*’:ab OR ‘Sinopharm*’:ab OR ‘Covilo’:ab OR ‘HB02’:ab OR ‘WIV04’:ab)	275,406
#10	#5 OR #6 OR #7 OR #8 OR #9	278,646
#11	(‘effic*’:ti OR ‘effec*’:ti) OR (‘effic*’:ab OR ‘effec*’:ab)	11,543,606
#12	'vaccine'/exp	416,426
#13	'vaccination'/exp	229,608
#14	'vaccin*':ti OR 'vaccin*':ab	461,746
#15	#12 OR #13 OR #14	602,465
#16	#4 AND #10 AND #11 AND #15	1,707
Cochrane Library		
#1	Mesh descriptor: [COVID-19] explode all trees	2,317
#2	Mesh descriptor: [SARS-CoV-2] explode all trees	1,127
#3	COVID-19 OR SARS-CoV-2 OR COVID19 OR COVID-2019 OR 2019 nCoV OR 2019nCoV OR CoV 2 OR CoV2 OR SARS-CoV-2019 OR SARS-CoV-19 OR SARSCoV2 OR SARS2 OR coronavir* OR corona virus OR nCoV	13,429
#4	#1 OR #2 OR #3	13,430
#5	Mesh descriptor: [Vaccines, Inactivated] explode all trees	1,043
#6	CoronaVac OR Picovacc OR Sinovac OR Sinopharm OR Covilo OR HB02 OR WIV04 OR BBIBP* OR BIBP* OR WIBP* OR inactivated OR killed OR inactive	10,798
#7	#5 OR #6	10,798
#8	Mesh descriptor: [Vaccines Efficacy] explode all trees	17
#9	effic* OR effec*	1,273,561
#10	#8 OR #9	1,273,561
#11	vaccin*	30,130
#12	#4 AND #7 AND #10 AND #11	166

Supplement table 2A. Characteristics of included studies in this systematic review and meta-analysis.

First author	Publish date	Country	Study design	Age (Mean, SD)	Male (%)	Population characteristics	Comorbidities, n (%)	Variants
Nawal Al Kaabi	2021.7.6	United Arab Emirates	Randomized control trial	WIV04 36.2 (9.2) HB02 36.1 (9.3) Alum-only placebo 36.1 (9.3)	Overall 84.4 WIV04 84.0 HB02 84.5 Placebo 84.8	General population (adults aged 18 years or older)	NA	NA
Alejandro Jara	2021.9.2	Chile	Prospective cohort study	16–19 years Unvaccinated n=670,451 Vaccinated n=30,033 20–29 years Unvaccinated n=1,655,595 Vaccinated n=306,227 30–39 years Unvaccinated n=1,446,544 Vaccinated n=361,781 40–49 years Unvaccinated n=851,622 Vaccinated n=406,661 50–59 years Unvaccinated n=434,694 Vaccinated n=838,602 60–69 years Unvaccinated n=221,738 Vaccinated n=1,102,509	Overall 46.1 Vaccinated 42.0 Unvaccinated 49.3	General population (adults aged 16 years or older)	Chronic kidney disease, diabetes, cardiovascular disease, stroke, chronic obstructive pulmonary disease, hematologic disease, autoimmune disease, human immunodeficiency virus infection, and Alzheimer's disease and other dementias. No. of comorbidities ≥1 Unvaccinated n=1,024,044 Vaccinated n=2,134,862	Gamma and Alpha

				70–79 years Unvaccinated n=111,592 Vaccinated n=742,078 ≥80 years Unvaccinated n=79,492 Vaccinated n=385,683				
Mine Durusu Tanriover	2021.7.17	Turkey	Randomized control trial	18–44 years 45–59 years	NA	General population (adults aged 18-59 years)	Hypertension, cardiovascular disease other than hypertension, chronic respiratory disease, diabetes, malignancy, autoimmune or autoinflammatory disease	NA
Otavio T Ranzani	2021.8.20	Brazil	Test-negative case-control study	≥70 years	NA	Elderly population (adults aged 70 years or older)	Cardiovascular, renal, neurological, haematological, and hepatic, diabetes, chronic respiratory disorder, obesity, or immunosuppression.	Gamma
Farida Ismail AlHosani	2022.2.19	United Arab Emirates	Retrospective cohort study	15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80+years	Overall 64.1 Unvaccinated 77.9 Fully vaccinated 54.6	General population (adults aged 18 years or older)	NA	Alpha and Beta
Min Kang	2022.2.1	China	Retrospective cohort study	Unvaccinated 48.0 (18.1) Fully vaccinated 39.3 (10.5)	Overall 54.1 Unvaccinated 53.9 Fully vaccinated 54.8	Adult case and close contacts (adults aged 18 years or older)	NA	Delta (GS)
Thiago Cerqueira-Silva	2022.7.18	Brazil	Test-negative case-control study	18-59 years 60-79 years ≥80 years	NA	General population (adults aged 18 years or older)	Cardiac disease, diabetes mellitus, obesity, immunosuppression, chronic respiratory disease, and chronic kidney disease.	Omicron

Alejandro Jara	2022.6.10	Chile	Prospective cohort study	CoronaVac booster Female 69.7 (11.9) Male 69.5 (10.6) BNT162b2 booster Female 44.8 (14.5) Male 45.8 (14.7) AZD1222 booster Female 68.4 (9.36) Male 67.5 (8.71)	Overall 43.4 Unvaccinated 52.8 Three doses of CoronaVac 39.5 Two doses of CoronaVac+BNT162b2 38.3 Two doses of CoronaVac+AZD1222 44.0	General population (adults aged 16 years or older)	Chronic kidney disease, diabetes, cardiovascular disease (ie, hypertension, myocardial infarction), stroke, chronic obstructive pulmonary disease, haematological disease (ie, lymphoma, leukaemia, myeloma), autoimmune disease (ie, rheumatoid arthritis, juvenile idiopathic arthritis, systemic lupus erythematosus), HIV, and Alzheimer's disease and other dementias.	Delta (63%)
Chao Ma	2022.5.3	China	Retrospective cohort study	18–59 years Unvaccinated n=52 Fully vaccinated n=325 ≥60 years Unvaccinated n=14 Fully vaccinated n=6	Overall 74.6 Unvaccinated 43.9 Fully vaccinated 80.7	Adult case and close contacts (adults aged 18 years or older)	NA	Delta
Gunay Can	2022.4.20	Turkey	Retrospective cohort study	Fully vaccinated 40 (11) Unvaccinated 35(10)	Overall 43.5 Fully vaccinated 45.2 Unvaccinated 39.3	Healthcare workers	NA	Alpha (75%)
Paskorn Sritipsukho	2022.2.16	Thailand	Test-negative case-control study	18-60 years >60 years	NA	General population (adults aged 18 years or older)	Obesity, Cardiovascular diseases, Diabetes mellitus, Chronic lung/airway diseases, Chronic kidney diseases, Malignancy, Cerebrovascular diseases.	Delta
Zoltán Vokó	2021.11.25	Hungary	Observational (cohort) study	16–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–84, ≥85 years	Overall 47.4 HB02 44.8 Unvaccinated 47.7	General population (Hungarian	NA	Alpha

						residents aged 16 years or older)		
Jing Lian Suah	2022.3.22	Malaysia	Retrospective cohort study	18-39 years Unvaccinated n=39,846 CoronaVac n=54,371 40-59 years Unvaccinated n=14,998 CoronaVac n=36,675 ≥60 years Unvaccinated n=7,662 CoronaVac n=19,752	Overall 55.0 Unvaccinated 60.7 CoronaVac 51.8	General population (confirmed COVID-19 cases aged 18 years or older)	Unvaccinated n=19,315 (30.9) CoronaVac n=12,533 (11.3)	NA
Analía Rearte	2022.3.26	Argentina	Test-negative case-control study	60-69 years 70-79 years ≥80 years	NA	Elderly population (adults aged 60 years or older)	Hypertension, heart disease, diabetes, kidney disease, liver disease, immunodeficiencies, asthma, oncological disease.	Alpha, Lambda, and Gamma
Leonardo Arregocés-Castillo	2022.3.21	Colombia	Retrospective cohort study	Median (IQR) Unvaccinated 68.0 (63.0–75.0) CoronaVac 72.0 (64.0–80.0)	Overall 45.5 Unvaccinated 45.7 CoronaVac 45.1	Elderly population (confirmed COVID-19 cases aged 60 years or older)	Hypertension, diabetes, chronic kidney disease, HIV, or cancer. At least one comorbidity Unvaccinated n=384,648 (27.2) CoronaVac n=204,302 (29.9)	Mu (B.1.621)
Thiago Cerqueira-Silva	2022.4.28	Brazil	Test-negative case-control study	18–59 years 60–79 years ≥80 years	NA	General population (adults aged 18 years or older)	Cardiac disease, diabetes mellitus, obesity, immunosuppression and chronic kidney disease.	Gamma and Delta
Yaowen Zhang	2022.8.20	Morocco	Retrospective cohort study	Unvaccinated 40.7 (15.1) Fully vaccinated 37.9 (13.5)	Overall 57.2 Unvaccinated 56.7 CoronaVac 57.9	General population (Morocco residents aged 18-99 years)	NA	Alpha

Dan Wu	2022.1.28	China	Retrospective cohort study	18-59 years Unvaccinated n=408 BBIBP-CorV n=199 CoronaVac n=329 BBIBP-CorV+CoronaVac n=212 ≥60 years Unvaccinated n=65 BBIBP-CorV n=12 CoronaVac n=7 BBIBP-CorV+CoronaVac n=25	Overall 46.4 Unvaccinated 49.0 BBIBP-CorV 46.0 CoronaVac 40.2 BBIBP-CorV+CoronaVac 51.5	General population (adults aged 18 years or older)	Unvaccinated n=113 BBIBP-CorV n=20 CoronaVac n=27 BBIBP-CorV+CoronaVac n=24	Delta (GS)
Alireza Mirahmadizadeh	2022.5.9	Iran	Historical cohort study	Median (IQR) Unvaccinated 36 (29–48) BBIBP-CorV NA 18-44 years 45-64 years ≥65 years	Unvaccinated 45.3 BBIBP-CorV NA	General population (adults aged 18 years or older)	underlying medical condition (ie, pregnancy, diabetes mellitus, malignancy, hypertension, cardiovascular disease, chronic kidney disease, and pulmonary disease)	NA
Alexandre R Marra	2022.3.30	Brazil	Retrospective cohort study	Median (IQR) Unvaccinated 32 (26–38) CoronaVac 36 (30–42)	Overall 27.5 Unvaccinated 30.8 CoronaVac 26.8	Healthcare workers (aged ≥ 18 years)	Hypertension, Diabetes mellitus, Obesity, Dyslipidemia, Asthma Unvaccinated n=191(20.3) CoronaVac n=1,181(24.9)	Gamma
Matt D T Hitchings	2021.9.1	Brazil	Test-negative case-control study	18-29 years 30-59 years ≥60 years	NA	Healthcare workers (aged ≥ 18 years)	NA	Gamma

Nawal Al Kaabi	2022.6.9	United Arab Emirates	Retrospective cohort study	Median (IQR) Overall 35 (28–43) Unvaccinated 34 (28–43) Vaccinated 35 (29–43)	Overall 63.7 Unvaccinated 63.8 Vaccinated 63.5	General population (UAE residents aged 18 years or older)	Asthma, Chronic kidney disease, Diabetes, Heart disease, Hypertension, Immunodeficiencies, Neoplasms, Respiratory diseases, History of transplantation.	Alpha and Delta
Pilar T V Florentino	2022.8.13	Brazil	Test-negative case-control study	6–11 years	NA	Young people aged 6-11 years	Cardiac disease, Diabetes mellitus, Obesity, Immunosuppression, and chronic kidney disease.	Omicron
Rapeepong Suphanchaimat	2022.7.5	Thailand	Test-negative case-control study	<18 years 18-59 years >60 years	NA	General population (the whole Thai population)	NA	Delta
Jing Lian Suah	2021.11.24	Malaysia	Retrospective cohort study	18-20 years n=38,823 20-29 years n=279,812 30-39 years n=237,335 40-49 years n=146,808 50-59 years n=96,808 60-69 years n=58,138 70-79 years n=22,383 ≥80 years n=8,440	NA	General population (confirmed COVID-19 cases aged 18 years or older)	Unvaccinated n=165,511 Fully vaccinated n=16,618	Beta and Delta
Iftikhar Nadeem	2022.5.4	Pakistan	Test-negative case-control study	60 years and above	Overall 67.4 Not vaccinated 64.9 Fully vaccinated 69.0	Elderly population (adults aged 60 years or older).	Ischaemic heart disease n=309 Hypertension n=1,068 Diabetes n=735 Chronic liver disease n=125	Beta, Gamma, and Delta

Angel Paternina-Caicedo	2022.7.1	Colombia	Retrospective cohort study	40-49 years Unvaccinated n=197,166 Two-dose CoronaVac n=1,503 50-59 years Unvaccinated n=166,090 Two-dose CoronaVac n=13,422 60-69 years Unvaccinated n=73,470 Two-dose CoronaVac n=19,011 70-79 years Unvaccinated n=41,849 Two-dose CoronaVac n=22,788 80+ years Unvaccinated n=60,435 Two-dose CoronaVac n=20,005	Overall 49.3 Unvaccinated 49.5 CoronaVac 47.9	General population (adults aged 40 years or older)	Diabetes, human immunodeficiency virus (HIV), cancer, hypertension, tuberculosis, neurological diseases, and chronic renal diseases.	Alpha, Gamma, Delta, Lambda, and Mu (>50%)
Vladimir Petrović	2022.3.30	Serbia	Observational (cohort) study	≥60 years	NA	Elderly population (adults aged 60 years or older)	NA	Alpha
Alejandro Jara	2022.7.28	Chile	Cohort study	3 years Unvaccinated n=76,259 CoronaVac n=52,024 4 years Unvaccinated n=60,282 CoronaVac n=64,628 5 years Unvaccinated n=52,982	Overall 50.8 Unvaccinated 52.2 CoronaVac 49.5	Young people aged 3-5 years	Chronic kidney disease, diabetes mellitus types 1 and 2, cancer, congenital heart disease, HIV, epilepsy, hemophilia, asthma, cystic fibrosis, juvenile idiopathic arthritis and systemic lupus erythematosus.	Omicron B.1.1.529

