Effectiveness of heterologous and homologous COVID-19 vaccine regimens: a living systematic review with network meta-analysis

Supplementary Materials

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Protocol

Updated protocol for 'Effectiveness of heterologous and homologous COVID-19 vaccine regimens: a systematic review with network meta-analysis'

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1. Introduction

We will conduct a systematic review and network meta-analysis of the real-world effectiveness of different regimens using the WHO-approved COVID-19 vaccines. We will follow the Cochrane guideline for living systematic review and network meta-analysis[1].

2. Methods

2.1 Criteria for included studies

2.1.1 Types of studies

We will include randomized controlled COVID-19 vaccine trials in their second and third phases. Additionally, we will include non-randomized studies to determine the effectiveness of heterologous and booster vaccines. The primary reason for including non-randomized studies is that many studies of heterologous and booster vaccine effectiveness typically involve participants who have already received a vaccine dose prior to enrollment, making randomization impossible. Another reason is that while randomized controlled trials (RCTs) do not address population-level interventions, non-randomized studies do. Due to the fact that COVID-19 vaccination campaigns target national or even global populations, non-randomized studies will provide evidence of vaccination's effect that is more interesting and relevant to the general public. As such, we will include case-control studies, retrospective cohort studies, and prospective cohort studies to examine the real-world effectiveness of various COVID-19 vaccines.

We will exclude non-human studies because we are more interested in the effect of a vaccine on humans than in animals. Case studies will be excluded because the purpose of our study is to determine the vaccine's effectiveness in a population rather than an individual. Commentaries, editorials, and letters will be included only if a complete data set containing the investigated population's sample size and total number of events is provided.

2.1.2 Types of participants (age, sex, conditions)

The review will include both males and females. We pre-define three major age groups: young (<18 years), adult (18-65 years), and older adult (aged over 65 years). Although vaccine effectiveness in children (ages 0-12) and adolescents (ages 13-17) is of great interest, we will stratify the young group into children and adolescents only if two or more studies evaluated or included this population as a subset in each group. Treatment group participants must have received at least one dose of WHO-approved vaccines. The reference group will be the no-vaccine group (participants who have never received a vaccine or received a placebo in an RCT). If a study compares participants who received two doses of heterologous or a third dose to those who received two doses of homologous vaccine, the network meta-analysis infers an indirect comparison with the no-vaccine group. All confirmed COVID-19 positive cases should be tested using polymerase chain reaction (PCR). Individuals at low risk of COVID-19 infection (community members who have not been exposed to COVID-19) and those at high risk of COVID-19 infection (e.g., close contacts, healthcare providers, and employees at hospitals, nursing homes, or chronic care institutions) are included. We will include

immunocompromised or immunodeficient patients if more than one study has examined this population. When new studies become available, we will update and incorporate them. To ensure that the analysis has sufficient statistical power, studies with an overall sample size of less than 100 participants will be excluded.

2.1.3 Types of interventions

We will investigate the effectiveness of any combinations of the WHO-approved vaccines (BNT162b2, ChAdOx1, Covishield (India), BBIBP-CorV, mRNA-1273, Ad26.COV2.S, CoronaVac, Covaxin, NVX-CoV2373, and Covovax (India)). We will define an intervention (a node in network) in two ways - by vaccine products and by platforms. For interventions defined by vaccine products, if a participant receives a homologous regimen to Vaccine A and the course of vaccination requires two doses, the intervention will be a "two-dose homologous regimen to vaccine A." If the participant receives a two-dose heterologous vaccine regimen consisting of Vaccine A and Vaccine B, the intervention is referred to as a "two-dose heterologous vaccine regimen with Vaccine A/B." where Vaccine A and B could be of the same platform but different brands. For interventions defined by vaccine platforms, a two-dose heterologous regimen with different order but the same vaccine platform will be considered the same node in the network meta-analysis. For instance, if Vaccine A and B are both nucleic acid-based vaccines, a two-dose heterologous regimen containing either Vaccine A or Vaccine B as the first dose will be grouped under the same node. The assumption is that similar vaccine platforms are equivalent in terms of efficacy. If a person in an intervention group receives a third dose of vaccine of any platform, the group will be considered a new node in the network meta-analysis. The interval between any two vaccine doses should be at least 14 days.

2.1.4 Types of outcomes (Primary and Secondary)

Primary outcome

1. Documented SARS-CoV-2 infections including both asymptomatic and symptomatic

Secondary outcomes

1. Symptomatic SARS-CoV-2 infections
2. Severe COVID-19 infections
3. COVID-19 related hospitalization
4. COVID-19 related deaths

2.2 Data sources and search strategies

We will conduct weekly searches of the WHO COVID-19 database for published studies and preprints. The WHO COVID-19 database compiles information on covid-19 from more than 30 sources. Significant sources include Medline [Ovid], Medline [PubMed], Scopus, Academic Search Complete [Ebsco], Africa Wide Information [Ebsco], CINAHL [Ebsco], ProQuest Central [Proquest], EuropePMC, China CDC MMWR, CDC Reports, BioRxiv [preprints], MedRxiv [preprints], ChemRxiv

[preprints], SSRN [preprints], Embase [Elsevier]. To identify studies that are not included in the WHO COVID-19 database, we will conduct individual searches of the sources listed in the WHO COVID-19 database. Additionally, we will conduct a search of the Cochrane Library. For registered clinical trials, we will conduct searches of trials through ICMJE-acceptable registries (http://www.icmje.org/about-icmje/faqs/clinical-trials-registration/) and the WHO International Clinical Trials Portal (https://www.who.int/clinical-trials-registry-platform/network/primary-registries). Queries consisting the following keywords are searched with Medical Subject Headings (MeSH): (COVID 19 or SARS-CoV-2 or coronavir* or 'corona virus') and ('Pfizer–BioNTech' or BNT162b2 or Comirnaty or 'Oxford–AstraZeneca' or AZD1222 or Covishield or Vaxzevria or ChAdOx1 or 'Sinopharm' or 'BIBP*' or 'BBIBP-CorV' or 'Moderna' or Spikevax or 'mRNA 1273' or Janssen* or 'Johnson & Johnson*' or 'Ad26.COV2.S' or CoronaVac* or Sinovac* or Covaxin or BBV152 or Novavax or Covovax or 'NVX-CoV2373' or Nuvaxovid* or Convidecia* or Covilo* or adenovirus* or 'viral vector*' or 'protein recombinant*' or 'recombinant spike proteins' or inactivate* or attenuate* or mRNA* or 'nucleic acid vaccine*') and (effect* or efficac* or immunogen* or 'first dose' or 'single dose' or 'second dose' or 'third dose' or booster or heterologous* or homologous* or combin* or mix*) and (alpha or beta or gamma or delta or omicron or B.1.1.7 or B.1.351 or P.1 or B.1.617.2 or B.1.1.529). In Chinese databases, the same keywords are translated. The dates of the searches are limited to December 2019-. A full search strategy will be provided. We may update the keywords as additional vaccines are approved by the World Health Organization. Apart from searching in the databases, we will screen studies that were included in the bibliographies of published reviews on the effectiveness of the COVID-19 vaccines. Data will be extracted from supplementary files or online platforms such as GitHub or an author-developed web page if the relevant study meets the inclusion criteria outlined in *2.3 Study selection and data extraction*. We will contact study authors if we discover any missing data or previously unpublished data. All English and Chinese studies are screened directly by the authors. We will also screen studies written in languages other than English or Chinese if an English translation of the full text is available.

2.3 Study selection and data extraction

2.3.1 Selection of studies

In the title and abstract screening, independent reviewers (WYA, PPHC, and others) will identify inclusions by perusing the titles and abstracts of all retrieved studies on EndNote 20. WYA and PPHC will ascertain whether any studies identified are inconsistent in the full-text study screening. All disagreements will be resolved through reaching a consensus between reviewers. Reviewers will eliminate duplicated search results during the importation process in EndNote 20. One reviewer will manually remove any remaining duplicates. To assist in the study selection process, we will utilize the machine learning tool ASReview[2].

2.3.2 Data collection process and management

We have conducted a pilot search in early November 2021 to identify key study characteristics to look for during full text screening. For each included study, reviewers (WYA and PPHC and others) will independently extract data on the study's characteristics (author and year, overall sample size of the trial, i.e., number of eligible

participants in the trial, study design, intervention group and comparator group with total number of participants in each group, and respective number of events in the intervention and comparator groups) and patient population (age, gender, country, time interval between the primary and boosting dose, period-of-exposure assessment from the last vaccine dose). If the number of events is not specified, we will derive it using the odds ratio, risk ratio, rate ratio, or hazard ratio reported. If the study has collected data on the number of events at two or more time points, we will extract data from the period when the vaccine was the most effective.

2.4 Statistical analysis

2.4.1 Risk of bias assessment of included studies

Although conventional meta-analysis does not usually summarize results from both randomized controlled trial studies and observational studies due to poor methodological quality and potential overestimation of the effect estimate, well-designed observational studies can still yield comparable results to randomized controlled trials[3]. We will perform risk of bias assessment using the Risk of Bias In Non-randomized Studies – of Interventions tool (ROBINS-I)[4] for all observational studies and the Cochrane Risk of Bias Assessment tool (built-in in Review Manager 5.4) for all RCTs. Conclusion of the meta-analysis will be drawn from studies that are rated as overall low risk.

2.4.2 Measures of effect of interventions

We will estimate the overall effectiveness of each vaccine regimen (1-summary odds ratio). To calculate the summary odds ratio for each intervention, arm-level data from the included studies will be extracted (number of events and number of participants in each intervention group). Relative effects in pairwise comparisons will be presented in a league table. To rank the vaccination regimens with different combination of vaccines, we will determine the surface under the cumulative ranking curve (SUCRA) values and indicate which combination is the most likely to be the best (i.e., highest vaccine effectiveness).