				CoronaVac n=77,775				
Betul Copur	2022.9.28	Turkey	Retrospective cohort study	Median (IQR) Overall 31 (26–40) CoronaVac 31 (27-41) Unvaccinated 31 (26-40)	38.6	Healthcare workers	Overall n=505 (26.4) Diabetes mellitus n=190 (9.9) Hypertension n=308 (16.1) Congestive heart disease n=9 (0.5) Chronic obstructive pulmonary disease n=21 (1.1) Chronic hepatitis B n=53 (2.8)	Alpha variant-dominant period
Maria Edith Solis-Castro	2022.8.26	Peru	Retrospective cohort study	Vaccinated 42.66 (12.98) Unvaccinated 39.75 (11.89)	Overall 34.4 Vaccinated 35.2 Unvaccinated 31.1	Healthcare workers (aged ≥18 years)	NA	Lambda and Gamma
Soledad González	2022.7.16	Argentina	Retrospective cohort study	Overall 7.6 (2.4) Unvaccinated 6.5 (2.6) Vaccinated 7.7 (2.4)	Overall 50.6 Unvaccinated 53.1 Vaccinated 50.4	Young people aged 3-11 years	Overall n=73,162 (10.6) Unvaccinated n=5,026 (8.6) Vaccinated n=68,136 (10.8)	Omicron
Otavio T Ranzani	2022.10.6	Brazil	Test-negative case-control study	18-39 years 40-59 years 60-79 years ≥80 years	NA	General population (adults aged 18 years or older)	Cardiovascular, renal, diabetes, chronic respiratory disorder, obesity, or immunosuppression.	Delta and Omicron
Zoltán Vokó	2022.7.22	Hungary	Observational study	18-64 years*	NA	General population (Hungarian residents aged 18-64 years)	Cardiovascular diseases (myocardial infarction, angina, chronic heart failure, peripheral vascular disease, and stroke), diabetes mellitus (type 1 and type 2), immunosuppression (immunosuppressive therapy and transplantation), chronic pulmonary diseases (asthma and chronic	Delta

							obstructive pulmonary diseases), neoplasms, and chronic kidney diseases.	
Vincent Ka Chun Yan	2022.10.9	China	Case-control study	⩾65 years*	NA	Elderly population (adults aged 65 years or older)	Cancer, chronic kidney disease, respiratory disease, diabetes mellitus, cardiovascular disease, dementia.	Omicron BA.2

Study ID consisted of the first author's surname and year of publication. Abbreviations: VE, vaccine effectiveness; NA, not available. ***** Only the age subgroups with higher vaccine effectiveness in the study were extracted.

Supplement table 2B. Characteristics of included studies in this systematic review and meta-analysis.

Study ID	Sample size	Vaccine name	Vaccine brand	Immunization regimens	Dose interval	Study period, duration and date	Follow-up period	Primary outcomes	Diagnostic methods	Outcome Measures
Al Kaabi, 2021	Total n=38,206 WIV04 n=12,743 HB02 n=12,726 Placebo n=12,737	WIV04, HB02	Sinopharm	Two doses of WIV04, Two doses of HB02	21 days	2020.7.16 - 2020.12.20	Median 77 days (range 1-121)	1. COVID-19 infection (Symptomatic infection)	RT-PCR	1-incidence rate ratio
Jara, 2021	Total n=9,645,302 Vaccinated n=4,173,574 Unvaccinated n=5,471,728	CoronaVac	Sinovac	Two doses of CoronaVac	28 days	2021.2.2-2021.5.1	by the end of the follow-up period (May 1, 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Hospitalization 3. ICU admission 4. Death	RT-PCR assay or antigen testing	1-hazard ratio
Tanriover, 2021	Total n=10029 Vaccine n=6559 Placebo n=3470	CoronaVac	Sinovac	Two doses of CoronaVac	14 days	2020.9.15 - 2021.3.16	Median days, 43 (IQR 36–48)	1. COVID-19 infection (Symptomatic infection) 2. Hospitalization	RT-PCR	1-incidence rate ratio
Ranzani, 2021	Total n=31,950 Cases n=18,612 Controls n=13,338	CoronaVac	Sinovac	Two doses of CoronaVac	Cases mean 30 days,	2021.1.17 - 2021.4.29	by the end of the follow-up period (April 29, 2021)	1. COVID-19 infection (Symptomatic infection) 2. Hospitalization 3. Death	RT-PCR	1-odds ratio

					Controls mean 25 days					
AlHosani, 2022	Total n=154,872 Unvaccinated n=91,941 Fully vaccinated n=62,931	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	NA	2020.9.1-2021.5.1	by the end of the follow-up period (May 1, 2021)	1. Hospitalization 2. ICU admission 3. Death	RT-PCR	1-odds ratio
Kang, 2022	Total n=7,291 Unvaccinated n=5,888 Fully vaccinated n=1,403	HB02, CoronaVac	Sinovac, Sinopharm	Two doses of HB02 or CoronaVac	21 days	2021.5.21 - 2021.6.23	1 month (May and June 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Severe COVID-19 (Severe and critical cases)	RT-PCR	1-adjusted risk ratio
Cerqueira-Silva_1, 2022	Total n=2,321,159 Cases n=1,346,119 Controls n=975,040	CoronaVac, BNT162b2	Sinovac, Pfizer-BioNTech	Two doses of CoronaVac, Two doses of CoronaVac+BNT161b2	NA, booster at 4-6 months	2022.1.1-2022.4.17	Second dose (14–180, >180) and a booster dose (14–30, 31–60, 61–90, 91–120, >120)	1. COVID-19 infection (Symptomatic infection) 2. Severe COVID-19 (Hospitalization or death)	RT-PCR or Lateral-flow tests	1-odds ratio
Jara_1, 2022	Total n=5,199,534 Unvaccinated n=1,071,988 Three doses of CoronaVac n=186,946	CoronaVac, AZD1222, BNT162b2	Sinovac, Oxford-AstraZeneca, Pfizer-BioNTech	Three doses of CoronaVac, Two doses of CoronaVac+BNT162b2, Two doses of CoronaVac+AZD1222	booster at 5-6 months	2021.2.2-2021.11.10	within 3 months after the booster doses	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Hospitalization 3. ICU admission	RT-PCR and antigen test	1-hazard ratio

	Two doses of CoronaVac+BNT162b2 n=2,019,260 Two doses of CoronaVac+AZD1222 n=1,921,340							4. Death		
Ma, 2022	Total n=397 Unvaccinated n=66 CoronaVac n=170 BBIBP-CorV n=92 CoronaVac and BBIBP-CorV n=69	CoronaVac, BBIBP-CorV	Sinovac, Sinopharm	Two doses of CoronaVac, Two doses of BBIBP-CorV, One dose of BBIBP-CorV+one dose of CoronaVac	NA	2021.7.4-2021.9.3	Fully vaccinated median days, 63 (IQR 46–94); Unvaccinated: from July 4 to September 3, 2021	1. COVID-19 infection (Symptomatic infection) 2. Severe COVID-19 (Severe and critical cases)	RT-PCR	1-relative risk
Can, 2022	Total n=3,174 Fully vaccinated n=2,267 Unvaccinated n=907	CoronaVac	Sinovac	Two doses of CoronaVac	NA	2021.3.1-2021.5.31	Median 90 days	1. COVID-19 Infection (Symptomatic infection)	PCR	1-incidence rate ratio
Sritipsukho, 2022	Total n=1,312 Cases n=179 Controls n=1,133	CoronaVac, BNT162b2, ChAdOx1 nCoV-19, BBIBP-CorV	Sinovac, Sinopharm, Oxford-AstraZeneca, Pfizer-BioNTech	Two doses of CoronaVac, Two doses of CoronaVac+BNT162b2, Two doses of CoronaVac+ChAdOx1	4 weeks, booster at 12 weeks	2021.7.25 - 2021.10.23	Median days, 81 (IQR 60-91), 21 (IQR 14-41), 45 (IQR 23-55)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection)	RT-PCR	1-odds ratio

Vokó, 2021	Total n=8,670,107 HB02 n=895,465 Unvaccinated n=7,774,642	HB02	Sinopharm	Two doses of HB02	NA	2021.1.22 - 2021.6.10	by the end of the follow-up period (June 10, 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Death	PCR or antigen rapid tests	1-risk ratio
Suah, 2022	Total n=173,304 Unvaccinated n=62,506 CoronaVac n=110,798	CoronaVac	Sinovac Biotech	Two doses of CoronaVac	NA	2021.9.1-2021.9.30	after 1-2 months and 3-5 months	1. ICU admission 2. Death	RT-PCR and rapid antigen tests	1-adjusted relative risk
Rearte, 2022	Total n=201,022 Cases n=78,221 Controls n=122,801	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	28 days	2021.1.31 - 2021.9.14	by the end of the follow-up period (September 14, 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Death	RT-PCR	1-relative risk
Arregocés-Castillo, 2022	Total n=2,097,431 Unvaccinated n=1,414,147 CoronaVac n=683,284	CoronaVac	Sinovac	Two doses of CoronaVac	NA	2021.3.11 - 2021.10.26	Fully vaccinated median days，118 (IQR 89–156); Unvaccinated median days, 117 (IQR 87–156)	1. Hospitalization 2. Death	NA	1-hazard ratio
Cerqueira-Silva_	Total n=6,443,048 Cases n=2,984,348 Controls n=3,458,700	CoronaVac, BNT162b2	Sinovac, Pfizer-BioNTech	Two doses of CoronaVac, Two doses of CoronaVac+BNT162b2	28 days, booster at 6 months	2021.1.18 - 2021.11.11	Second dose 14-180 days, >180 days;	1. COVID-19 infection (Asymptomatic infection and symptomatic infection)	RT–PCR or rapid antigen test	1-odds ratio

2, 2022							Booster dose 14-30 days, >30 days	2. Hospitalization 3. Death 4. Severe COVID-19 (hospitalization or death)		
Zhang, 2022	Total n=347,041 Unvaccinated n=206,149 Fully vaccinated n=140,892	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	21-28 days	2021.2.1-2021.6.30	by the end of the follow-up period (June 30, 2021)	1. Hospitalization	RT-PCR	1-odds ratio
Wu, 2022	Total n=1,257 Unvaccinated n=473 BBIBP-CorV n=211 CoronaVac n=336 BBIBP-CorV+CoronaVac n=237	BBIBP-CorV, CoronaVac	Sinopharm, Sinovac	Two doses of CoronaVac, Two doses of BBIBP-CorV, One dose of BBIBP-CorV+one dose of CoronaVac	NA	2021.7.31 - 2021.8.24	within 6 months after the second doses	1. COVID-19 infection (Symptomatic infection) 2. Severe COVID-19 (Severe and critical illness)	PCR	1-relative risk
Mirahmadizadeh, 2022	Total n=1,664,611 Unvaccinated n=1,000,510 BBIBP-CorV n=664,101	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	28 days	2021.2.9-2021.10.22	by the end of the follow-up period (October 22, 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Hospitalization 3. Death	RT-PCR	1-relative risk
Marra, 2022	Total n=7,897 Unvaccinated n=1,512 CoronaVac n=6,385	CoronaVac	Sinovac	Two doses of CoronaVac	21 days	2021.1.1-2021.8.3	by the end of the follow-up period (August 3, 2021)	1. COVID-19 infection (Symptomatic infection)	RT-PCR	1-rate ratio

Hitchings, 2021	Total n=543 Cases n=261 Controls n=282	CoronaVac	Sinovac	Two doses of CoronaVac	NA	2021.1.19 - 2021.4.13	by the end of the follow-up period (April 13, 2021)	1. COVID-19 infection (Symptomatic infection)	RT-PCR or antigen detection	1-odds ratio
Al Kaabi, 2022	Total n=2,199,772 Unvaccinated n=1,099,886 Vaccinated n=1,099,886	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	NA	2021.7.1-2021.9.30	by the end of the follow-up period (September 30, 2021)	1. Hospitalization 2. ICU admission 3. Death	RT-PCR	1-hazard ratio
Florentino, 2022	Total n=147,485 Cases n=72,651 Controls n=74,834	CoronaVac	Sinovac	Two doses of CoronaVac	≥14 days	2022.1.21 - 2022.4.15	by the end of the follow-up period (April 15, 2022)	1. COVID-19 infection (Symptomatic infection) 2. Hospitalization	RT-PCR and antigen tests	1-odds ratio
Suphanchaimat, 2022	Total n=657,010 Cases n=221,658 Controls n=435,352	CoronaVac, ChAdOx1 nCoV-19, BNT162b2	Sinovac, Oxford-AstraZeneca, Pfizer-BioNTech	Two doses of CoronaVac+ChAdOx1, Two doses of CoronaVac+BNT162b2	NA	2021.9.1-2021.12.31	Time since the last vaccination date: 15–29 days, 30–59 days, 60–89 days, and 90 days onward.	1.COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Severe COVID-19 (Hypoxemic pneumonia or an intubated patient or a death)	PCR and rapid antigen diagnostic test	1-odds ratio
Suah, 2021	Total n=888,547 Unvaccinated n=749,524 Fully vaccinated n=139,023	CoronaVac	Sinovac	Two doses of CoronaVac	21 days	2021.4.1-2021.9.15	by the end of the follow-up period (September 15, 2021)	1. ICU admission 2. Death	RT-PCR or rapid molecular	1-odds ratio

Nadeem, 2022	Total n=3,426 Not vaccinated n=1,360 Fully vaccinated n=2,066	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	NA	2021.5.5-2021.7.31	by the end of the follow-up period (July 31, 2021)	1. COVID-19 infection (Symptomatic infection) 2. Hospitalization 3. Death	PCR	1-odds ratio
Paternina-Caicedo, 2022	Total n=615,739 Unvaccinated n=539,010 CoronaVac n=76,729	CoronaVac	Sinovac	Two doses of CoronaVac	28 days	2021.3.1-2021.8.15	by the end of the follow-up period (August 15, 2021)	1. Hospitalization 2. ICU admission 3. Death	PCR, antigen, or IgM positive test	1-hazard ratio
Petrovic, 2022	Total n=359,080 Unvaccinated n=241,166 BBIBP-CorV n=117,914	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	21 days	2020.12.24-2021.4.28	started 14 days from application of the second dose and lasted four weeks.	1. COVID-19 infection (Symptomatic infection) 2. Severe COVID-19 (Confirmed pneumonia and oxygenation was needed)	RT-PCR or antigen rapid diagnostic test	1-risk ratio
Jara_2, 2022	Total n=383,950 Unvaccinated n=189,523 CoronaVac n=194,427	CoronaVac	Sinovac	Two doses of CoronaVac	28 days	2021.12.6-2022.2.26	by the end of the follow-up period (February 26, 2022)	1. COVID-19 infection (Symptomatic infection) 2. Hospitalization 3. ICU admission	RT–PCR assay or antigen tests	1-hazard ratio
Copur, 2022	Total n=1,911 Vaccinated n=1,160 Unvaccinated n=751	CoronaVac	Sinovac	Two doses of CoronaVac	NA	2021.2.25-2021.5.20	Median 93 days (vaccinated 90 days; unvaccinated 95 days).	1. COVID-19 infection (Asymptomatic infection and symptomatic infection)	RT-PCR	1-hazard ratios

Edith Solis-Castro, 2022	Total n=520,733 Vaccinated n=415,212 Unvaccinated n 105,521	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	21 days	2021.2.9-2021.6.26	by the end of the follow-up period (June 26, 2021)	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Hospitalization 3. Death	PCR or antigen test	1-incident density ratio
González, 2022	Total n=689,552 Vaccinated n=630,908 Unvaccinated n=58,644	BBIBP-CorV	Sinopharm	Two doses of BBIBP-CorV	21 days or 28 days	2021.12.1-2022.3.9	by the end of the follow-up period (March 9, 2022)	1. Hospitalization	RT-PCR	1-odds ratios
Ranzani, 2022	Total n=1,845,695 Cases n=975,604 Controls n=870,091	CoronaVac	Sinovac	Two doses of CoronaVac	NA	2021.9.6-2022.4.22	by the end of the follow-up period (April 22, 2022)	1. COVID-19 infection (Symptomatic infection) 2. Severe COVID-19 (Hospitalization or death)	RT-PCR or rapid antigen test	1-adjusted odds ratio
Vokó, 2022	Cases (18-64 years) * Total n=196,704 Unvaccinated n=162,864 Vaccinated n=33,840	HB02, BNT162b2, mRNA-1273, Ad26.COV2.S	Sinopharm, Pfizer-BioNTech, Moderna, Janssen	Two doses of HB02, Three doses of HB02, Two doses of HB02+BNT162b2, Two doses of HB02+mRNA-1273, Two doses of HB02+Ad26.COV2.S	NA, booster at least 4 months	2021.9.13 - 2021.12.31	Two doses of HB02: 14-120, 121-180, 181-240, or more than 240 days; booster vaccinations: 14–120 days	1. COVID-19 infection (Asymptomatic infection and symptomatic infection) 2. Hospitalization 3. Death	PCR or antigen test	1-incidence rate ratio

Yan, 2022	≥65 years* Total n=59,965 Cases n=6,314, Controls n=53,651	CoronaVac, BNT162b2	Sinovac, Pfizer-BioNTech	Two doses of CoronaVac, Three doses of CoronaVac, Two doses of CoronaVac+BNT162b2	NA, booster at least 6 months	2022.1.1-2022.3.31	by the end of the follow-up period (31 March 2022)	1. Severe COVID-19 (Admission to ICU or ventilatory support) 2. Death	PCR	1-adjusted odds ratio

Study ID consisted of the first author's surname and year of publication. Abbreviations: VE, vaccine effectiveness; NA, not available. * Data were extracted only for the age subgroup in the study with high vaccine effectiveness.

Supplement table 3. Interpretation of primary clinical outcomes.

Clinical outcomes	Interpretation
COVID-19 infection	Laboratory-confirmed COVID-19 infection through polymerase chain reaction or antigen test;
COVID-19 related hospitalization	Any inpatient hospital admission with a positive, laboratory confirmed COVID-19;
COVID-19 related intensive care unit (ICU) admission	Any inpatient admission to intensive care unit with a positive, laboratory confirmed COVID-19;
COVID-19 related death	Occurrence of any death with a positive, laboratory confirmed COVID-19;
Severe COVID-19 outcomes	Severe cases were those in which the patient had a respiratory rate above 30 breaths/min, resting blood oxygen saturation of 93% or lower, or Pao2–FIo2 ratio of 300 mm Hg or lower; critical cases had at least one of the following: the need for oxygen supplementation, admission to intensive care, mechanical ventilation, or death.

Supplement table 4. Risk of bias for included randomized control trails.

Study ID	Random Sequence Generation	Allocation Concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective Reporting	Other bias	**Overall bias**
Al Kaabi, 2021	Low	Low	Low	Low	Low	Low	Low	**Low**
Tanriover, 2021	Low	Low	Low	Low	Low	Low	Low	**Low**

Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Supplement table 5. Risk of bias for included cohort studies.

Study ID	Selection				Comparability	Exposure			Total scores	**Quality**
	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8		
Jara, 2021	1	1	1	1	2	1	1	1	9	**Good**
AlHosani, 2022	1	1	1	1	1	1	1	1	8	**Good**
Kang, 2022	0	1	1	1	2	1	1	1	8	**Good**
Jara_1, 2022	1	1	1	1	2	1	1	1	9	**Good**
Ma, 2022	0	1	1	1	1	1	1	1	7	**Good**
Can, 2022	0	1	1	1	1	1	1	1	7	**Good**
Suah, 2022	1	1	1	1	2	1	1	1	9	**Good**
Arregocés-Castillo, 2022	0	1	1	1	2	1	1	1	8	**Good**
Zhang, 2022	1	1	1	1	2	1	1	1	9	**Good**
Wu, 2022	0	1	1	1	1	1	1	1	7	**Good**
Mirahmadizadeh, 2022	1	1	1	1	2	1	1	1	9	**Good**
Marra, 2022	0	1	1	1	2	1	1	1	8	**Good**
Al Kaabi, 2022	1	1	1	1	2	1	1	1	9	**Good**
Suah, 2021	1	1	1	1	2	1	1	1	9	**Good**
Paternina-Caicedo, 2022	1	1	1	1	2	1	1	1	9	**Good**
Jara_2, 2022	0	1	1	1	2	1	1	1	8	**Good**
Copur, 2022	0	1	0	1	2	1	1	1	7	**Good**
Vokó, 2021	1	1	1	1	2	1	1	1	9	**Good**
Petrovic, 2022	0	1	1	1	0	1	1	1	6	**Moderate**
Edith Solis-Castro, 2022	0	1	1	0	2	1	1	1	7	**Good**
González, 2022	0	1	1	0	2	1	1	1	7	**Good**
Vokó, 2022	1	1	1	1	1	1	1	1	8	**Good**

Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Item 1: Representativeness of the exposed cohort.

Item 2: Selection of the non-exposed cohort.

Item 3: Ascertainment of exposure.

Item 4: Demonstration that outcome of interest was not present at start of study.

Item 5: Comparability of cohorts on the basis of the design or analysis.

Item 6: Assessment of outcome.

Item 7: Was follow up long enough for outcomes to occur.

Item 8: Adequacy of follow up of cohorts.

Supplement table 6. Risk of bias for included case-control studies.

Study ID	Selection				Comparability	Exposure			Total score	**Quality**
	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 7		
Ranzani, 2021	1	0	1	1	2	1	1	1	8	**Good**
Cerqueira-Silva_1, 2022	1	1	1	0	2	1	1	1	8	**Good**
Sritipsukho, 2022	1	1	1	1	2	1	1	1	9	**Good**
Rearte, 2022	1	0	1	1	2	1	1	1	8	**Good**
Cerqueira-Silva_2, 2022	1	1	1	1	2	1	1	1	9	**Good**
Hitchings, 2021	1	0	1	0	2	1	1	1	7	**Good**
Florentino, 2022	1	0	1	1	2	1	1	1	8	**Good**
Suphanchaimat, 2022	1	1	1	1	1	1	1	1	8	**Good**
Nadeem, 2022	1	0	1	1	0	1	1	1	6	**Moderate**
Ranzani, 2022	1	1	1	0	2	1	1	1	8	**Good**
Yan, 2022	1	1	1	1	1	1	1	1	8	**Good**

Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Item 1: Is the case definition adequate?

Item 2: Representativeness of the cases.

Item 3: Selection of controls.

Item 4: Definition of controls.

Item 5: Comparability of cases and controls on the basis of the design or analysis.

Item 6: Ascertainment of exposure.

Item 7: Same method of ascertainment for cases and controls.

Item 8: Non-Response Rate.

Supplement table 7. Vaccine effectiveness of immunization regimens included in the study.

Study ID	Population	Age (years)	Immunization regimens	COVID-19 infection	Hospitalization	ICU admission	Death	Severe outcomes
Al Kaabi, 2021a	GP	≥18	2 WIV04	72.8 (58.1, 82.4)	None	None	None	None
Al Kaabi, 2021b	GP	≥18	2 HB02	78.1 (64.8, 86.3)	None	None	None	None
Jara, 2021	GP	≥16	2 CoronaVac	65.9 (65.2, 66.6)	87.5 (86.7, 88.2)	90.3 (89.1, 91.4)	86.3 (84.5, 87.9)	None
Tanriover, 2021	GP	18-59	2 CoronaVac	83.5 (65.4, 92.1)	100.0 (20.4, 100.0)	None	None	None
Ranzani, 2021	EP	≥70	2 CoronaVac	46.8 (38.7, 53.8)	55.5 (46.5, 62.9)	None	61.2 (48.9, 70.5)	None
AlHosani, 2022	GP	≥15	2 BBIBP-CorV	None	79.8 (78.0, 81.4)	92.2 (89.7, 94.1)	97.1 (83.0, 99.9)	None
Kang, 2022	CCs	≥18	2 HB02 or CoronaVac	51.8 (20.3, 83.2)	None	None	None	100.0 (98.4, 100.0)
Cerqueira-Silva_1, 2022a	GP	≥18	2 CoronaVac	3.2 (2.1, 4.2)	None	None	67.8 (64.0, 71.3)	64.5 (62.6, 66.3)
Cerqueira-Silva_1, 2022b	GP	≥18	2 CoronaVac+BNT161b2	63.6 (62.8, 64.3)	None	None	90.6 (89.8, 91.3)	89.4 (87.8, 90.7)
Jara_1, 2022a	GP	≥16	3 CoronaVac	78.8 (76.8, 80.6)	86.3 (83.7, 88.5)	92.2 (88.7, 94.6)	86.7 (80.5, 91.0)	None
Jara_1, 2022b	GP	≥16	2 CoronaVac+BNT162b2	96.5 (96.2, 96.7)	96.1 (95.3, 96.9)	96.2 (94.6, 97.3)	96.8 (93.9, 98.3)	None
Jara_1, 2022c	GP	≥16	2 CoronaVac+AZD1222	93.2 (92.9, 93.6)	97.7 (97.3, 98.0)	98.9 (98.5, 99.2)	98.1 (97.3, 98.6)	None
Ma, 2022	GP	≥18	Combined BBIBP-CorV and CoronaVac	74.6 (36.0, 90.0)	None	None	None	100.0 (47.6, 100.0)
Can, 2022	HCWs	<30, 30-39, 40-49, ≥50	2 CoronaVac	39.0 (19.6, 53.7)	None	None	None	None
Sritipsukho, 2022a	GP	≥18	2 CoronaVac	60.0 (49.0, 69.0)	None	None	None	None
Sritipsukho, 2022b	GP	≥18	2 CoronaVac+BNT162b2	98.0 (87.0, 100.0)	None	None	None	None
Sritipsukho, 2022c	GP	≥18	2 CoronaVac+ChAdOx1	86.0 (74.0, 93.0)	None	None	None	None
Vokó, 2021	GP	≥16	2 HB02	72.8 (71.2, 74.4)	None	None	86.0 (83.7, 87.9)	None