To combine randomized and non-randomized evidence in the network meta-analysis, we will estimate treatment effects using a three-level Bayesian hierarchical modeling approach[5 6]. The first level will be the individual study level. The true number of events in the group receiving the j^{th} intervention is assumed to follow a normal distribution within the i^{th} study. The second level collates studies that share a common research design D. The studies included in this review will be classified according to their design into four categories: RCT, retrospective cohort study (RC), prospective cohort study (PC), and case-control study (CC). As shown below, we assume that all treatment effects conform to a normal distribution with a design-specific mean and variance.

$$Y_{i,j}^{D} \sim \mathcal{N}\left(\theta_{i,j}^{D}, S_{i,j}^{D^2}\right)$$

$$\text{logit}(\theta_{i,j}^{D}) = \mu_{i,b_i}^{D} + \varphi_{i,j}^{D}$$

$$\varphi_{i,j}^{D} \sim \mathcal{N}\left(d_j^D - d_b^D, \tau^2\right)$$

where the superscript *D* denotes any one of the four study designs and μ_{i,b_i}^{D} is the baseline effect. We will estimate the difference (log odds ratio) between the

investigated vaccine regimen and the control intervention. At the third level, we assume a random effect model for each vaccine regimen's treatment effect. Vague priors are used in the estimation of the treatment effects and the between-trial standard deviation (i.e., heterogeneity) presented in precision.

$$d_j^D \sim \mathcal{N}\left(\mu_j^{ALL}, \sigma^2\right)$$

$$\mu_j^{ALL} \sim \mathcal{N}(0,0.001)$$

$$\sigma^2 \sim unif(0,0.1)$$

The number of MCMC iterations will be set to 100000, and the burn-in will be equal to the number of iterations divided by 5. If no convergence is observed in trace plots, we will double the iterations to 200000. We choose (#iterations-#burn-in)/1000 for thinning. There will be three MCMC chains run. Inconsistency will be evaluated using Daly and colleague's guideline[7]. We will compare the consistency and inconsistency models by their residual deviance as suggested in the guideline. BUGS codes will be run with the *R2jags* package in R and be made available on GitHub.

2.4.3 Unit of analysis issues

We will follow the guidelines in Cochrane Handbook 5.1 when it comes to unit-of-analysis issues. In any longitudinal studies where numbers of events were recorded over several time intervals, we will extract data at the time when the vaccine effectiveness was the highest. To avoid counting participants twice in a common reference group when performing multiple comparisons, each node corresponds to a particular intervention.

2.4.4 Dealing with missing data

We take Cochrane's recommendations (training handbook 16.1.2) into account and contact the original investigators to obtain missing data. We will conduct the analysis using only the available data in the study if missing data is unobtainable from the original investigators.

2.4.5 Measures for transitivity assumptions and heterogeneity

During full-text screening and data extraction, we will ensure that each vaccine regimen is administered to participants in a comparable manner, for example, using the same dosage in a comparable setting. Additionally, we will ensure that outcomes are defined consistently across all included studies, such as PCR-confirmed positive cases for post-vaccination infections. We assume that all studies shared a common variance in heterogeneity. Subgroup analyses will be used to examine heterogeneity.

2.4.6 Measures for publication bias

The comparison-adjusted funnel plot will be used to assess publication bias in NMA, where each data point in the funnel represents a pair of treatment comparisons rather than a single study[8].

2.4.7 Subgroup and sensitivity analyses

We will conduct subgroup analyses for age, sex, ethnicity, populations having high risk of COVID-19 infection such as close contacts and healthcare providers, patients with one or more disease conditions, and COVID-19 variants, depending on the data

availability. Sensitivity analyses will exclude studies classified as having a high risk of bias.

2.4.8 Summary of findings and GRADE quality assessment

We will follow the GRADE guideline to assess the strength of evidence considering risk of bias, inconsistency, indirectness, publication bias, and imprecision in the evidence[9]. We will base our final decisions following instructions in the Technical Support Documents in Evidence Synthesis prepared for the National Institute for Health and Clinical Excellence (NICE) Decision Support Unit[10 11].

3. Update of NMA

We will update the results when new published studies or preprints become available. To facilitate and speed up the review process in the next iteration, we will search the WHO COVID-19 databases weekly as well as receive update alerts from various journals. This will save time for the laborious search process and synchronize our results with the most up-to-date research studies in the field. Updated results will be posted on BMJ.com together with the latest version of the article and documents. We may adjust the analytical methods and some of the outcomes depending on data availability. We may add other vaccine types and multiple-dose regimens to the analysis as more vaccines are being approved by the WHO EUA and research on the fourth or more additional doses to the primary vaccination is coming. If necessary, any changes in the pre-specified protocol will be discussed by the main authors and documented in the Methods. Final decisions on the changes will be made by the review team.

4. References

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Table 1. Search strategy

Data base	**Weekly Search Strategy**
MEDLINE (Ovid)	
	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2).mp. AND ("first dose" OR "single dose" OR "second dose" OR "third dose" OR booster OR heterologous* OR homologous* OR combin* OR mix*).mp.
	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) .mp. AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo* OR "virus-like particle" OR adenovirus* OR "viral vector" OR "protein recombinant" OR "recombinant spike proteins" OR inactivate* OR attenuate* OR mRNA* OR "nucleic acid vaccine").mp.
	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) .mp. AND (alpha OR beta OR gamma OR delta OR omicron OR "B.1.1.7" OR "B.1.351" OR "P.1" OR "B.1.617.2" OR "B.1.1.529).mp.
	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2).mp. AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*).mp. AND (effect* OR efficac* OR immunogen*).mp.
	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) .mp. AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR

	BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*).mp. AND ("first dose" OR "single dose" OR "second dose" OR "third dose" OR booster OR heterologous* OR homologous* OR combin* OR mix*).mp. AND (effect* OR efficac* OR immunogen*).mp.
Medline (PubMed)	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND ("first dose" OR "single dose" OR "second dose" OR "third dose" OR booster OR heterologous* OR homologous* OR combin* OR mix*) AND (effect* OR efficac* OR immunogen*)
Cochrane Library	covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2 AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND (effect* OR efficac* OR immunogen*)
CAB Abstract (WHO)	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND (effect* OR efficac* OR immunogen*)
Global Health (Ovid)	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) .mp. AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR

	Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*).mp. AND (effect* OR efficac* OR immunogen*).mp.
PsycInfo (Ovid)	(covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) .mp. AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*).mp. AND (effect* OR efficac* OR immunogen*).mp.
Scopus (Elsevier)	TITLE-ABS-KEY (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND TITLE-ABS-KEY ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND TITLE-ABS-KEY ("first dose" OR "single dose" OR "second dose" OR "third dose" OR booster OR heterologous* OR homologous* OR combin* OR mix*) AND TITLE-ABS-KEY (effect* OR efficac* OR immunogen*)
Academic Search Ultimate (Ebsco)	TI,AB,SU ((covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND ("first dose" OR "single dose" OR "second dose" OR "third dose" OR booster OR heterologous* OR homologous* OR combin* OR mix*) AND (effect* OR efficac* OR immunogen*))
Africa Wide Information (WHO)	TI,AB,SU ((covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR

	BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND (effect* OR efficac* OR immunogen*))
CINAHL (Ebsco)	TI,AB,SU ((covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND (effect* OR efficac* OR immunogen*))
ProQuest Central (ProQuest)	TI,AB,SU ((covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer-BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford-AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1* OR Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR "NVX-CoV2373" OR Nuvaxovid* OR Covidecia* OR Covilo*) AND (effect* OR efficac* OR immunogen*))
EMBASE (OVID)	
	covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR '2019nCoV:ti,ab OR ncov19':ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab AND ('first dose':ti,ab OR 'single dose':ti,ab OR 'second dose':ti,ab OR 'third dose':ti,ab)
	(covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ((CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin:ti,ab OR BBV152:ti,ab OR Novavax:ti,ab OR Covovax:ti,ab OR 'NVX-CoV2373':ti,ab) OR ('Pfizer-BioNTech':ti,ab OR BNT162b2:ti,ab OR 'Moderna':ti,ab OR 'mRNA-1273':ti,ab))
	((covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ('first dose':ti,ab OR 'single dose':ti,ab OR 'second dose':ti,ab OR 'third dose':ti,ab) OR (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ((CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin:ti,ab OR BBV152:ti,ab OR Novavax:ti,ab OR Covovax:ti,ab OR