Suah, 2022	GP	≥18	2 CoronaVac	74.5 (70.6, 78.0)	None	56.0 (51.2, 60.2)	79.2 (76.8, 81.4)	None
Rearte, 2022	EP	≥60	2 BBIBP-CorV	44.0 (42.0, 45.0)	None	None	85.0 (84.0, 86.0)	None
Arregocés-Castillo, 2022	EP	≥60	2 CoronaVac	None	47.3 (41.9, 52.3)	None	72.1 (70.1, 73.9)	None
Cerqueira-Silva_2, 2022a	GP	≥18	2 CoronaVac	55.0 (54.3, 55.7)	82.1 (81.4, 82.8)	None	82.7 (81.7, 83.6)	82.6 (82.1, 83.2)
Cerqueira-Silva_2, 2022b	GP	≥18	2 CoronaVac+BNT162b2	92.7 (91.0, 94.0)	97.2 (96.0, 98.0)	None	98.3 (96.3, 99.2)	97.3 (96.1, 98.1)
Zhang, 2022	GP	≥18	2 BBIBP-CorV	None	88.5 (85.8, 90.7)	None	None	None
Wu, 2022	CCs	≥18	Combined BBIBP-CorV and CoronaVac	50.5 (27.6, 66.2)	None	None	None	82.4 (21.0, 96.1)
Mirahmadizadeh, 2022	GP	≥18	2 BBIBP-CorV	79.9 (79.4, 80.4)	71.9 (70.7, 73.1)	None	86.1 (84.1, 88.0)	None
Marra, 2022	HCWs	≥18	2 CoronaVac	51.3 (34.6, 63.7)	None	None	None	None
Hitchings, 2021	HCWs	≥18	2 CoronaVac	37.1 (-53.3, 74.2)	None	None	None	None
Al Kaabi, 2022	GP	≥18	2 BBIBP-CorV	None	79.6 (77.7, 81.3)	86.0 (82.2, 89.0)	84.1 (70.8, 91.3)	None
Florentino, 2022	Children	6-11	2 CoronaVac	40.3 (34.2, 45.9)	59.2 (11.3, 84.5)	None	None	None
Suphanchaimat, 2022a	GP	<18, 18-59, >60	2 CoronaVac+BNT162b2	95.0 (93.8, 95.9)	None	None	None	98.9 (92.1, 99.8)
Suphanchaimat, 2022b	GP	<18, 18-59, >60	2 CoronaVac+ChAdOx1	89.2 (88.0, 90.3)	None	None	None	99.1 (93.6, 99.9)
Suah, 2021	GP	>18	2 CoronaVac	None	None	72.0 (69.9, 73.9)	82.4 (81.0, 83.7)	None
Nadeem, 2022	EP	≥60	2 BBIBP-CorV	94.3 (92.2, 95.9)	60.5 (7.9, 82.9)	None	98.6 (94.2, 99.6)	None
Paternina-Caicedo, 2022	GP	≥40	2 CoronaVac	-44.0 (-54.1, -34.6)	3.3 (-15.1, 18.7)	18.0 (-10.6, 39.2)	21.4 (-0.7, 38.6)	None
Petrovic, 2022	EP	≥60	2 BBIBP-CorV	86.9 (86.0, 87.7)	None	None	None	90.5 (88.9, 91.9)

Jara_2, 2022	Children	3-5	2 CoronaVac	38.2 (36.5, 39.9)	64.6 (49.6, 75.2)	69.0 (18.6, 88.2)	None	None
Copur, 2022	HCWs	31 (26-40)[a]	2 CoronaVac	65.0 (50.0, 75.0)	None	None	None	None
Edith Solis-Castro, 2022	HCWs	≥18	2 BBIBP-CorV	26.3 (23.8, 28.6)	67.7 (60.1, 73.8)	None	90.9 (85.5, 94.2)	None
González, 2022	Children	3-11	2 BBIBP-CorV	None	76.4 (62.9, 84.5)	None	None	None
Ranzani, 2022a	GP	≥18	2 CoronaVac	51.3 (49.9, 52.7)	None	None	None	86.5 (83.4, 88.9)
Ranzani, 2022b	GP	≥18	2 CoronaVac	28.1 (26.5, 29.6)	None	None	None	56.1 (40.6, 67.5)
Vokó, 2022a	GP	18-64	2 HB02	10.9 (6.7, 15.0)	53.8 (43.9, 61.9)	None	67.4 (39.2, 82.5)	None
Vokó, 2022b	GP	18-64	3 HB02	60.6 (53.4, 66.7)	77.5 (58.2, 87.9)	None	91.1 (36.4, 98.7)	None
Vokó, 2022c	GP	18-64	2 HB02+BNT162b2	88.0 (87.2, 88.7)	94.6 (93.3, 95.6)	None	95.9 (93.4, 97.5)	None
Vokó, 2022d	GP	18-64	2 HB02+mRNA-1273	91.0 (88.2, 93.1)	94.8 (87.6, 97.9)	None	None	None
Vokó, 2022e	GP	18-64	2 HB02+Ad26.COV2.S	78.1 (74.7, 81.0)	95.3 (88.7, 98.0)	None	95.8 (70.0, 99.4)	None
Yan, 2022a	EP	≥65	2 CoronaVac	None	None	None	74.8 (72.5, 76.9)	58.9 (50.3, 66.1)
Yan, 2022b	EP	≥65	3 CoronaVac	None	None	None	95.5 (93.7, 96.8)	88.0 (80.8, 92.5)
Yan, 2022c	EP	≥65	2 CoronaVac+BNT162b2	None	None	None	97.2 (93.7, 98.7)	95.2 (80.5, 98.8)

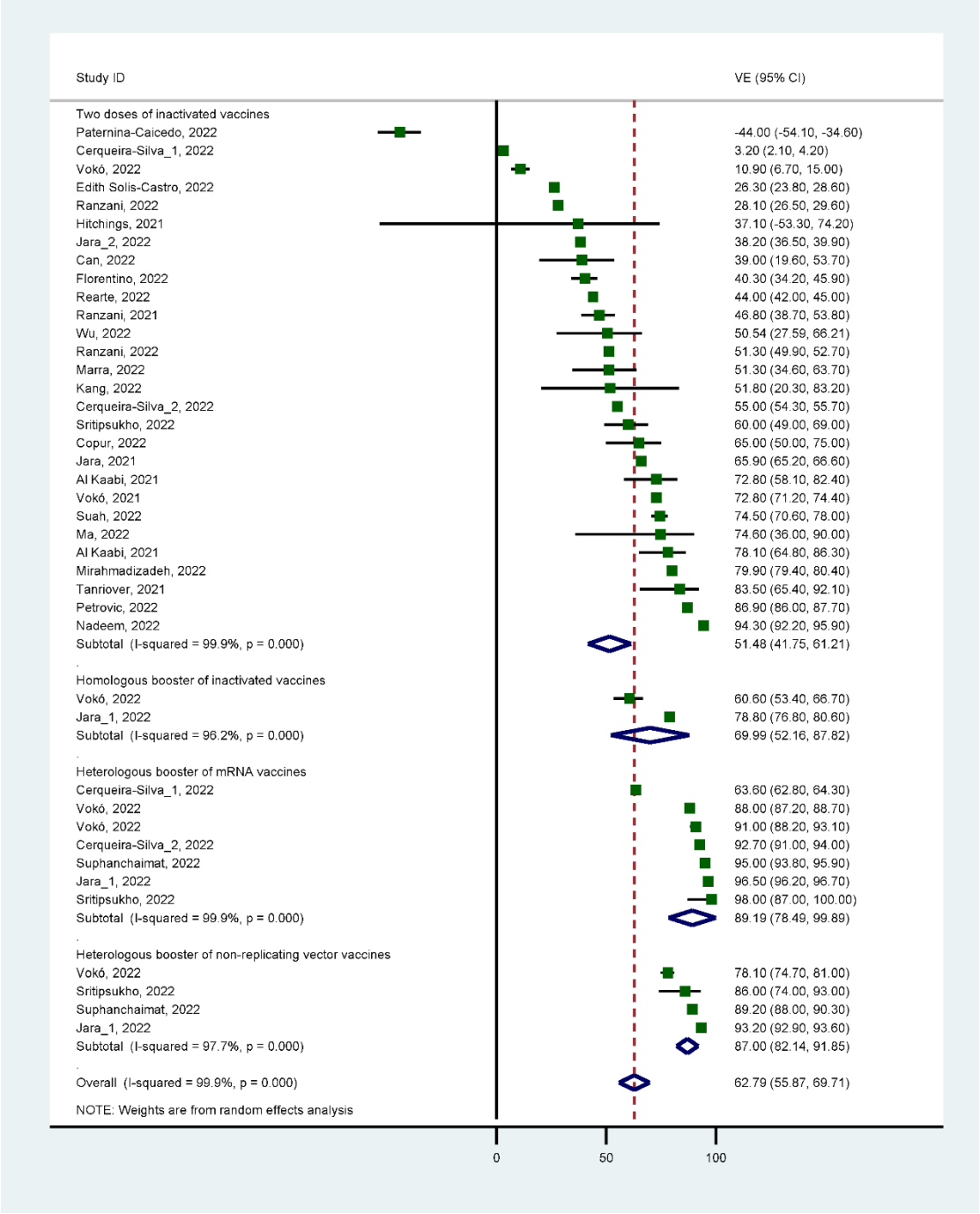
Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; HCWs, healthcare workers; GP, general population; EP, elderly people; CCs, Cases and close contacts; CI, confidence interval. Data are VE% and its 95% CI.

[a] Median age (interquartile range).

None: Data not reported or not applicable.

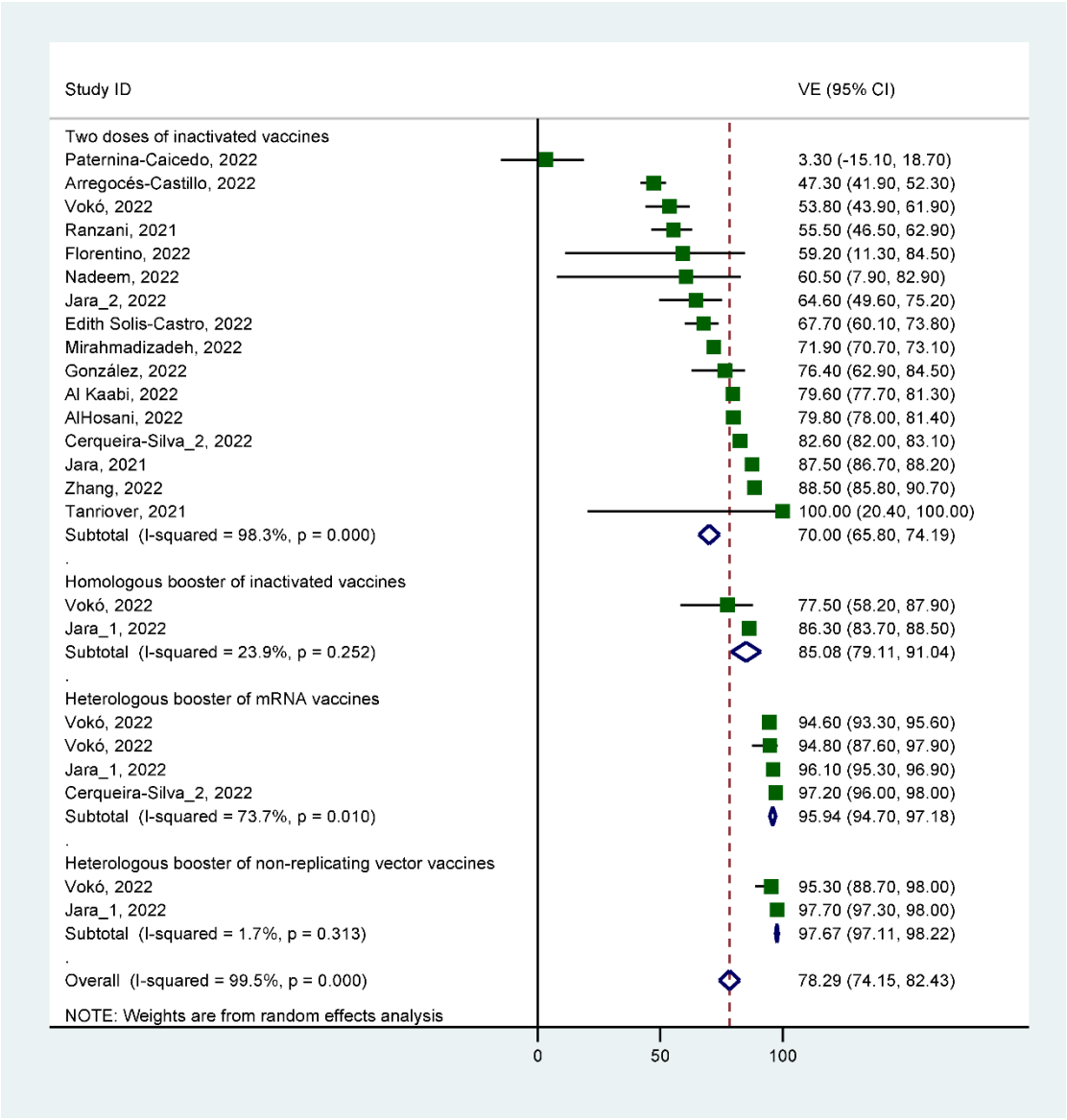
Supplement figure 1. Vaccine effectiveness against COVID-19 infection.



Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; CI, confidence interval.

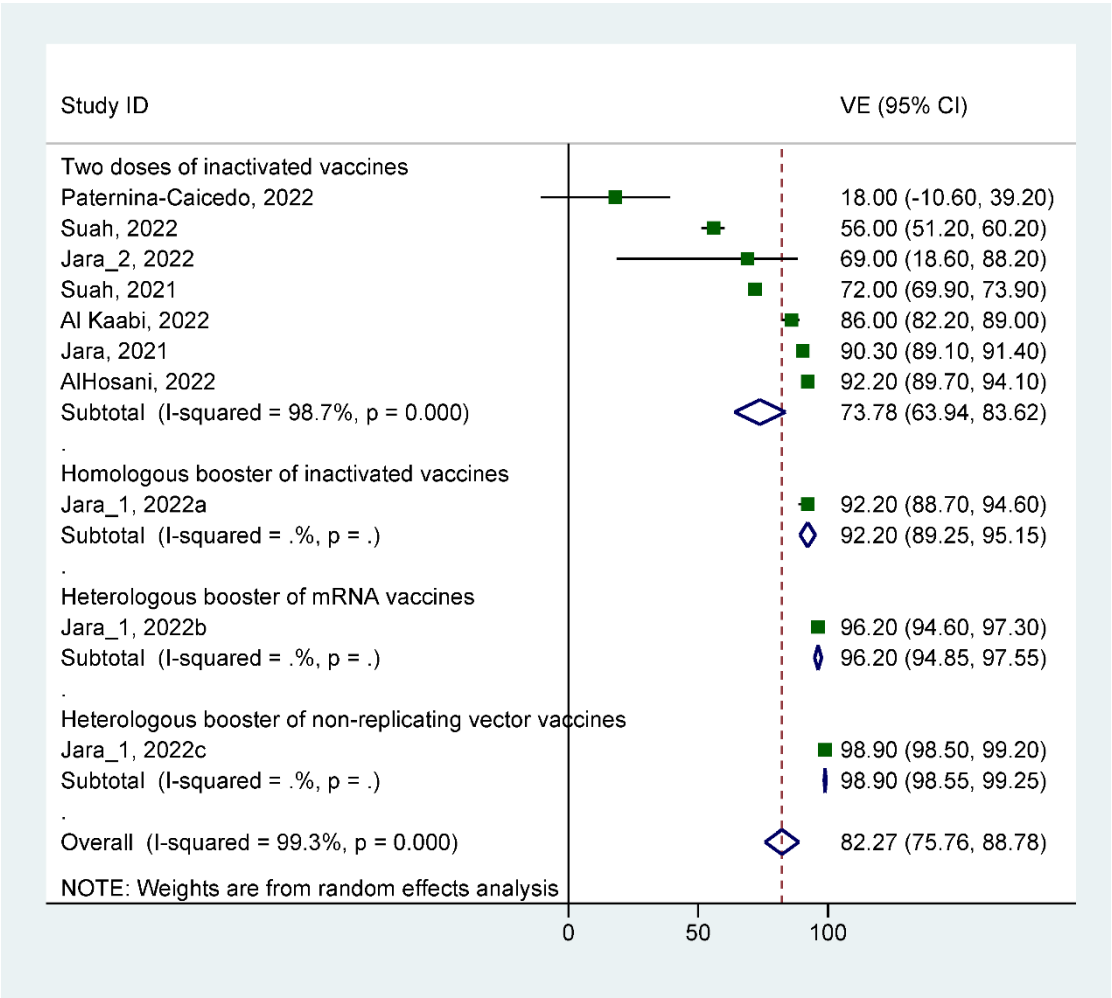
Supplement figure 2. Vaccine effectiveness against COVID-19 related hospitalization.



Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; CI, confidence interval.

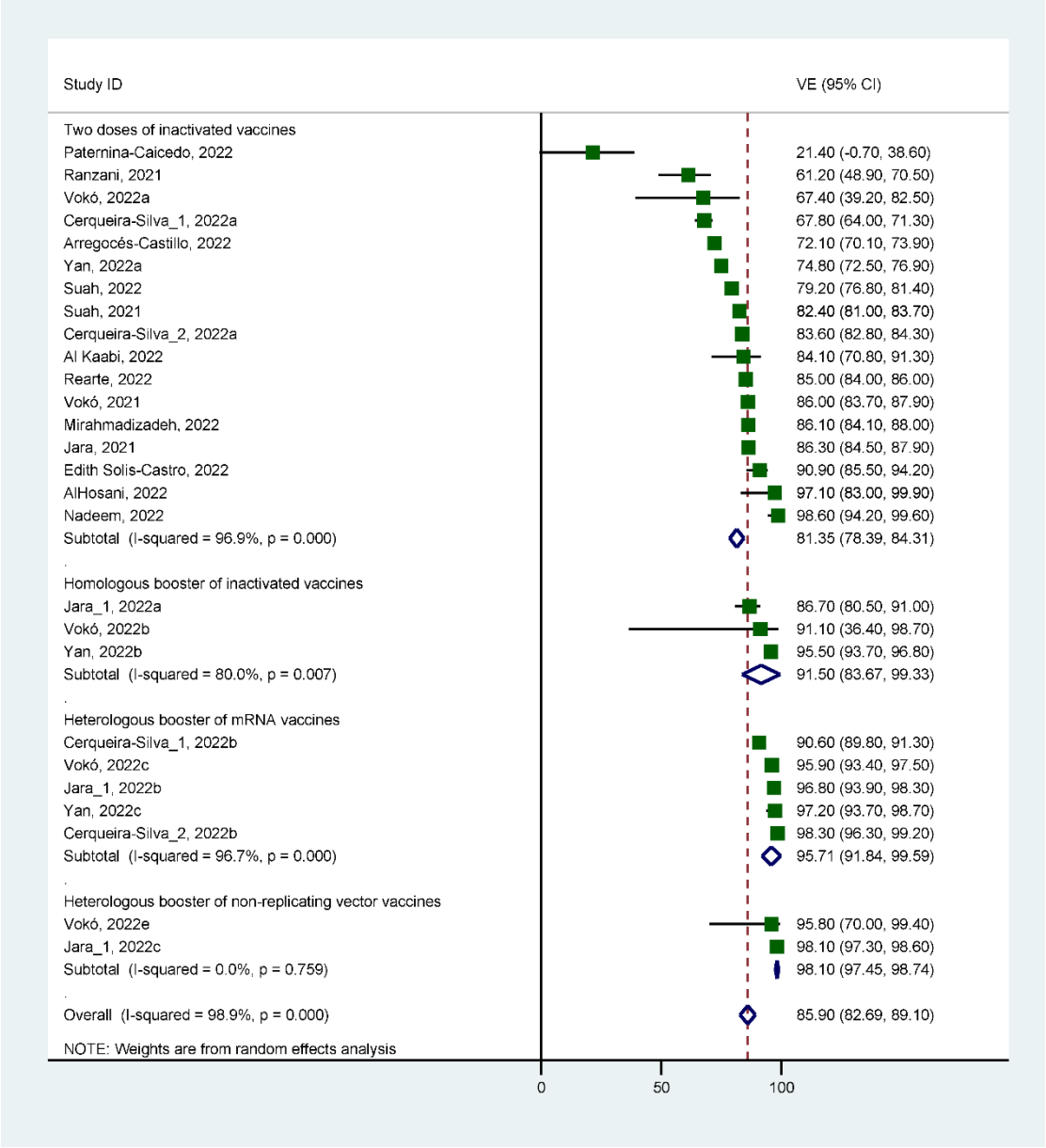
Supplement figure 3. Vaccine effectiveness against COVID-19 related ICU admission.



Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; CI, confidence interval.

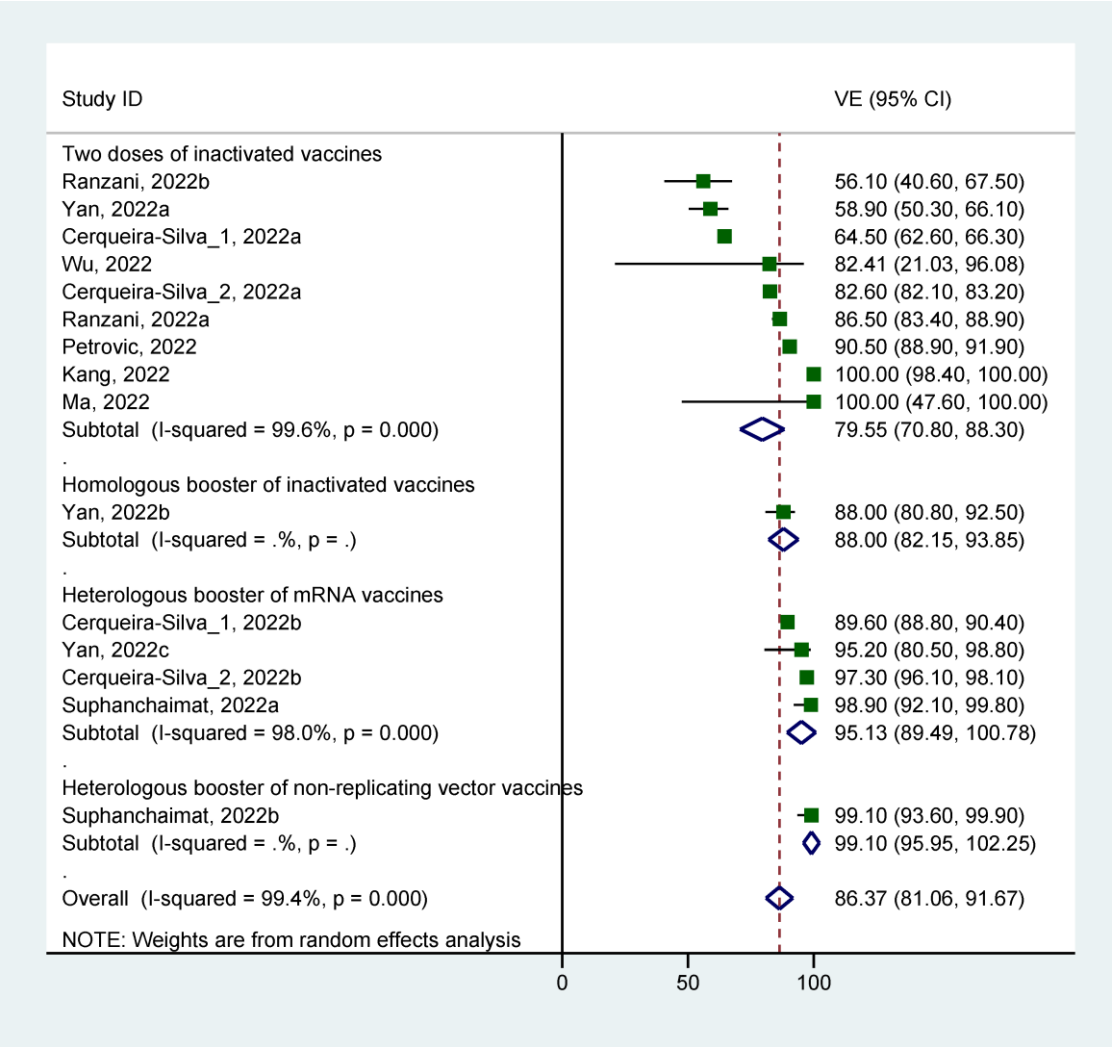
Supplement figure 4. Vaccine effectiveness against COVID-19 related death.



Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; CI, confidence interval.

Supplement figure 5. Vaccine effectiveness against severe COVID-19 outcomes.



Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).
Abbreviations: VE, vaccine effectiveness; CI, confidence interval.

Supplement table 8. Subgroup analysis of follow-up times.

Outcomes	Study (n)	VE% (95% CI)	I^2 (%)	p value
Within 6 months				
COVID-19 infection				
Overall	26	62.57 (55.02, 70.12)	99.9	<0.001
Two doses of inactivated vaccines	24	50.32 (39.81, 60.84)	99.9	<0.001
Homologous booster of inactivated vaccines	2	69.99 (52.16, 87.82)	96.2	<0.001
Heterologous booster of mRNA vaccines	6	89.19 (78.49, 99.89)	99.9	<0.001
Heterologous booster of non-replicating vector vaccines	4	87.00 (82.14, 91.85)	97.7	<0.001
COVID-19 related hospitalization				
Overall	15	79.05 (75.10,82.99)	99.4	<0.001
Two doses of inactivated vaccines	14	69.03 (64.64, 73.42)	97.6	<0.001
Homologous booster of inactivated vaccines	2	85.08 (79.11,91.04)	23.9	0.252
Heterologous booster of mRNA vaccines	3	95.94 (94.70,97.18)	73.7	0.010
Heterologous booster of non-replicating vector vaccines	2	97.67 (97.11, 98.22)	1.7	0.313
COVID-19 related ICU admission				
Overall	7	80.75 (73.54,87.97)	99.4	<0.001
Two doses of inactivated vaccines	6	69.15 (56.89,81.41)	98.8	<0.001
Homologous booster of inactivated vaccines	1	92.20(89.25,95.15)	NA	NA
Heterologous booster of mRNA vaccines	1	96.20 (94.85,97.55)	NA	NA
Heterologous booster of non-replicating vector vaccines	1	98.90(98.55,99.25)	NA	NA
COVID-19 related death				
Overall	16	85.38 (81.93,88.82)	98.9	<0.001
Two doses of inactivated vaccines	15	79.89 (76.55,83.24)	97.1	<0.001
Homologous booster of inactivated vaccines	3	91.50 (83.67,99.33)	80.0	0.007
Heterologous booster of mRNA vaccines	5	95.71 (91.84,99.59)	96.7	<0.001
Heterologous booster of non-replicating vector vaccines	2	98.10 (97.45,98.74)	0.0	0.759
Severe COVID-19				
Overall	9	86.12 (80.25,91.98)	99.4	<0.001
Two doses of inactivated vaccines	8	79.48 (70.35,88.61)	99.6	<0.001
Homologous booster of inactivated vaccines	1	88.00 (82.15,93.85)	NA	NA
Heterologous booster of mRNA vaccines	4	95.13 (89.49, 100.78)	98.0	<0.001
Heterologous booster of non-replicating vector vaccines	1	99.10 (95.95,102.25)	NA	NA
Over 6 months				
COVID-19 infection				
Two doses of inactivated vaccines	5	32.52 (-9.72, 74.75)	100.0	<0.001
COVID-19 related hospitalization				
Two doses of inactivated vaccines	4	68.22 (61.14, 75.30)	98.4	<0.001
COVID-19 related ICU admission				

Two doses of inactivated vaccines	1	92.20 (90.00, 94.40)	NA	NA
COVID-19 related death				
Two doses of inactivated vaccines	5	76.37 (65.08, 87.66)	98.6	<0.001
Severe COVID-19				
Two doses of inactivated vaccines	2	67.19 (56.61, 77.78)	99.0	<0.001

Abbreviations: VE, vaccine effectiveness; CI, confidence interval; NA, not applicable. p value for heterogeneity.

Supplement table 9. Vaccine effectiveness of immunization regimens against SARS-CoV-2 variants.