	'NVX-CoV2373':ti,ab) OR ('Pfizer-BioNTech':ti,ab OR BNT162b2:ti,ab OR 'Moderna':ti,ab OR 'mRNA-1273':ti,ab))
	(effect*:ti,ab OR efficac*:ti,ab OR immunogen*:ti,ab) AND ("Pfizer–BioNTech":ti,ab OR BNT162b2:ti,ab OR Comirnaty*:ti,ab OR "Oxford– AstraZeneca":ti,ab OR AZD1222:ti,ab OR Covishield*:ti,ab OR Vaxzevria*:ti,ab OR ChAdOx1*:ti,ab OR Sinopharm*:ti,ab OR BIBP*:ti,ab OR "BBIBP-CorV":ti,ab OR Moderna*:ti,ab OR Spikevax*:ti,ab OR "mRNA 1273":ti,ab OR Janssen*:ti,ab OR "Johnson & Johnson":ti,ab OR "Ad26.COV2.S":ti,ab OR CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin*:ti,ab OR BBV152:ti,ab OR Novavax*:ti,ab OR Covovax*:ti,ab OR "NVX-CoV2373":ti,ab OR Nuvaxovid*:ti,ab OR Covidecia*:ti,ab OR Covilo*:ti,ab OR "virus-like particle":ti,ab OR adenovirus*:ti,ab OR "viral vector":ti,ab OR "protein recombinant":ti,ab OR "recombinant spike proteins":ti,ab OR "nucleic acid vaccine":ti,ab) AND (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR "severe acute respiratory syndrome":ti,ab OR sars cov 2:ti,ab)
	(((covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ('first dose':ti,ab OR 'single dose':ti,ab OR 'second dose':ti,ab OR 'third dose':ti,ab) OR (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ((CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin:ti,ab OR BBV152:ti,ab OR Novavax:ti,ab OR Covovax:ti,ab OR 'NVX-CoV2373':ti,ab) OR ('Pfizer-BioNTech':ti,ab OR BNT162b2:ti,ab OR 'Moderna':ti,ab OR 'mRNA-1273':ti,ab)) OR ((effect*:ti,ab OR efficac*:ti,ab OR immunogen*:ti,ab) AND ("Pfizer–BioNTech":ti,ab OR BNT162b2:ti,ab OR Comirnaty*:ti,ab OR "Oxford– AstraZeneca":ti,ab OR AZD1222:ti,ab OR Covishield*:ti,ab OR Vaxzevria*:ti,ab OR ChAdOx1*:ti,ab OR Sinopharm*:ti,ab OR BIBP*:ti,ab OR "BBIBP-CorV":ti,ab OR Moderna*:ti,ab OR Spikevax*:ti,ab OR "mRNA 1273":ti,ab OR Janssen*:ti,ab OR "Johnson & Johnson":ti,ab OR "Ad26.COV2.S":ti,ab OR CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin*:ti,ab OR BBV152:ti,ab OR Novavax*:ti,ab OR Covovax*:ti,ab OR "NVX-CoV2373":ti,ab OR Nuvaxovid*:ti,ab OR Covidecia*:ti,ab OR Covilo*:ti,ab OR "virus-like particle":ti,ab OR adenovirus*:ti,ab OR "viral vector":ti,ab OR "protein recombinant":ti,ab OR "recombinant spike proteins":ti,ab OR "nucleic acid vaccine":ti,ab) AND (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR "severe acute respiratory syndrome":ti,ab OR sars cov 2:ti,ab))) NOT (((covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ('first

	dose':ti,ab OR 'single dose':ti,ab OR 'second dose':ti,ab OR 'third dose':ti,ab) OR (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ((CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin:ti,ab OR BBV152:ti,ab OR Novavax:ti,ab OR Covovax:ti,ab OR 'NVX-CoV2373':ti,ab) OR ('Pfizer-BioNTech':ti,ab OR BNT162b2:ti,ab OR 'Moderna':ti,ab OR 'mRNA-1273':ti,ab)) AND ((covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ('first dose':ti,ab OR 'single dose':ti,ab OR 'second dose':ti,ab OR 'third dose':ti,ab)) OR (covid19:ti,ab OR coronavir*:ti,ab OR corona virus*:ti,ab OR nCoV*:ti,ab OR 2019nCoV:ti,ab OR ncov19:ti,ab OR 'severe acute respiratory syndrome':ti,ab OR sars cov 2:ti,ab) AND ((CoronaVac*:ti,ab OR Sinovac*:ti,ab OR Covaxin:ti,ab OR BBV152:ti,ab OR Novavax:ti,ab OR Covovax:ti,ab OR 'NVX-CoV2373':ti,ab) OR ('Pfizer-BioNTech':ti,ab OR BNT162b2:ti,ab OR 'Moderna':ti,ab OR 'mRNA-1273':ti,ab)))
Eurosurveillance	
	COVID 19 OR SARS-CoV-2 OR coronavir* OR‘corona virus’ AND (first dose’ OR ‘single dose’ OR ‘second dose’ OR ‘third dose’)
	‘Pfizer–BioNTech’ OR BNT162b2 OR ‘Moderna’ OR ‘mRNA-1273’ AND (‘third dose’ OR booster)
	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘Oxford–AstraZeneca’ AND (‘first dose’ OR ‘single dose’ OR ‘second dose’ OR ‘third dose’)
	COVID 19 OR SARS-CoV-2 OR coronavir* OR ‘corona virus’ AND (effectiveness OR efficacy OR immunogen)
	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘OxfORd–AstraZeneca’ OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR ‘NVX-CoV2373’ OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
American Chemistry Society	
	‘Pfizer–BioNTech’ OR BNT162b2 OR ‘Moderna’ OR ‘mRNA-1273’ AND (‘third dose’ OR booster)
	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘OxfORd–AstraZeneca’ OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
Biomed central	
	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘OxfORd–AstraZeneca’ OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)

	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR 'NVX-CoV2373' OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
	COVID 19 OR SARS-CoV-2 OR coronavir* OR'corona virus') AND (Covilo* OR 'virus-like particle' OR adenovirus* OR 'viral vectOR*' OR 'protein recombinant*' AND (effect OR efficacy* OR immunogen*)
	COVID 19 OR SARS-CoV-2 OR coronavir* OR'corona virus') AND ('recombinant spike proteins' OR inactivate* OR attenuate* OR mRNA* OR 'nucleic acid vaccine*' AND (effect OR efficacy* OR immunogen*)
Scielo (Web of science)	
	TS= 'Pfizer–BioNTech' OR TS= BNT162b2 OR TS= Comirnaty OR TS= 'OxfORd–AstraZeneca' OR TS= AZD1222 OR TS= Covishield OR TS= Vaxzevria OR TS=ChAdOx1) AND (TS= effect OR TS= efficacy* OR TS= immunogen*
	TS= CORonaVac* OR TS= Sinovac* OR TS= Covaxin OR TS= BBV152 OR TS= Novavax OR TS= Covovax OR TS= 'NVX-CoV2373' OR TS= Nuvaxovid* OR TS= Covidecia*) AND (TS= effect OR TS= efficacy* OR TS= immunogen*)
	TS= COVID 19 OR TS= SARS-CoV-2 OR TS= coronavir* OR TS= 'corona virus' AND (TS= 'Sinopharm' OR TS= 'BIBP*' OR TS= 'BBIBP-CORV' OR TS= 'Moderna' OR TS= Spikevax OR TS= 'mRNA 1273' OR TS=Janssen* OR TS='Johnson & Johnson*' OR TS='Ad26.COV2.S' AND (TS= effect OR efficacy* OR TS= immunogen*
	TS=COVID 19 OR TS=SARS-CoV-2 OR TS=coronavir* OR TS='corona virus' AND (TS= Covilo* OR TS= 'virus-like particle' OR TS= adenovirus* OR TS='viral vectOR*' OR TS= 'protein recombinant*' AND (TS= effect OR TS= efficacy* OR TS= immunogen*)
	TS= COVID 19 OR TS=SARS-CoV-2 OR TS=coronavir* OR TS= 'corona virus' AND (TS= 'recombinant spike proteins' OR TS= inactivate* OR TS= attenuate* OR TS=mRNA* OR TS= 'nucleic acid vaccine*') AND (TS= effect OR TS= efficacy* OR TS=immunogen*)
J-Stage	
	'Pfizer–BioNTech' OR BNT162b2 OR Comirnaty OR 'OxfORd–AstraZeneca' OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR 'NVX-CoV2373' OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
Mary Ann Liebert	

	'Pfizer–BioNTech' OR BNT162b2 OR Comirnaty OR 'OxfORd–AstraZeneca' OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR 'NVX-CoV2373' OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
Taylor Francis	
	[Publication Title: 'Pfizer–BioNTech'] OR [Publication Title: BNT162b2] OR [Publication Title: Comirnaty] OR [Publication Title: 'Oxford–AstraZeneca'] OR [Publication Title: AZD1222] OR [Publication Title: Covishield] OR [Publication Title: Vaxzevria] OR [Publication Title: ChAdOx1] AND [[Publication Title: effect] OR [Publication Title: efficacy*] OR [Publication Title: immunogen*]]
	[Publication Title: CoronaVac*] OR [Publication Title: Sinovac*] OR [Publication Title: Covaxin] OR [Publication Title: BBV152] OR [Publication Title: Novavax] OR [Publication Title: Covovax] OR [Publication Title: 'NVX-CoV2373'] OR [Publication Title: Nuvaxovid*] OR [Publication Title: Covidecia*] AND [[Publication Title: effect] OR [Publication Title: efficacy*] OR [Publication Title: immunogen*]]
MDPI	
	'Pfizer–BioNTech' OR BNT162b2 OR Comirnaty OR 'OxfORd–AstraZeneca' OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR 'NVX-CoV2373' OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
Ariti	'武漢肺炎' OR '新冠病毒' OR '2019新型冠狀病毒病' OR ' 新型冠狀病毒肺炎' OR covid OR coronavirus OR corona OR hcov OR ncov OR covid2019 OR covid19 OR 2019covid AND ('疫苗' OR 'vaccine')
JMIR	'Pfizer–BioNTech' OR BNT162b2 OR Comirnaty OR 'OxfORd–AstraZeneca' OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
WHO IRIS	
	COVID 19 OR SARS-CoV-2 OR coronavir* OR'corona virus' AND (first dose' OR 'single dose' OR 'second dose' OR 'third dose')
	'Pfizer–BioNTech' OR BNT162b2 OR 'Moderna' OR 'mRNA-1273' AND ('third dose' OR booster)