Study ID	Study design	Country	Population	Immunization regimens	Outcomes	VE% (95% CI)	SARS-CoV-2 variants
Can, 2022	Cohort	Turkey	HCWs	2 CoronaVac	COVID-19 infection	39.0 (19.6, 53.7)	Alpha (75%)
Vokó, 2021	Cohort	Hungary	GP	2 HB02	COVID-19 infection	72.8 (71.2, 74.4)	Alpha
			GP	2 HB02	Death	86.0 (83.7, 87.9)	Alpha
Zhang, 2022	Cohort	Morocco	GP	2 BBIBP-CorV	Hospitalization	88.5 (85.8, 90.7)	Alpha
Petrovic, 2022	Cohort	Serbia	EP	2 BBIBP-CorV	COVID-19 infection	86.9 (86.0, 87.7)	Alpha
			EP	2 BBIBP-CorV	Severe COVID-19	90.5 (88.9, 91.9)	Alpha
Copur, 2022	Cohort	Turkey	HCWs	2 CoronaVac	COVID-19 infection	65.0 (50.0, 75.0)	Alpha
Ranzani, 2021	Case-control	Brazil	EP	2 CoronaVac	COVID-19 infection	46.8 (38.7, 53.8)	Gamma
			EP	2 CoronaVac	Hospitalization	55.5 (46.5, 62.9)	Gamma
			EP	2 CoronaVac	Death	61.2 (48.9, 70.5)	Gamma
Marra, 2022	Cohort	Brazil	HCWs	2 CoronaVac	COVID-19 infection	51.3 (34.6, 63.7)	Gamma
Hitchings, 2021	Case-control	Brazil	HCWs	2 CoronaVac	COVID-19 infection	37.1 (-53.3, 74.2)	Gamma
Jara_1, 2022	Cohort	Chile	GP	2 CoronaVac	COVID-19 infection	78.8 (76.8, 80.6)	Delta (63%)
			GP	2 CoronaVac	Hospitalization	86.3 (83.7, 88.5)	Delta (63%)
			GP	2 CoronaVac	ICU admission	92.2 (88.7, 94.6)	Delta (63%)
			GP	2 CoronaVac	Death	86.7 (80.5, 91.0)	Delta (63%)
			GP	2 CoronaVac+BNT162b2	COVID-19 infection	96.5 (96.2, 96.7)	Delta (63%)
			GP	2 CoronaVac+BNT162b2	Hospitalization	96.1 (95.3, 96.9)	Delta (63%)
			GP	2 CoronaVac+BNT162b2	ICU admission	96.2 (94.6, 97.3)	Delta (63%)
			GP	2 CoronaVac+BNT162b2	Death	96.8 (93.9, 98.3)	Delta (63%)
			GP	2 CoronaVac+AZD1222	COVID-19 infection	93.2 (92.9, 93.6)	Delta (63%)
			GP	2 CoronaVac+AZD1222	Hospitalization	97.7 (97.3, 98.0)	Delta (63%)
			GP	2 CoronaVac+AZD1222	ICU admission	98.9 (98.5, 99.2)	Delta (63%)

			GP	2 CoronaVac+AZD1222	Death	98.1 (97.3, 98.6)	Delta (63%)
Kang, 2022	Cohort	China	CCs	2 CoronaVac	COVID-19 infection	51.8 (20.3, 83.2)	Delta (GS)
			CCs	2 CoronaVac	COVID-19 infection	60.4 (31.8, 88.9)	Delta (GS)
			CCs	2 CoronaVac	Severe COVID-19	100.0 (98.4, 100.0)	Delta (GS)
Ma, 2022	Cohort	China	CCs	BBIBP-CorV and CoronaVac	COVID-19 infection	74.6 (36.0, 90.0)	Delta (GS)
			CCs	BBIBP-CorV and CoronaVac	Severe COVID-19	100.0 (47.6, 100.0)	Delta (GS)
Sritipsukho, 2022	Case-control	Thailand	GP	2 CoronaVac	COVID-19 infection	60.0 (49.0, 69.0)	Delta
			GP	2 CoronaVac+BNT162b2	COVID-19 infection	98.0 (87, 100.0)	Delta
			GP	2 CoronaVac+ChAdOx1	COVID-19 infection	86.0 (74.0, 93.0)	Delta
Wu, 2022	Cohort	China	GP	BBIBP-CorV and CoronaVac	COVID-19 infection	50.5 (27.6, 66.2)	Delta (GS)
			GP	BBIBP-CorV and CoronaVac	Severe COVID-19	82.4 (21.0, 96.1)	Delta (GS)
Ranzani, 2022a	Case-control	Brazil	GP	2 CoronaVac	COVID-19 infection	51.3 (49.9, 52.7)	Delta
			GP	2 CoronaVac	Severe COVID-19	86.5 (83.4, 88.9)	Delta
Suphanchaimat, 2022	Case-control	Thailand	GP	2 CoronaVac+ChAdOx1	COVID-19 infection	87.1 (85.2, 88.8)	Delta
			GP	2 CoronaVac+ChAdOx1	Severe COVID-19	99.1 (93.6, 99.9)	Delta
			GP	2 CoronaVac+BNT162b2	COVID-19 infection	95.0 (93.8, 95.9)	Delta
			GP	2 CoronaVac+BNT162b2	Severe COVID-19	97.6 (90.3, 99.4)	Delta
Vokó, 2022	Cohort	Hungary	GP	2 HB02	COVID-19 infection	10.9 (6.7, 15.0)	Delta
			GP	2 HB02	Hospitalization	53.8 (43.9, 61.9)	Delta
			GP	2 HB02	Death	67.4 (39.2, 82.5)	Delta
			GP	2 HB02	COVID-19 infection	60.6 (53.4, 66.7)	Delta
			GP	2 HB02	Hospitalization	77.5 (58.2, 87.9)	Delta
			GP	2 HB02	Death	91.1 (36.4, 98.7)	Delta
			GP	2 HB02+BNT162b2	COVID-19 infection	88.0 (87.2, 88.7)	Delta

				GP	2 HB02+BNT162b2	Hospitalization	94.6 (93.3, 95.6)	Delta
				GP	2 HB02+BNT162b2	Death	95.9 (93.4, 97.5)	Delta
				GP	2 HB02+mRNA-1273	COVID-19 infection	91.0 (88.2, 93.1)	Delta
				GP	2 HB02+mRNA-1273	Hospitalization	94.8 (87.6, 97.9)	Delta
				GP	2 HB02+Ad26.COV2.S	COVID-19 infection	78.1 (74.7, 81.0)	Delta
				GP	2 HB02+Ad26.COV2.S	Hospitalization	95.3 (88.7, 98.0)	Delta
				GP	2 HB02+Ad26.COV2.S	Death	95.8 (70.0, 99.4)	Delta
Florentino, 2022	Case-control	Brazil		Children	2 CoronaVac	COVID-19 infection	39.8 (33.7, 45.4)	Omicron
				Children	2 CoronaVac	Hospitalization	59.2 (11.3, 84.5)	Omicron
Jara_2, 2022	Cohort	Chile		Children	2 CoronaVac	COVID-19 infection	38.2 (36.5, 39.9)	Omicron
				Children	2 CoronaVac	Hospitalization	64.6 (49.6, 75.2)	Omicron
				Children	2 CoronaVac	ICU admission	69.0 (18.6, 88.2)	Omicron
González, 2022	Cohort	Argentina		Children	2 BBIBP-CorV	Hospitalization	76.4 (62.9, 84.5)	Omicron
Ranzani, 2022b	Case-control	Brazil		GP	2 CoronaVac	COVID-19 infection	28.1 (26.5, 29.6)	Omicron
				GP	2 CoronaVac	Severe COVID-19	56.1 (40.6, 67.5)	Omicron
Cerqueira-Silva_1, 2022	Case-control	Brazil		GP	2 CoronaVac	COVID-19 infection	3.2 (2.1, 4.2)	Omicron
				GP	2 CoronaVac	Death	67.8 (64.0, 71.3)	Omicron
				GP	2 CoronaVac	Severe COVID-19	64.5 (62.6, 66.3)	Omicron
				GP	2 CoronaVac+BNT161b2	COVID-19 infection	63.6 (62.8, 64.3)	Omicron
				GP	2CoronaVac+BNT161b2	Death	90.6 (89.8, 91.3)	Omicron
				GP	2 CoronaVac+BNT161b2	Severe COVID-19	89.6 (88.8, 90.4)	Omicron
Yan, 2022	Case-control	China		EP	2 CoronaVac	Severe COVID-19	74.8 (72.5, 76.9)	Omicron
				EP	2 CoronaVac	Death	58.9 (50.3, 66.1)	Omicron
				EP	3 CoronaVac	Severe COVID-19	95.5 (93.7, 96.8)	Omicron
				EP	3 CoronaVac	Death	88.0 (80.8, 92.5)	Omicron
				EP	2 CoronaVac+BNT162b2	Severe COVID-19	97.2 (93.7, 98.7)	Omicron
				EP	2 CoronaVac+BNT162b2	Death	95.2 (80.5, 98.8)	Omicron
AlHosani, 2022	Cohort	United	Arab	GP	2 BBIBP-CorV	Hospitalization	79.8 (78.0, 81.4)	Alpha and Beta

		Emirates					
			GP	2 BBIBP-CorV	ICU admission	92.2 (89.7, 94.1)	Alpha and Beta
			GP	2 BBIBP-CorV	Death	97.1 (83.0, 99.9)	Alpha and Beta
Jara, 2021	Cohort	Chile	GP	2 CoronaVac	COVID-19 infection	65.9 (65.2, 66.6)	Alpha and Gamma
			GP	2 CoronaVac	Hospitalization	87.5 (86.7, 88.2)	Alpha and Gamma
			GP	2 CoronaVac	ICU admission	90.3 (89.1, 91.4)	Alpha and Gamma
			GP	2 CoronaVac	Death	86.3 (84.5, 87.9)	Alpha and Gamma
Rearte, 2022	Case-control	Argentina	EP	2 BBIBP-CorV	COVID-19 infection	44.0 (42.0, 45.0)	Alpha, Gamma and Lambda
			EP	2 BBIBP-CorV	Death	85.0 (84.0, 86.0)	Alpha, Gamma and Lambda
Al Kaabi, 2022	Cohort	United Arab Emirates	GP	2 BBIBP-CorV	Hospitalization	79.6 (77.7, 81.3)	Alpha and Delta
				2 BBIBP-CorV	ICU admission	86.0 (82.2, 89.0)	Alpha and Delta
				2 BBIBP-CorV	Death	84.1 (70.8, 91.3)	Alpha and Delta
Suah, 2021	Cohort	Malaysia	GP	2 CoronaVac	ICU admission	72.0 (69.9, 73.9)	Beta and Delta
			GP	2 CoronaVac	Death	82.4 (81.0, 83.7)	Beta and Delta
Nadeem, 2022	Case-control	Pakistan	EP	2 BBIBP-CorV	COVID-19 infection	94.3 (92.2, 95.9)	Beta, Gamma, and Delta
			EP	2 BBIBP-CorV	Hospitalization	60.5 (7.9, 82.9)	Beta, Gamma, and Delta
				2 BBIBP-CorV	Death	98.6 (94.2, 99.6)	Beta, Gamma, and Delta
Edith Solis-Castro, 2022	Cohort	Peru	HCW	2 BBIBP-CorV	COVID-19 infection	26.3 (23.8, 28.6)	Lambda and Gamma
				2 BBIBP-CorV	Hospitalization	67.7 (60.1, 73.8)	Lambda and Gamma
				2 BBIBP-CorV	Death	90.9 (85.5, 94.2)	Lambda and Gamma
Paternina-Caicedo, 2022	Cohort	Colombia	GP	2 CoronaVac	COVID-19 infection	-44.0 (-54.1, -34.6)	Alpha, Gamma, Delta, Lambda, and Mu (>50%)
				2 CoronaVac	Hospitalization	3.3 (-15.1, 18.7)	Alpha, Gamma, Delta, Lambda, and Mu (>50%)
				2 CoronaVac	ICU admission	18.0 (-10.6, 39.2)	Alpha, Gamma, Delta, Lambda, and Mu (>50%)
				2 CoronaVac	Death	21.4 (-0.7, 38.6)	Alpha, Gamma, Delta,

							Lambda, and Mu (>50%)
Arregocés-Castillo, 2022	Cohort	Colombia	EP	2 BBIBP-CorV	Hospitalization	79.6 (77.7, 81.3)	Mu (B.1.621)
				2 BBIBP-CorV	ICU admission	86.0 (82.2, 89.0)	Mu (B.1.621)
				2 BBIBP-CorV	Death	84.1 (70.8, 91.3)	Mu (B.1.621)

Study ID consisted of the first author's surname and year of publication; different immunization regimens in the same study were named by adding letters after the year (a,b,c,d,e, etc.); different studies by the same author in the same year of publication were named by adding Arabic numerals after the surname (1,2,3,4,5, etc.).

Abbreviations: VE, vaccine effectiveness; CI, confidence interval; HCWs, healthcare workers; GP, general population; EP, elderly people; CCs, Close contacts; GS, genome sequencing.

Supplement table 10. Vaccine effectiveness of immunization regimens against Alpha and Gamma variants.

Outcomes	Study (n)	VE% (95% CI)	I^2 (%)	p value
Alpha				
COVID-19 related hospitalization				
Two doses of inactivated vaccines	1	88.50 (86.05, 90.95)	NA	NA
COVID-19 related death				
Two doses of inactivated vaccines	1	86.00 (83.90, 88.10)	NA	NA
Severe COVID-19				
Two doses of inactivated vaccines	1	90.50 (89.00, 92.00)	NA	NA
Gamma				
COVID-19 related hospitalization				
Two doses of inactivated vaccines	1	55.50 (47.30, 63.70)	NA	NA
COVID-19 related death				
Two doses of inactivated vaccines	1	61.20 (50.40, 72.00)	NA	NA

Abbreviations: VE, vaccine effectiveness; CI, confidence interval; NA, not applicable. p value for heterogeneity.

Supplement table 11. Vaccine effectiveness of immunization regimens against Delta variants.