	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘Oxford–AstraZeneca’ AND (‘first dose’ OR ‘single dose’ OR ‘second dose’ OR ‘third dose’)
	COVID 19 OR SARS-CoV-2 OR coronavir* OR ‘corona virus’ AND (effectiveness OR efficacy OR immunogen)
	‘Pfizer–BioNTech’ OR BNT162b2 OR Comirnaty OR ‘OxfORd–AstraZeneca’ OR AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR efficacy* OR immunogen*)
	CORonaVac* OR Sinovac* OR Covaxin OR BBV152 OR Novavax OR Covovax OR ‘NVX-CoV2373’ OR Nuvaxovid* OR Covidecia* AND (effect OR efficacy* OR immunogen*)
Sage Publications	
	[All ‘Pfizer–BioNTech’] OR [All BNT162b2] OR [All ‘Moderna’] OR [All ‘mRNA-1273’] AND [[All ‘third dose’] OR [All booster]]
	[All COVID 19] OR [All SARS-CoV-2] OR [All coronavir*] OR [All ‘corona virus’] AND [[All effectiveness] OR [All efficacy] OR [All immunogen]]
	[All ‘Pfizer–BioNTech’] OR [All BNT162b2] OR [All Comirnaty] OR [All ‘OxfORd–AstraZeneca’] OR [All AZD1222] OR [All Covishield] OR [All Vaxzevria] OR [All ChAdOx1] AND [[All effect OR efficacy*] OR [All immunogen*]]
ANZCTR	(Vaccine OR Effcacy OR Effectiveness) AND COVID19
ReBEC	(Vaccine OR Effcacy OR Effectiveness) AND COVID19
ChCTR	
	(Vaccine OR Effcacy OR Effectiveness) AND COVID19
	新冠疫苗
Science Direct	
	BBV152 OR Novavax OR Covovax OR ‘NVX-CoV2373’ AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	‘Moderna’ OR ‘mRNA-1273’ OR CoronaVac OR Sinovac AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	Covaxin OR ‘Pfizer–BioNTech’ OR BNT162b2 OR “Oxford–AstraZeneca” AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	AZD1222 OR Covishield OR Vaxzevria OR ChAdOx1 AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	Sinopharm OR BIBP OR “BBIBP-CorV” OR Moderna AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)

	Spikevax OR “mRNA 1273” OR Janssen OR “Johnson & Johnson” AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	‘Ad26.COV2.S’ AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
Wiley Online	
	“Pfizer–BioNTech” OR BNT162b2 OR Comirnaty* OR “Oxford–AstraZeneca” OR AZD1222 AND (effect* OR efficac* OR immunogen*)
	‘Moderna’ OR ‘mRNA-1273’ OR CoronaVac OR Sinovac AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
	Moderna* OR Spikevax* OR “mRNA 1273” OR Janssen* OR “Johnson & Johnson” OR “Ad26.COV2.S” AND (effect* OR efficac* OR immunogen*)
	CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR “NVX-CoV2373” OR Nuvaxovid* OR Covidecia* OR Covilo* OR “virus-like particle” OR adenovirus* OR “viral vector” OR “protein recombinant” OR “recombinant spike proteins” OR inactivate* OR attenuate* OR mRNA* OR “nucleic acid vaccine” AND (effect* OR efficac* OR immunogen*)
	Sinopharm OR BIBP OR “BBIBP-CorV” OR Moderna AND (effect OR effectiveness OR efficacy OR efficiency OR immunogen)
PubMed Central	effect*[Title] OR efficac*[Title] OR immunogen*[Title] AND (“Pfizer–BioNTech” [Title] OR BNT162b2[Title] OR Comirnaty*[Title] OR “Oxford– AstraZeneca”[Title] OR AZD1222[Title] OR Covishield*[Title] OR Vaxzevria*[Title] OR ChAdOx1*[Title] OR Sinopharm*[Title] OR BIBP*[Title] OR “BBIBP-CorV” [Title] OR Moderna*[Title] OR Spikevax*[Title] OR “mRNA 1273” [Title] OR Janssen*[Title] OR “Johnson & Johnson” [Title] OR “Ad26.COV2.S” [Title] OR CoronaVac*[Title] OR Sinovac*[Title] OR Covaxin*[Title] OR BBV152[Title] OR Novavax*[Title] OR Covovax*[Title] OR “NVX-CoV2373” [Title] OR Nuvaxovid*[Title] OR Covidecia*[Title] OR Covilo*[Title] OR “virus-like particle” [Title] OR adenovirus*[Title] OR “viral vector” [Title] OR “protein recombinant” [Title] OR “recombinant spike proteins” [Title] OR “nucleic acid vaccine” [Title]) AND (covid19[Title] OR coronavir*[Title] OR corona virus*[Title] OR nCoV*[Title] OR

	2019nCoV[Title] OR ncov19[Title] OR "severe acute respiratory syndrome" [Title] OR sars cov 2[Title])
Web of Science Core Collection (Clarivate)	TS= effect* OR TS= efficac* OR TS=immunogen* AND (TS= "Pfizer–BioNTech" OR TS=BNT162b2 OR TS=Comirnaty* OR TS= "Oxford– AstraZeneca" OR TS=AZD1222 OR TS=Covishield* OR TS=Vaxzevria* OR TS=ChAdOx1* OR TS=Sinopharm* OR TS=BIBP* OR TS= "BBIBP-CorV" OR TS=Moderna* OR TS=Spikevax* OR TS= "mRNA 1273" OR TS=Janssen* OR TS="Johnson & Johnson" OR TS= "Ad26.COV2.S" OR TS=CoronaVac* OR TS=Sinovac* OR TS=Covaxin* OR TS=BBV152 OR TS=Novavax* OR TS=Covovax* OR TS= "NVX-CoV2373" OR TS=Nuvaxovid* OR TS=Covidecia* OR TS=Covilo* OR TS= "virus-like particle" OR TS=adenovirus* OR TS= "viral vector" OR TS= "protein recombinant" OR TS= "recombinant spike proteins" OR TS= "nucleic acid vaccine") AND (TS=covid19 OR TS=coronavir* OR TS=corona virus* OR TS=nCoV* OR TS=2019nCoV OR TS=ncov19 OR TS= "severe acute respiratory syndrome" OR TS=sars cov 2)
Global Index Medicus (WHO)	
	effect* OR efficac* OR immunogen* AND (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer–BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford– AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1*)
	effect* OR efficac* OR immunogen* AND (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND (Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna* OR Spikevax* OR "mRNA 1273" OR Janssen* OR "Johnson & Johnson" OR "Ad26.COV2.S" OR CoronaVac* OR Sinovac*)
EuropePMC (from WHO)	
	effect* OR efficac* OR immunogen* AND (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND ("Pfizer–BioNTech" OR BNT162b2 OR Comirnaty* OR "Oxford– AstraZeneca" OR AZD1222 OR Covishield* OR Vaxzevria* OR ChAdOx1*)
	effect* OR efficac* OR immunogen* AND (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR "severe acute respiratory syndrome" OR sars cov 2) AND (Sinopharm* OR BIBP* OR "BBIBP-CorV" OR Moderna*

	OR Spikevax* OR “mRNA 1273” OR Janssen* OR “Johnson & Johnson” OR “Ad26.COV2.S” OR CoronaVac* OR Sinovac*)
	effect* OR efficac* OR immunogen* AND (covid19 OR coronavir* OR corona virus* OR nCoV* OR 2019nCoV OR ncov19 OR “severe acute respiratory syndrome” OR sars cov 2) AND (“Ad26.COV2.S” OR CoronaVac* OR Sinovac* OR Covaxin* OR BBV152 OR Novavax* OR Covovax* OR “NVX-CoV2373” OR Nuvaxovid* OR Covidecia* OR Covilo*)
AAS Open Research	COVID19 vaccine
bioRxiv	(Vaccine OR Effcacy OR Effectiveness) AND COVID19
F1000	Vaccine AND COVID19
Gates Open Research	Vaccine AND COVID19
Wellcome Open Research	Vaccine AND COVID19

Table 2A. Study characteristics table with information of participants including eligibility, age, percentage of male, baseline characteristics, vaccine priority groups, ethnicity, country of study, and variants of concern. Ten new studies were included in this update (highlighted in green).

Study, year	Study design	Participant eligibility	Age	Male (%)	Baseline characteristics (%)	Vaccine priority groups (%)	Ethnicity (%)	Country	Variants of concern investigated
Abu Raddad, 2021	Test-negative case-control	Population of Qatar who took PCR test	<30 (n=27278) 30-39 (n=27336) 40-49 (n=15214) 50-59 (n=4318) 60-69 (n=954) ≥70 (n=248)	72%	NA	NA	Indian (28.2%) Filipino (12.7%) Qatari (8.5%) Egyptian (5.6%) Pakistani (5.2%) Nepalese (9.5%) Bangladeshi (8.2%) Sri Lankan (4.0%) Sudanese (2.5%) Other (15.6%)	Qatar	B.1.1.7 (alpha) B.1.351 (beta)
Accorsi 2022	Test negative case control study	Adults 18 years or older with COVID-like illness tested December 10, 2021, through January 1, 2022, by a national pharmacy-based testing program (4666 COVID-19 testing sites across 49 US states) Exclusion criteria: - For those reporting 3 doses, if the interval between second and third doses was less than 6 months, as per recommendations during the analysis period for booster doses among immunocompetent individuals - if the most recent dose was received less than 14 days before testing	18-24 (n=10 808) 25-34 (n=21 308) 35-44 (n=13 515) 45-54 (n=9467) 55-64 (n=8543) ≥65 (n=6514)	39.9%	High blood pressure (n=11 437) Overweight (n=11 197) Smoking (n=6750) Diabetes (n=4144) Lung disease or asthma (n=3635) Heart condition (n=3104) Kidney disease (n=217) Liver disease (n=116) No conditions (n=44 627) 1 Condition (n=15 373) ≥2 Conditions (n=10 155)	NA	American Indian or Alaska Native (0.3%) Asian (3.4%) Black or African American (6.0%) Native Hawaiian or Other Pacific Islander (0.2%) White (30.8%) Hispanic (9.2%) Latino ethnicity (50.1%)	USA	Omicron and Delta
Al, 2021	Randomized control Tiral ClinicalTrials.gov Identifier: NCT04510207; Chinese Clinical Trial Registry: ChiCTR2000034780	Adults 18 years and older without prior known history of SARS-CoV, SARS-CoV-2, or Middle East respiratory syn- drome infection (via on-site inquiry) were eligible for enroll- ment. Participants with respiratory symptoms within 14 days before enrollment and those with confirmed or sus- pected serious respiratory diseases or various acute or chronic diseases that may affect adherence were excluded.	<60 WIVO4 vaccine group n=12530, HBO2 Vaccine group n= 12525, Alum-only group n= 12539 ≥60 WIVO4 vaccine group n=213, HBO2 Vaccine group n= 201, Alum-only group n= 198	WIVO4 vaccine group = 84%, HBO2 Vaccine group = 84.5 Alum-only group = 84.8	With positive baseline IgG antibody WIVO4 vaccine group (6.4%) HBO2 Vaccine group (6.7) Alum-only group (6.2)	NA	NA	United Arab Emirates, Bahrain	NA
Ali, 2021	Randomized control Tiral NCT04649151	Male and female adolescents between the ages of 12 and 17 years were eligible for enrollment if they were considered to be in good general health by the 26 U.S. investigators (listed in the Supple- mentary Appendix, available at NEJM.org). Exclu- sion criteria included travel outside of the United States in the 28 days before screening, pregnancy or breast-feeding, acute illness or fever 24 hours before or at screening, previous administration of an investigational vaccine against SARS-CoV-2, or current treatment with investigational agents for prophylaxis against Covid-19. The trial did not exclude participants with previous anaphylaxis or serious allergic reactions to foods, medications, or both other than to a vaccine. Full inclusion and exclusion criteria are provided in the protocol.	12-15 n= 2767 16-17 n= 959	51%	SARS-CoV-2 Status Positive (6%)	NA	White (84%) Black race (3%) Asian (6%) Native Hawaiian or Other Pacific Islander ethnic group (<1%) American Indian or Alaska Native ethnic group (1%) Multiple races or ethnic groups. (5%) Others (1%) Not reported (1%) Unknown (1%)	United States of America	NA
Andrews, 2021	Test-negative case-control	Population of England aged over 50 who are registered with a GP in England over 50 were offered either a full dose of the BNT162b2 vaccine or a half dose of the mRNA-1273 vaccine	50-64 (n=13,882) 65-79 (n=86,664) ≥80 (n=171,201)	40.3%	Immunosuppressed (2.3%) COVID-19 positive >90 days previously (0.3%)	Healthcare worker (6%) Carehome resident (0.4%)	African (0.5%) Arab (0.2%) Asian (5.3%) Black (0.1%) White (89.5%) Other (4.4%)	United Kingdom	NA
Andrews, 2022	Test-negative case-control	Clinical risk groups included a range of chronic conditions as described in the Green Book,30 whereas the clinically extremely vulnerable group included persons who were considered to be at the high- est risk for severe Covid-19, including those with immunosuppressed conditions and those with severe respiratory disease.31 Booster doses were identified as a third dose given at least 175 days after a second dose and administered after Sep- tember 13, 2021. Persons with four or more doses of vaccine, a heterologous primary sched- ule, or fewer than 19 days between their first dose and second dose were excluded.	18-19 yr n=86,559 20-24 yr n=279,465 25–29 yr n= 336,504 30–34 yr n=355,731 35–39 yr n=327,751 40-44 yr n=283,074 45–49 yr n=244,583 50–54 yr n=231,704 55–59 yr n=193,831 60-64 yr n=131,656 65–69 yr n=80,267 70-74 yr n=55,598 75–79 yr n=30,615 80-84 yr n=15,333 85–89 yr n=7,452 ≥90 yr n=3,426	41.4	previously tested positive (13.6%)	Health and social care worker (6.2%) Clinically extremely vulnerable (5.3%) At risk (18.1%) Severely immunosuppressed (0.8%)	African (1.5%) Caribbean (0.9) Another black background (0.1) Arab (0.3%) Bangladeshi (0.7%) Chinese (0.7%) Indian (3.3%) Pakistani (1.7%) Another Asian background (1.3%) Mixed or multiple ethnic groups (2.0%) White (83.2%) Another ethnic background (0.7%) Prefer not to say (3.6%)	United Kingdom	Omicron (B.1.1.529) Variant

Baden, 2021	Randomized control Tiral NCT04470427	Eligible participants were persons 18 years of age or older with no known history of SARS-CoV-2 infection and with locations or circumstances that put them at an appreciable risk of SARS- CoV-2 infection, a high risk of severe Covid-19, or both. Inclusion and exclusion criteria are pro- vided in the protocol (available with the full text of this article at NEJM.org). To enhance the di- versity of the trial population in accordance with Food and Drug Administration Draft Guidance, site-selection and enrollment processes were adjusted to increase the number of persons from racial and ethnic minorities in the trial, in addi- tion to the persons at risk for SARS-CoV-2 infec- tion in the local population. The upper limit for stratification of enrolled participants considered to be "at risk for severe illness" at screening was increased from 40% to 50%.	18 - <65 yr not at risk n=17774 18 - <65 yr at risk n=5065 ≥ 65 yr n=7512	52.7	Positive SARS-CoV-2 (2.2%)	NA	White (79.1%) Black or African American (10.1%) Asian (4.8%) American Indian or Alaska Native (0.8%) Native Hawaiian or Other Pacific islander (0.2%) Multiracial (2.1%) Other (2.1%) Not reported and unknown (0.8%)	United States of America	NA
Barda, 2021	Observational study, matched pair	Eligible individuals who received the third dose on that day were matched to eligible controls who were previously vaccinated with two vaccine doses but had not yet received the third dose	Median [IQR] 52 [37, 68]	49%	Cancer (2.8%) Respiratory disease (7%) Heart disease (9.8%) Solid organ transplant (<0.1%) Obesity with BMI≥30 (21.9%) Pregnancy (0.8%) Smoking (17.2%) Diabetes (16.5%) Immunosuppression (3.6%)	NA	Jewish (83.4%) Arab (13.4%) Others (3.2%)	Israel	NA
Bjork, 2022	Cohort study	Population in Skane county who met these inclusion criteria: 1) Aged 18-64 years	18-44 (n=475010) 45-49 (n=88237) 50-54 (n=87397) 55-59 (n=82926) 60-64 (n=72171)	20.0% for vaccinated 52.0% for unvaccinated	Documented COVID infection before start of study (4.9%)	NA	NA	Sweden	NA
Bruxvoort, 2021	Test negative case-control	We included in the study all people with or without symptoms who had a positive test for SARS-CoV-2 sent for whole genome sequencing or a negative test from 1 March to 27 July 2021 if they were aged ≥18 years and had ≥12 months of KPSC membership as of the specimen collection date (needed to ascertain exposure status and covariates accurately). We excluded those who received a covid-19 vaccine other than mRNA- 1273, received two doses of mRNA-1273 <24 days apart or <14 days before the specimen collection date, received more than two doses of mRNA-1273 before the specimen collection date, or had a positive SARS- CoV-2 test or covid-19 diagnosis code between 18 December 2020 and 28 February 2021 or ≤90 days before the positive test date (supplementary figure S1).	18-44. n=1342 45-64. n=564 65-74 n=79 ≥75. n=42	44.1	Immunocompromised. (2.4%) Autoimmune conditions (2.3%) Pregnant at specimen collection date (2.5%) History of SARS-CoV-2 infection (0.8%) History of SARS-CoV-2 molecular test (52.4%)	NA	Non-Hispanic White (31.3%) Non-Hispanic Black (15.2%) Hispanic (42.7%) Non-Hispanic Asian (3.7%) Other/unknown (7.1%)	United States of America	delta (B.1.617.2, AY.*), alpha (B.1.1.7) epsilon (B.1.427, B.1.429) gamma (P.1, P.1.1, P.1.2) iota (B.1.526, B.1.526.1, B.1.526.2) mu (B.1.621, B.1.621.1) others (beta, eta, kappa, and any other variants)
Bruxvoort, 2022	Test negative case-control	Individuals aged ≥18 years who were members of KPSC for ≥12 months prior to index date (allowing a 31-day membership gap) through 14 days after the index date were eligible for inclusion in the study. The index date was defined as the date of receipt of the second dose of mRNA-1273 for vaccinated individuals and their matched unvaccinated counterparts. Individuals who received a COVID-19 vaccine other than mRNA-1273 prior to the index date, received 2 doses of mRNA-1273 <24 days apart, received any COVID-19 vaccine <14 days after the index date, had no health care utiliza- tion and no vaccination from the 2 years prior to the index date through the index date, or had a COVID-19 outcome <14 days after the index date were excluded. For this interim analysis, eligible individuals who received 2 doses of mRNA-1273 at least 24 days apart (4- day grace period allowed prior to the recommended 28-day interval) from December 18, 2020 to March 31, 2021 were included in the vaccinated group. The unvaccinated com- parison group comprised eligible individuals who had not received mRNA-1273 or any other COVID-19 vaccine as of the index date. Unvaccinated individuals were randomly selected and 1:1 matched to vaccinated individuals by age (18−44 years, 45−64 years, 65−74 years, and ≥75 years), sex, and race/ethnicity (Non-Hispanic White, Non-His- panic Black, Hispanic, Non-Hispanic Asian, and Other/ Unknown).	18-44.vaccinated n=84052 unvaccinated n=84052 45-64. vaccinated n=85685 unvaccinated n=85685 65-74 vaccinated n=109268 unvaccinated n=109268 ≥75 vaccinated n=73873 unvaccinated n=73873	40.6	Kidney disease (vaccinated 9.9%) (unvaccinated 9.1%) Heart disease (vaccinated 4.9%) (unvaccinated 5.3%) Lung disease (vaccinated 10.4%) (unvaccinated 9.4%) Liver disease (vaccinated 3.2%) (unvaccinated 3.0%) Diabetes (vaccinated 19.3%) (unvaccinated 18.1%) Immunocompromised (vaccinated 3.5%) (unvaccinated 3.5%) HIV/AIDS (vaccinated 0.4%) (unvaccinated 0.2%) Leukemia, lymphoma, congenital and other immunodeficiencies, asplenia/hyposplenia (vaccinated 1.4%) (unvaccinated 1.2%) Organ transplant (vaccinated 0.3%) (unvaccinated 0.2%) Immunosuppressant medications (vaccinated 2.0%) (unvaccinated 1.6%) Autoimmune conditions (vaccinated 3.6%) (unvaccinated 3.2%) Rheumatoid arthritis (vaccinated 1.7%) (unvaccinated 1.5%) Inflammatory bowel disease (vaccinated 0.6%) (unvaccinated 0.6%) Psoriasis and psoriatic arthritis (vaccinated 1.2%) (unvaccinated 1.1%) Multiple sclerosis (vaccinated 0.2%) (unvaccinated 0.2%) Systemic lupus erythematosus (vaccinated 0.2%) (unvaccinated 0.2%) Pregnant at index date 1st trimester (vaccinated 0.1%) (unvaccinated 0.3%) Pregnant at index date 2nd trimester (vaccinated 0.1%) (unvaccinated 0.3%) Pregnant at index date 3rd trimester (vaccinated 0.1%) (unvaccinated 0.3) History of COVID-19 infections (vaccinated 6.6%) (unvaccinated 10.2%) History of SARS-CoV-2 molecular tests (vaccinated 37.9%) (unvaccinated 33.1%)	NA	(percentages are for both vaccinated and unvaccinated populations) Non-Hispanic White (38.7%) Non-Hispanic Black (7.4%) Hispanic (32.4%) Non-Hispanic Asian (15.3%) Other/unknown (6.3%)	United States of America	41.6% Alpha (B.1.1.7, Q.3) 17.5% Epsilon (B.1.427, B.1.429), 11.5% Delta (B.1.617.2, AY.*) 9.1% Gamma (P.1, P.1.1, P.1.10)