Outcomes	Study (n)	VE% (95% CI)	I^2 (%)	p value
COVID-19 related hospitalization				
Overall	2	91.05 (88.18, 93.93)	96.7	<0.001
Two doses of inactivated vaccines	1	53.80 (44.80, 62.80)	NA	NA
Homologous booster of inactivated vaccines	2	85.08 (79.11, 91.04)	23.9	0.252
Heterologous booster of mRNA vaccines	2	95.39 (94.15, 96.64)	55.5	0.106
Heterologous booster of non-replicating vector vaccines	2	97.67 (97.11, 98.22)	1.7	0.313
COVID-19 related ICU admission				
Overall	1	96.10 (93.04, 99.15)	93.9	<0.001
Homologous booster of inactivated vaccines	1	92.20 (89.25, 95.15)	NA	NA
Heterologous booster of mRNA vaccines	1	96.20 (94.85, 97.55)	NA	NA
Heterologous booster of non-replicating vector vaccines	1	98.90 (98.55, 99.25)	NA	NA
COVID-19 related death				
Overall	2	94.90 (92.05, 97.75)	79.8	<0.001
Two doses of inactivated vaccines	1	67.40 (45.75, 89.05)	NA	NA
Homologous booster of inactivated vaccines	2	86.82 (81.64, 92.00)	0.0	0.785
Heterologous booster of mRNA vaccines	2	96.32 (94.82, 97.82)	0.0	0.557
Heterologous booster of non-replicating vector vaccines	2	98.10 (97.45, 98.74)	0.0	0.759
Severe COVID-19				
Overall	5	95.97 (89.89, 102.05)	94.2	<0.001
Two doses of inactivated vaccines	4	93.36 (81.77, 104.95)	96.5	<0.001
Heterologous booster of mRNA vaccines	1	98.90 (95.05, 102.75)	NA	NA
Heterologous booster of non-replicating vector vaccines	1	99.10 (95.95, 102.25)	NA	NA

Abbreviations: VE, vaccine effectiveness; CI, confidence interval; NA, not applicable. p value for heterogeneity.

Supplement table 12. Vaccine effectiveness of immunization regimens against Omicron variants.

Outcomes	Study (n)	VE% (95% CI)	I^2 (%)	p value
COVID-19 related hospitalization				
Two doses of inactivated vaccines	3	70.55 (61.46, 79.65)	13.8	0.314
COVID-19 related ICU admission				
Two doses of inactivated vaccines	1	69.00 (34.20, 103.80)	NA	NA
COVID-19 related death				
Overall	2	85.29 (77.47, 93.12)	99.0	<0.001
Two doses of inactivated vaccines	2	71.46 (64.60, 78.31)	90.4	0.001
Homologous booster of inactivated vaccines	1	95.50 (93.95, 97.05)	NA	NA
Heterologous booster of mRNA vaccines	2	93.79 (87.32, 100.25)	95.9	<0.001
Severe COVID-19				
Overall	3	75.71 (61.83, 89.59)	99.2	<0.001
Two doses of inactivated vaccines	3	62.31 (57.64, 66.97)	37.5	0.202
Homologous booster of inactivated vaccines	1	88.00 (82.15, 93.85)	NA	NA
Heterologous booster of mRNA vaccines	2	90.47 (86.49, 94.44)	30.0	0.232

Abbreviations: VE, vaccine effectiveness; CI, confidence interval; NA, not applicable. p value for heterogeneity.

Supplement table 13. Subgroup analysis of different populations.

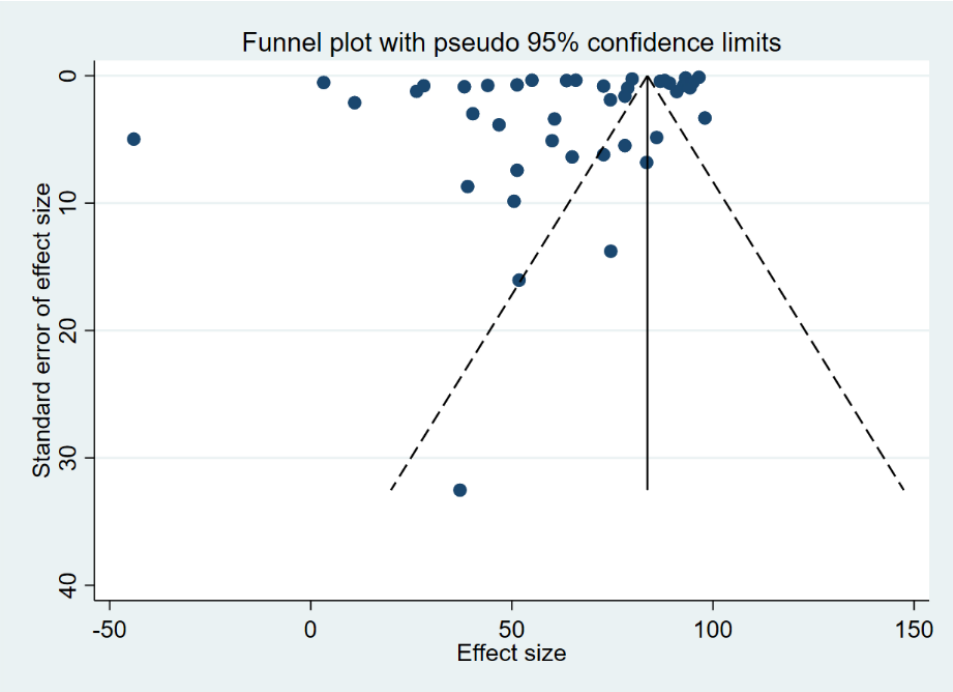
Outcomes	Study (n)	VE% (95% CI)	I^2 (%)	p value
Children aged <18 years				
COVID-19 related hospitalization				
Two doses of inactivated vaccines	3	70.55 (61.46, 79.65)	13.8	0.314
COVID-19 related ICU admission				
Two doses of inactivated vaccines	1	69.00 (34.20, 103.80)	NA	NA
General population				
COVID-19 related hospitalization				
Overall	10	83.43 (78.91, 87.96)	99.6	<0.001
Two doses of inactivated vaccines	9	75.52 (70.98, 80.07)	98.7	<0.001
Homologous booster of inactivated vaccines	2	85.08 (79.11, 91.04)	23.9	0.252
Heterologous booster of mRNA vaccines	3	95.94 (94.70, 97.18)	73.7	0.010
Heterologous booster of non-replicating vector vaccines	2	97.67 (97.11, 98.22)	1.7	0.313
COVID-19 related ICU admission				
Overall	7	82.64 (76.05, 89.24)	99.4	<0.001
Two doses of inactivated vaccines	6	74.05 (63.93, 84.18)	98.9	<0.001
Homologous booster of inactivated vaccines	1	92.20 (89.25, 95.15)	NA	NA
Heterologous booster of mRNA vaccines	1	96.20 (94.85, 97.55)	NA	NA
Heterologous booster of non-replicating vector vaccines	1	98.90 (98.55, 99.25)	NA	NA
COVID-19 related death				
Overall	12	86.29 (82.58, 90.00)	98.8	<0.001
Two doses of inactivated vaccines	11	81.61 (78.73, 84.48)	93.8	<0.001
Homologous booster of inactivated vaccines	2	86.82 (81.64, 92.00)	0.0	0.785
Heterologous booster of mRNA vaccines	4	95.36 (90.92, 99.80)	97.3	<0.001
Heterologous booster of non-replicating vector vaccines	2	98.10 (97.45, 98.74)	0.0	0.759
Severe COVID-19				
Overall	4	85.55 (79.02, 92.07)	99.5	<0.001
Two doses of inactivated vaccines	3	73.62 (62.42, 84.81)	99.2	<0.001
Heterologous booster of mRNA vaccines	3	95.12 (88.89, 101.35)	98.8	<0.001
Heterologous booster of non-replicating vector vaccines	1	99.10 (95.95, 102.25)	NA	NA
Elderly people aged ≥60 years				
COVID-19 related hospitalization				
Two doses of inactivated vaccines	3	50.83 (44.21, 57.44)	34.6	0.217
COVID-19 related death				
Overall	5	84.19 (76.54, 91.85)	99.1	<0.001
Two doses of inactivated vaccines	5	79.17 (70.44, 87.89)	98.8	<0.001
Homologous booster of inactivated vaccines	1	95.50 (93.95, 97.05)	NA	NA
Heterologous booster of mRNA vaccines	1	97.20 (94.70, 99.70)	NA	NA
Severe COVID-19				

Overall	2	83.30 (71.10, 95.50)	95.1	<0.001
Two doses of inactivated vaccines	2	74.95 (43.98, 105.91)	98.3	<0.001
Homologous booster of inactivated vaccines	1	88.00 (82.15, 93.85)	NA	NA
Heterologous booster of mRNA vaccines	1	95.20 (86.05, 104.35)	NA	NA
Healthcare workers				
COVID-19 related hospitalization				
Two doses of inactivated vaccines	1	67.70 (60.85, 74.55)	NA	NA
COVID-19 related death				
Two doses of inactivated vaccines	1	90.90 (86.55, 96.25)	NA	NA
Close contacts				
Severe COVID-19				
Two doses of inactivated vaccines	3	99.99 (99.19, 100.79)	0.0	0.656

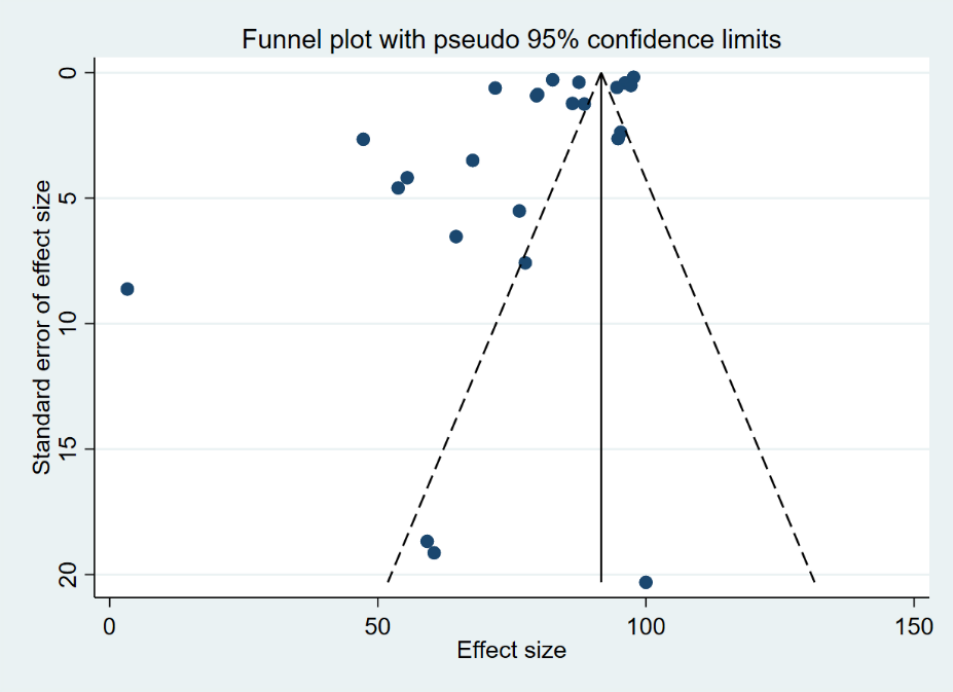
Abbreviations: VE, vaccine effectiveness; CI, confidence interval; NA, not applicable.

Supplement figure 6. Funnel plots to assess publication bias.

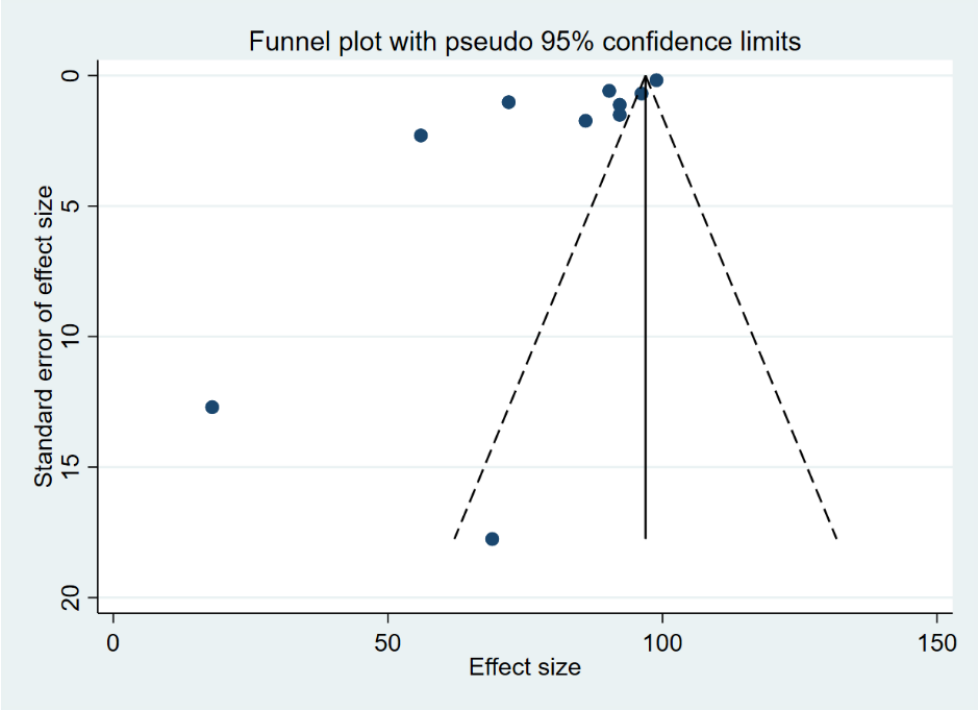
(a) Funnel plot of COVID-19 infection (t value of Egger's test =-2.80, p=0.008).