Butt-2022	national retrospective study	Veterans enrolled in the Department of Veterans Affairs Healthcare System (the VA) in the United States	median (IQR) 73 (66,77)	94%	NA	NA	White (72%) Black(19%) Other (8.7%)	USA	NA
Carazo, 2021	Test-negative case-control	Healthcare workers as well as staff of private facilities who were COVID-19 negative (RT-PCR confirmed or epidemiologically-linked) before January 17, 2021	18-29 (n=13,179) 30-39 (n=16,219) 40-49 (n=16,003) 50-59 (n=13,865) 60-74 (n=3,579)	17.2%	NA	Nurse or nursing assistant (31.3%) Healthcare support worker (22.8%) Healthcare technician (9.1%) Social worker (6.3%) Adminstrative staff (11%) Other (19.5%)	NA	Canada	B.1.1.7 (Alpha)
Cerqueira-Silva, 2021	Test-negative case-control	Inclusion criteria for this study included: 1) age ≥18 years; 2) prior SARS-CoV-2 infection confirmed by RT-PCR or rapid antigen test; 3) a second exam (RT-PCR test) fulfilling themedRxiv preprint doi: https://doi.org/10.1101/2021.12.21.21268058; this version posted December 27, 2021. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted medRxiv a license to display the preprint in perpetuity. It is made available under a CC-BY-NC-ND 4.0 International license . following criteria: a) associated with an event of symptomatic illness and occurring within 10 days of symptom onset; b) at least 90 days after their first positive test; and c) occurring after the vaccination program began in Brazil (January 17, 2021). We included individuals with first infection between February 24, 2020, and August 13, 2021, and second RT-PCR test occurring between January 18, 2021, and November 11, 2021	28-50 years	38%	Pregnancy (0.643%) Post-partum (0.0441%) DM (4.49%) Obesity (2.57%) Immune supressed (1.39%) CKD (0.654%) Cardiac Disease (8.71%) Medical comorbidities: 1 (10.6%) ≥2 (3.32%)	NA	White (46.3%) Mixed (35.1%) Black (5.14%) Asian/Indigenous (6.08%) (Missing) (7.35%)	Brazil (online)	Non VOC/VOI Gamma Delta Others
Cerqueira-Silva, 2022a	Test-negative case-control	Valid tests* from 24 February 2020 to 11 November 2021 = 29,088,356 Individuals =23,476,273 Excluded tests: Notification before 18 January 2021 = 8,813,201 Younger than 18 years old = 2,595,143 Missing symptoms' data = 50,159 Duplicated notification = 539,239 Inconsistencies (date of symptom onset greater than notification) = 183,671 Negative test followed by positive (up to 7 d): 83,198 Consecutive negative tests fewer than 14 d = 330,489 Consecutive positive tests fewer than 90 d = 431,873 People with different vaccine types between first and second dose = 302,472 Missing values in age, sex, sample collection date and city = 2,847	18-19 overall n=6,659,189 60-79 overall n=926,683 ≥80 overall n=161,249	NA, female = 54.2	Pregnancy (0.9%) Postpartum period (0.1%) Pervious confirmed status (3.5%) Vaccination : unvaccinated (71.4%) Vaccination : CoronaVac (11.8%) Vaccination: Other vaccines (16.8%)	NA	White (41.4%) Black (4.5%) Asian (1.6%) Mixed (32.7%) Indigenous (0.1%) Missing (19.7%)	Brazil	NA
Cerqueira-Silva, 2022b	Retrospective Cohort	We included all individuals who received their first COVID-19 vaccine dose between January 18, 2021 and July 24, 2021. COVID-19 diagnosis was based on RT- PCR or antigen test results. Non-vaccinated individuals were not included in our analysis, since this data was not available. The following were excluded: (i) individuals with confirmed COVID-19 infection prior to the date of vac- cine administration; (ii) individuals with essential covariate information missing (sex and/or age); (iii) individuals receiving vaccines other than Vaxzevria or CoronaVac; (iv) individuals with inconsistent vaccine records	<60 60-69 70-79 80-89 >90	NA	NA	NA	NA	Brazil	NA
Chin, 2021	retrospective cohort	Incarcerated people in California prisons in a specialized medical or psychiatric care setting, age and medical comorbidities, no confirmed SARS-CoV-2 infection, and participation in penal labor.	18-39 (n= 29,922) 40-59 (n= 23,469) ≥ 60 (n=7,316)	95.60%	Any pre-existing condition (84.2%) Any immunocompromising condition (3.3%) Advanced liver disease (3.5%) Asthma (13.7%) Cancer (2.9%) Chronic kidney disease (14.6%) Chronic obstructive pulmonary disease (2.9%) Connective tissue disorder (0.8%) Cardiovascular disease (5.1%) Diabetes (8.0%) HIV (0.8%) Hypertension (24.8%) Immunocompromised (1.4%) Overweight (34.8%) Obesity (36.2%) Severe obesity (4.2%) Any disability (38.6%) Cognitive disability (1.6%) Hearing disability (3.3%) Mental health disability (32.1%) Mobility disability (11.5%) Speech disablity (0.2%) Vision disability (0.8%)	NA	Hispanic or Latino (42.7%) Black or African American (32.8%) White (18.0%) American Indian or Alaska Native (1.1%) Asian or Pacific Islander (1.4%) Other (4.0%)	USA	NA
Collie, 2022	Test-negative case-control	NA	NA	NA	NA	NA	NA	South Africa	Omicron (B.1.1.529) Variant
Desai, 2022	Test-negative case-control	We included all employees of the hospital who had symptoms suggestive of COVID-19 and had been tested for SARS-CoV-2 by RT-PCR at the institute's COVID-19 samplecollectionfacilitybetweenApril15andMay15,2021, the peak of the second wave of the COVID-19 pandemic in India. We excluded people who had an invalid test result that precluded the assignment of an outcome (RT-PCR positive or negative), were asymptomatic at the time of testing, had received the ChAdOx1 nCoV-19 vaccine, or had missing data regarding dates of vaccination.	<30 ->60	50%	NA	Works in COVID19 area (16.2%)	NA	India	delta

Dunkle, 2022	Randomized control tiral NCT04611802	Adults 18 years of age or older who were healthy or who had stable chronic medical conditions, including chronic pulmonary, renal, or cardiovascular disease, diabetes mellitus type 2, or well-controlled human immunodeficiency virus (HIV) infection, were eligible for participation. Key exclusion criteria included known previous laboratory-confirmed SARS-CoV-2 infection or known immunosuppression.	18-64 ≥ 65	52.3	White (75.9%) Black or African American (11.0%) American Indian or Alaska Native, including Mexican Natives (6.2%) Asian (4.4%) Multiple (1.7%) Native Hawaiian or other Pacific Islander (0.2%) Hispanic or Latino (21.5%)	NA	Obesity (37.2%) Chronic lung disease (14.4%) Diabetes mellitus type 2 (7.8%) Cardiovascular disease (1.1%) Chronic kidney disease (0.6%) HIV infection (0.7%)	USA Mexico	alpha
Ella, 2021	Randomized control Tiral NCT04641481	Participants were adult volunteers aged 18 years or older who were healthy or had stable chronic medical conditions. A stable condition was defined as a disease not requiring significant change in therapy or hospitalisation or that did not worsen during the 3 months before enrolment. Volunteers were screened for eligibility on the basis of their health status, including medical history, vital signs, and physical examination results. Key exclusion criteria included any diagnosis with an immunocompromising condition, or treatment with immunosuppressive therapy.	≥65 yr	67.10%	Stable cardiovascular disease (4.2%) Stable respiratory disease (1.1%) Controlled diabetes (5.6%) Stable liver disease (0.20%) Severe obesity (BMI>35 kg/m2) (0.58%) Other stable comorbidities (6.79%) Mutiple risk categories (3.7%)	NA	NA	India	delta kappa alpha other
Emary,2021	Randomized control Tiral NCT04400838, and ISRCTN, 15281137	Adults aged 18 years and older, enrolled at 19 study sites in England, Wales, and Scotland. Enrolment targeted partici- pants in occupations with potentially high SARS-CoV-2 exposure, such as those in health and social care set- tings.	18-55 >55	41%	NA	NA	white (66%)	UK	alpha others
Falsey, 2021	Randomized control tiral NCT04516746	Not mentioned	18-64 >65	55.60%	High Blood Pressure (27%) History of Obesity (27.2%) History of smoking (18.5%) Asthma (10.1%) Type 2 diabetes (7.4%) Serious heart conditions (3.3%) Liver disease (1.6%) COPD (1.4%) Cerebrovascular diseases (1.0%) Chronic kidney disease (0.7%) Type 1 diabetes (0.6%) Thalassemia (0.2%) Scarring in the lungs: pulmonary fibrosis (0.1%) Dementia (<0.1%) Sickle cell disease (<0.1%) Lower immune health due to solid organ transplantation (<0.1%) Cystic fibrosis (<0.1%) HIV infection (1.6%) Cancer (6.5%)	NA	White (79.0%) Black (8.3%) Asian (4.4%) American Indian or Alaska Native (4.0%) Multiple (2.4%) Native Hawaiian or other Pacific Islander (0.3%)	USA Chile Peru	NA
Ferdinands, 2022	Test-negative case-control	Eligible medical encounters were defined as those among adults aged ≥18 years with a COVID-19–like illness diagnosis	18–44 45–64 65–74 75–84 ≥85	41%	Chronic respiratory condition (18%) Chronic nonrespiratory condition (26%) Immunocompromised status (4%)	NA	White, non-Hispanic (62%) Hispanic (15%) Black, non-Hispanic (10%) Other, non-Hispanic (7%)	USA	Delta Omicron
Frenck, 2021	Randomized control tiral NCT04368728	Eligible participants were healthy or had stable preexisting disease (including hepatitis B, hepatitis C, or human immunodeficiency virus infection). Persons with a previous clinical or virologic Covid-19 diagnosis or SARS-CoV-2 infection, previous coronavirus vaccination, diagnosis of an immunocompromising or immunodeficiency disorder, or treatment with immunosuppressive therapy (including cytotoxic agents and systemic glucocorticoids) were excluded	12-15 16-25	51.00%	NA	NA	White (85.5%) Black or African American (4.8%) American Indian or Alaska Native (0.31%) Asian (6.3%) Native Hawaiian or other Pacific Islander (0.13%) Multiracial (2.30%) Hispanic or Latinx (11.6%)	Argentina Brazil Germany South Africa Turkey United States	NA
Glatman-Freedman, 2021b	retrospective longitudinal cohort	27 consecutive cohorts, each comprised of individuals vaccinated on specific days	<16 16-39 40-59 60-79 >80	NA	NA	NA	NA	Isarel	NA
Heath, 2021	Randomized control tiral EudraCT number, 2020-004123-16	Eligible participants were men and nonpregnant women between the ages of 18 and 84 years who were healthy or had stable chronic medical conditions, including human immunodeficiency virus infection (for which they were receiving highly active antiretroviral therapy) and cardiac and respiratory diseases. Key exclusion criteria were a history of documented Covid-19, treatment with immunosuppressive therapy, or a diagnosis of an immunodeficient condition.	18–64 ≥65	51.60%	Coexisting condition (44.6%)	NA	White (94.5%) Black (0.4%) Asian (2.9%) Hispanic or Latinx (0.8%) Multiple races (0.9%) Other (0.1%)	UK	NA

Kirsebom, 2022	Test-negative case control	Population in England: -aged 18 years or older -received a ChAdOx1-S primary course -received a ChAdOx1-S or BNT162b2 booster Exclusion criteria: -negative tests taken within 21 days of a subsequent positive test -positive and negative tests within 90 days of a previous positive test	18-19 (n=42671) 20-24 (n=191891) 25-29 (n=252739) 30-34 (n=358142) 35-39 (n=457677) 40-44 (n=1103427) 45-49 (n=1289303) 50-54 (n=1658189) 55-59 (n=1673250) 60-64 (n=1480694) 65-69 (n=1382160) 70-74 (n=1500109) 75-79 (n=975606) 80-84 (n=347425) 85-89 (n=206671) 90+ (n=162125)	48%	Clinically extremely vulnerable (11.0%) Severely immunosuppressed (1.8%) Health and social care workers (1.9%)	NA	African (1.0%) Any other Asian background (1.3%) Any other Black background (0.3%) Any other White background (1.3%) Any other ethnic group (0.4%) Any other mixed background (5.8%) Bangladeshi or British Bangladeshi (0.5%) British, Mixed British (74.7%) Caribbean (0.5%) Chinese (0.5%) Indian or British Indian (2.6%) Irish (0.7%) Pakistani or British Pakistani (1.2%) White an Asian (0.2%) White and Black African (0.1%) White and Blakc Carribean (0.2%) Missing (8.8%)	UK	Omicron and Delta
Klein, 2022	Test-negative case control	Children aged 5-17 years: -admitted to emergency department (ED) or urgent care (UC) -with COVID-like illness Exclusion criteria: -were vaccinated before the CDC recommendation date for their age group -received a third dose before booster doses were recommended for their age group -received a booster dose <5 months after dose 2 -received 1 or >3 doses of the vaccine -if <14 days had elapsed since receipt of dose 2 or <7 days since dose 3 -patients who were likely immunocompromised based on diagnosis codes	5-11 (n=9181) 12-15 (n=18138) 16-17 (n=11898)	48.2	Chronic respiratory condition (8.1%) Chronic non-respiratory condition (4.6%)	NA	Hispanic (23.7%) White, non-Hispanic (51.4%) Black, non-Hispanic (10.4%) Other, non-Hispanic (7.6%) Unknown (6.7%)	US	Delta Omicron
Lauring, 2022	Test-negative case-control	Patients aged 18 years or older in 21 hospitals across United States Cases inclusion criteria: 1) clinical syndrome consistent with acute covid-19 2) positive molecular or antigen test result for SARS-CoV-2 within 10 days of symptom onset Test-negative control: 1) signs or symptoms consistent with acute covid-19 2) tested negative for SARSCoV-2 Syndrome-negative control: 1) admitted to hospital without signs or symptoms consistent with acute covid-19 2) tested negative for SARS-CoV-2	median (IQR) 63 (50, 72) for controls 56 (43, 65.5) for alpha 57 (43, 69) for delta 62 (49, 73) for omicron	50.1% 51.6% 54.4% 52.8%	Resident of long term care facility (4.5%) ≥1 hospital admission in past year (42.5%) Current tobacco use (15.3%) Chronic cardiovascular disease (62.8%) Chronic pulmonary disease (27.6%) Diabetes mellitus (31.0%) Immunocompromising condition (21.0%) Obesity (47.0%)	NA	Non-Hispanic white (56.8%) Non-Hispanic black (21.4%) Hispanic (15.6%) Non-Hispanic, other (4.6%) Unknown (1.6%)	United States	Alpha (B.1.1.7) Delta (B.1.617.2) Omicron (B.1.1.529)
Lee 2022	Test negative case control study	Adults (aged ≥18 years) with cancer in the UKCCEP registry were identified via Public Health England's Rapid Cancer Registration Dataset between Jan 1, 2018, and April 30, 2021, and comprised the cancer cohort control population cohort from adults with PCR tests in the UKCCEP registry who were not contained within the Rapid Cancer Registration Dataset.	18–19 years, 20–29 years, 30–39 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years, 80–89 years, ≥90 years	49.66%	Different stages of cancer Systemic anticancer therapy Radiotherapy	NA	White or White British 1 533 034 (89·51%) Asian or Asian British 70 859 (4.14%) Black or Black British 50 063 (2·92%) Mixed or other ethnic group 15 885 (0·93%) Unknown 42 887 (2·50%)	UK	Mainly Delta
Lopez, 2021	Test-negative case-control	All individuals aged ≥16 in England Exclusion criteria: 1) individuals tested positive for COVID before the study period	16-29 (n=6,896) 30-39 (n=5,363) 40-49 (n=3,757) 50-59 (n=1,997) 60-69 (n=835) 70-79 (n=210) ≥80 (n=51)	49.1	Index of multiple deprivation: 1 (most deprived) (32.6%) Clinically etremely vulnerable (1.7%) Care home residen (<0.1%) Health or social care worker (1.6%)	Older adults Caregivers Health and social care workers	Bangladeshi (1.7%) Chinese (0.4%) Indian (6.1%) Pakistani (8.0%) Other Asian (2.4%) Black African of Caribbean (2.0%) White (60.0%) Mixed (1.6%) Other ethnic groups (3.0%) Missing data (14.7%)	United Kingdom	B.1.1.7 (Alpha) B.1.617.2 (Delta)