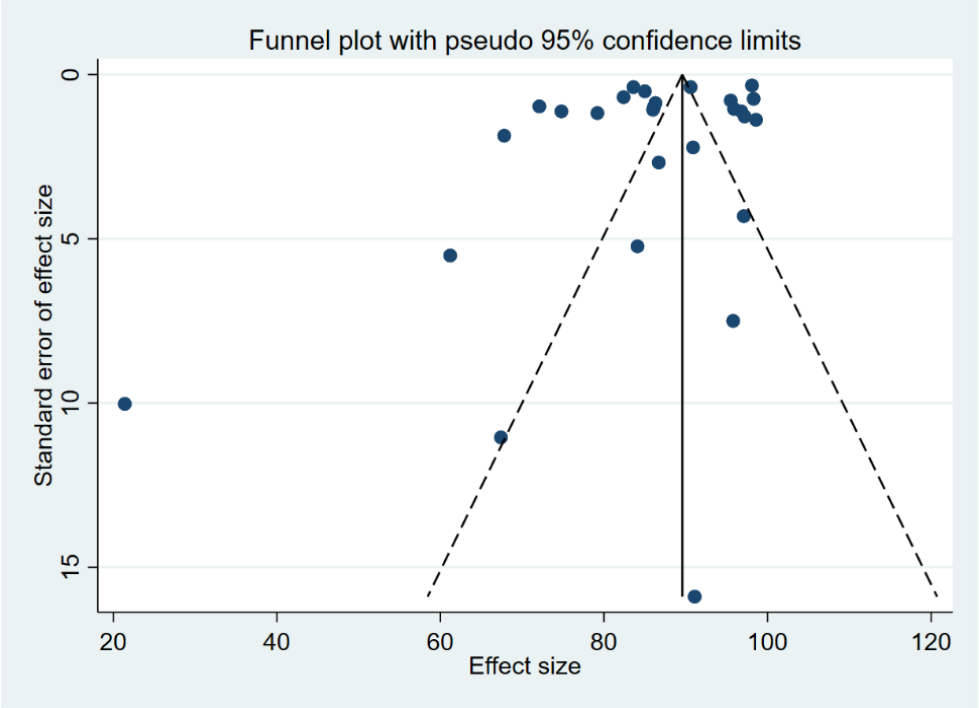
(b) Funnel plot of COVID-19 related hospitalization (t value of Egger's test =-2.17, p=0.041).



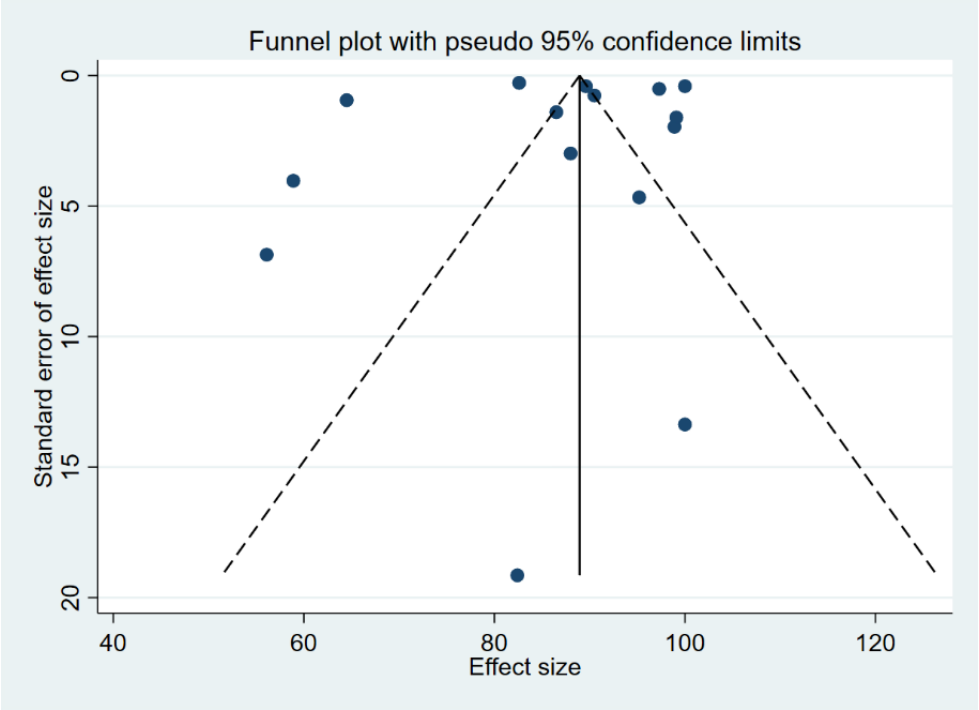
(c) Funnel plot of COVID-19 related ICU admission (t value of Egger's test =-3.10, p=0.015).



(d) Funnel plot of COVID-19 related death (t value of Egger's test =-1.23, p=0.229).

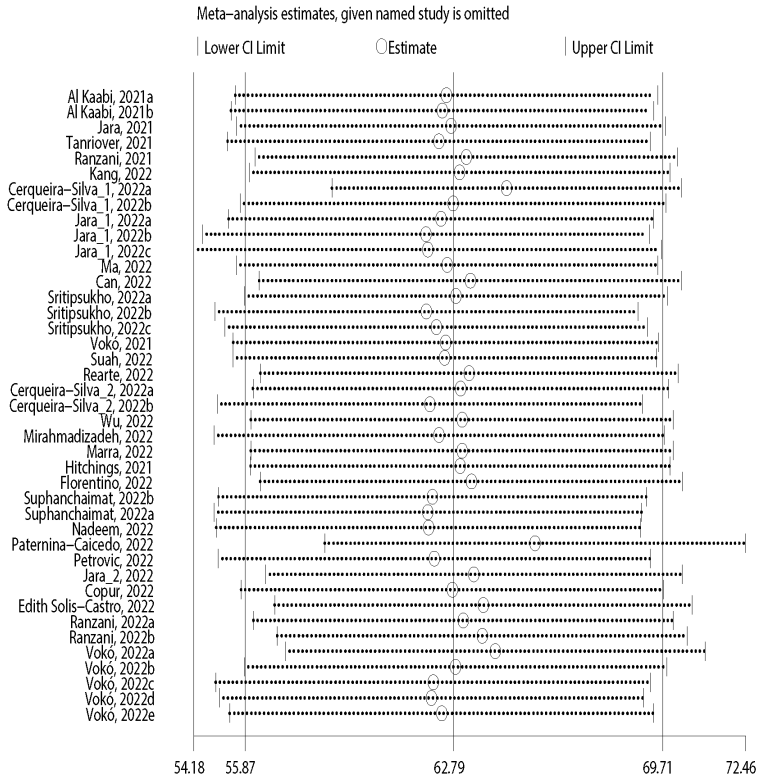


(e) Funnel plot of severe COVID-19 infection (t value of Egger's test =-0.07, p=0.947).

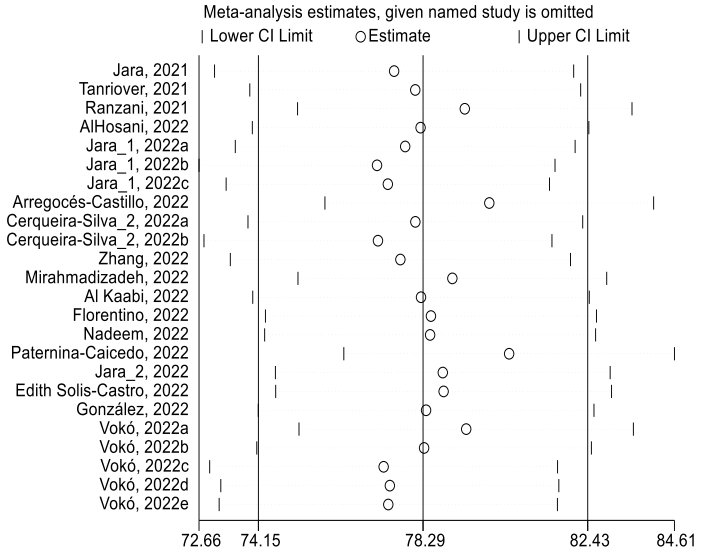


Supplement figure 7. Sensitivity analysis.

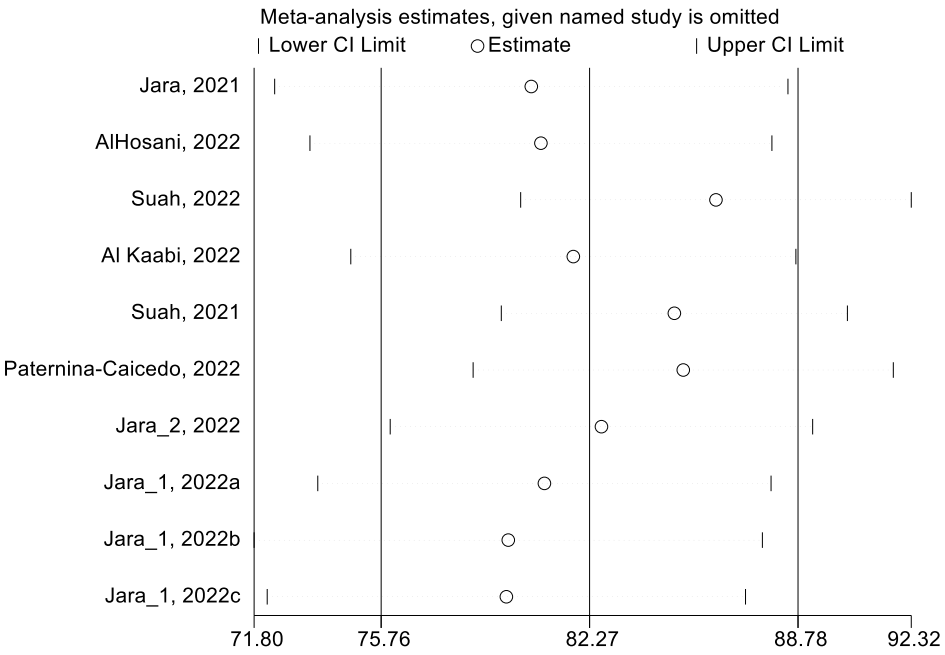
(a) Sensitivity analysis of VE for prevention of COVID-19 infection.



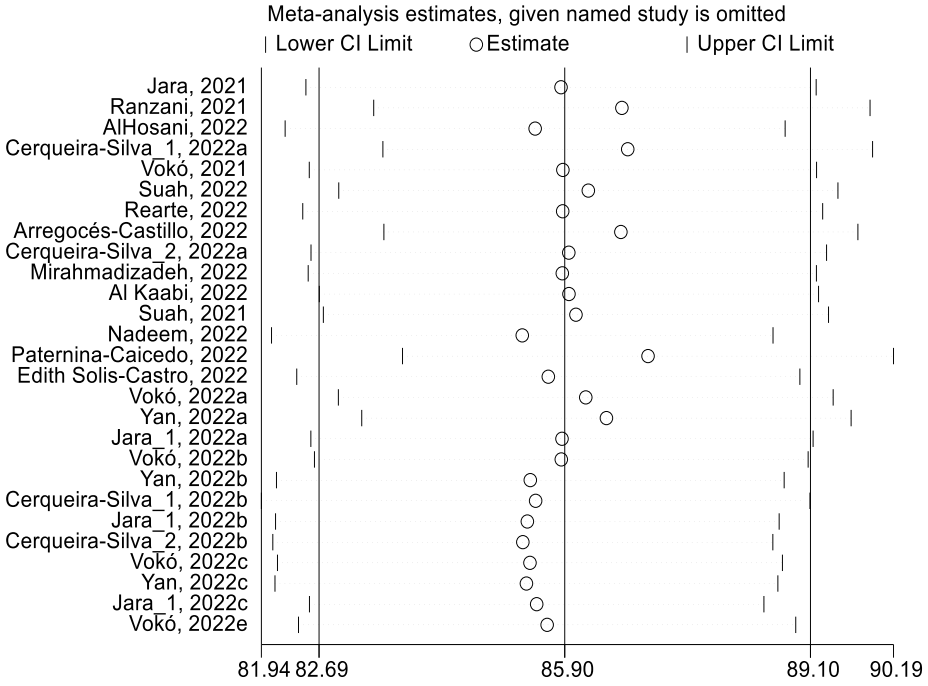
(b) Sensitivity analysis of VE for prevention of COVID-19 related hospitalization.



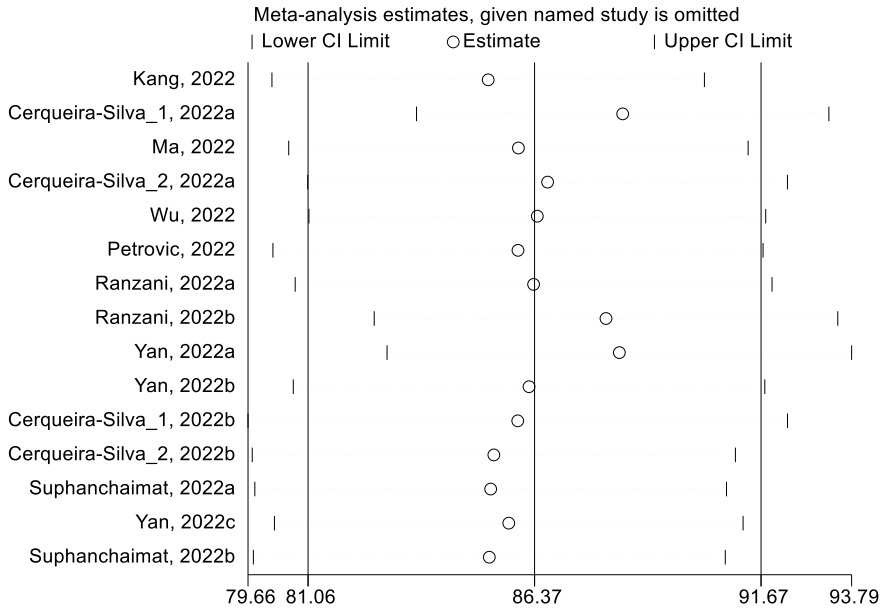
(c) Sensitivity analysis of VE for prevention of COVID-19 related ICU admission.



(d) Sensitivity analysis of VE for prevention of COVID-19 related death.



(e) Sensitivity analysis of VE for prevention of severe COVID-19 infection.


Meta-analysis estimates, given named study is omitted
Lower CI Limit
Estimate
Upper CI Limit
Kang, 2022
Cerqueira-Silva_1, 2022a
Ma, 2022
Cerqueira-Silva_2, 2022a
Wu, 2022
Petrovic, 2022
Ranzani, 2022a
Ranzani, 2022b
Yan, 2022a
Yan, 2022b
Cerqueira-Silva_1, 2022b
Cerqueira-Silva_2, 2022b
Suphanchaimat, 2022a
Yan, 2022c
Suphanchaimat, 2022b
79.66
81.06
86.37
91.67
93.79