Magen 2022	case control	people who were 60 years of age or older, who had received a third vaccine dose or a fourth dose at least 4 months earlier	60–69 (matched pairs) n= 67,778 70–79 (matched pairs) n= 76,630 ≥80 (matched pairs) n= 37,714	47%	Cancer (matched pairs) = 5% Chronic kidney disease (matched pairs) = 18% Chronic obstructive pulmonary disease (matched pairs) = 6% Heart disease (matched pairs) = 22% Solid-organ transplantation (matched pairs) = <1% Obesity (matched pairs) = 27% Severe obesity (matched pairs) = 2% Sickle cell disease (matched pairs) = <1% Smoking (matched pairs) = 14% Type 2 diabetes mellitus (matched pairs) = 33% Asthma (matched pairs) = 7% Cerebrovascular disease (matched pairs) = 11% Other respiratory disease (matched pairs) = 1% Hypertension (matched pairs) = 56% Immunosuppression (matched pairs) = 6% Neurologic disease (matched pairs) = 13% Liver disease (matched pairs) = 4% Overweight (matched pairs) = 41% Thalassemia (matched pairs) = <1% Type 1 diabetes mellitus (matched pairs) = <1%	NA	NA	Israel	Omicron
Martinez-baz, 2021	Prospective cohort	excluded close contacts with a prior positive test, nursing home residents and those who did not complete the testing protocol.	18-34 (n=9,608) 35-49 (n=7,655) 50-69 (n=10,286) ≥70 (n=2,691)	48.2%	Have chronic conditions (28.2%) Have no chronic conditions (71.8%)	Household (53.9%) Other (46.1%)	NA	Spain	B.1.1.7 (Alpha) B.1.617.2 (Delta)
Natarajan 2022	Test negative case control study	Exclusion criteria: - patients vaccinated with a booster dose >120 days before the index date - received only 1 or 2 primary mRNA vaccine doses or >3 mRNA vaccine doses - received >2 mRNA doses fol- lowing a primary Janssen dose - received the first Janssen dose 1–13 days earlier or a booster dose 1–6 days earlier - received a booster dose following a primary Janssen dose earlier than the recommended interval (<2 months after dose 1) or an mRNA booster dose earlier than the recommended interval (<5 months after dose 2)	18–44 (n= 3,976) 45–64 (n=7,334) 65–74 (n=5,813) 75–84 (n=4,971) ≥85 (n=3,150)	49.6%	Chronic respiratory condition (58.8%) Chronic nonrespiratory condition (28.5%)	NA	White, non-Hispanic (62.7%) Hispanic (13.1%) Black, non-Hispanic (13.1%) Other, non-Hispanic (7.3%) Unknown (3.8%)	USA	Omicron
Nordstrom, 2021a	Retrospective cohort	All individuals that received heterologous ChAdOx1 nCoV-19 / BNT162b2 prime-boost vaccination, all individuals that received heterologous vaccination and all individuals that received homologous ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19 prime-boost vaccination in Sweden until July 5, 2021. Each vaccinated individual was matched with one individual on birth year, sex and municipality	Mean ± SD 54.5±19.0 49.3±18.0 54.6±18.9 36.5±10.9	41.4% 44.8% 39.4% 26.9%	Cancer (6.8%) Diabetes (10.3%) Kidney failure (1.3%) Chronic obstructive pulmonary disease (2%) Asthma (4.4%) Hypertension (37%) COVID-19 positive (8.5%)	NA	NA	Sweden	NA
Nordstrom, 2021b	Retrospective cohort	Population of Sweden was included. Inclusion criteria of main cohort: 1) received ChAdOx1 nCoV-19 as first dose 2) received ChAdOx1 nCoV-19 or BNT162b2 or mRNA-1273 as second dose Inclusion criteria of matched group: 1) matched to an individual in the main cohort on birth year, sex and municipality 2) did not receive any vaccine before the baseline date	Mean (SD) 44.4 (13.5) for ChAdOx1 nCoV-19 / BNT162b2 (vaccinated) 36.1 (18.5) for ChAdOx1 nCoV-19 / BNT162b2 (unvaccinated) 43.8 (13.0) for ChAdOx1 nCoV-19 / mRNA-1273 (vaccinated) 39.2 (11.2) for ChAdOx1 nCoV-19 / mRNA-1273 (unvaccinated) 67.2 (12.8) for ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19 (vaccinated) 56.4 (18.4) for ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19 (unvaccinated)	38.8%	Myocardial infarction (3.1%) Stroke (2.3%) Diabetes (10.3%) Hypertension (37.0%) Kidney failure (1.3%) Chronic obstructive pulonary disease (2.0%) Asthma (4.4%) COVID-19 (8.5%) Cancer (6.8%)	NA	NA	Sweden	B.1.617.2 (Delta)
Olson, 2022	Test-negative case-control	Adolescents aged 12 to 18 who had been admitted to 31 hospitals in the CDC-funded Overcoming Covid-19 Network Exclusion criteria: 1) patients who was diagnosed of MIS-C during their current hospitalization 2) patients who had received mRNA1273 vaccine (Moderna) or Ad26.COV2.S vaccine (Johnson & Johnson–Janssen) 3) patients who had received only one dose less than 14 days before illness onset	Median (IQR) 16 (14-17) for cases 15 (14-17) for test-negative controls 15 (14-17) for syndrome-negative controls	50.5%	Respiratory, including asthma (26.4%) Cardiovascular (7.9%) Neurologic or neuromuscular (18.3%) Immunosuppression or autoimmune (9.2%) Endocrine, including diabetes (13.0%) Diabetes (8.2%) Other chronic condition, including obesity (46.6%)	NA	Non-hispanic white (41.0%) Non-hispanic black (21.7%) Hispanic (23.3%) Others (8.2%) Unknown (5.8%)	United States	B.1.617.2 (delta)
Palacios, 2021	Randomized control Trial NCT0445659	aged 18 years or older without previous SARS-CoV-2 infection. (study amendment to 18 or older, originally 18-59) Inclusion criteria: healthcare professionals ddirectly dealing with 9 COVID-19 patients Exclusion criteria: 1) pregnant or lactating women 2) unstable chronic disease 3) previous use of any COVID-19 vaccines 4) acute disease symptoms including COVID-19 in previous 72 hours	18-59 (94.9%) 60 or older (5.1%)	35.80%	Cardiovascular disease (12.6%) Diabetes (3.4%) Obesity (22.5%)	NA	White (75.3%) Multiracial (16.8%) Black or African American (2.5%) American Indian or Alaska Native (0.2%)	Brazil	NA

Polack, 2020	Randomized control Trial NCT04368728	Aged 16 years or older who were healthy or had stable chronic medical conditions, including but not limited to human immunodeficiencyvirus (HIV), hepatitis B virus, or hepatitis C virus infection. Exclusion criteria: 1) medical history of Covid-19 2) treatment with immunosuppressive therapy 3_ diagnosis with an immunocompromising condition	Median 52 16-55 (n= 21,785) >55 (n= 15,921)	50.6	body mass ratio (>=30.0: obese) (35.1%)	NA	White (82.9) Black or African American (9.3) Asian (4.3) Native American or Alaska Native (0.5) Native Hawaiian or other Pacific Islander (0.2) Multiracial (2.3) Not reported (0.6) Hispanic or Latinx (28.0)	Argentina(15.3) Brazil (6.1) South Africa (2.0) United States (76.7)	NA
Poukka, 2021	Nation-wide register-based cohort study	16-69 years old healthcare workers including those in non-clinical positions due to unavailable information on current position who were had no laboratory-confirmed SARS-CoV-2 infection prior to 27 December 2020	17-33 (n=87238) 33-42 (n=84638) 42-51 (n=85861) 51-60 (n=86496) 60-70 (n=83672)	13.9%	No medical condition (78.2%) ≥1 medical conditions (9.1%) ≥1 highly medical conditions (12.7%)	Healthcare worker (100%)	NA	Finland	NA
Powell, 2021	Test-negative case-control	Adolescents aged 12 to 17 in England Exclusion critera: 1) individuals with a positive COVID test within past 90 days 2) negative tests taken within 21 days of a subsequenct positive test	12 (n=153,429) 13 (n=156,854) 14 (n=154,773) 15 (n=152,243) 16 (n=113,384) 17 (n=112,286)	49.0%	Previously positive (8.0%)	At risk (21.1%) Clinically extremely vulnerable (0.1%)	African (1.6%) Another asian background (1.3%) Another black background (0.2%) Another ethnic background (0.6%) Arab (0.5%) Bangladeshi (1.0%) Caribbean (0.5%) Chinese (0.5%) Indian (2.7%) Mixed or multiple ethnic groups (4.6%) Pakistani (2.8%) Prefer not to say (3.1%) White (80.6%)	United Kingdom	Delta (B.1.617.2) Omicron (B.1.1.529)
Pozzetto, 2021	Longitudinal survey	Individuals who received either heterologous ChAdOX1/BNT16b2 or homologous BNT162b2/BNT162b2 vaccination regimen	Median [IQR] 41 [33, 52] for two-dose BNT162b2 34 [27, 40] for heterologous vaccine	28.30%	Smoker (21.7%) Alcoholconsumption (20%) Presence of comorbidity (0%)	NA	NA	France	NA
Pramod 2022	Test-negative case control	healthcare worker in a teaching hospital, located in the Puducherry district in Southern India, on the East coast,	≤29 (cases n=108, matched controls n= 115) 30 - 39 (cases n=130, matched controls n=135) 40 - 49 (cases n=84, matched controls n=75) ≥50 (cases n=38, matched controls n=35)	49.5%	With comorbidities (cases 15%, matched controls 11%) Without comorbidities (cases 85%, matched controls 88.3%)	NA	NA	India	delta
Prieto-alhambra, 2021	Retrospective cohort	Individuals aged <60 who received a first dose of ChAdOx1 could choose between ChAdOx1 and BNT162b2 for their second dose	Mean ± SD 42.2±9.6 for heterologous vaccine 42.21±9.57 for homologous vaccine	62.5%	Asthma (6.4%) Diabetes (1.7%) Hypertension (5.7%) Heart failure (0.02%) Chronic obstructive pulmonary disease (0.29%) Chronic kidney disease (0.7%) Cancer (2.3%) Obesity (10.2%)	NA	NA	Spain	NA
Prunas, 2022	Test-negative case-control	Individuals aged 12-16, who registered on the Maccabi Healthcare Services (MHS) in Israel Exclusion criteria: 1) positive COVID PCR test prior to the study period 2) disengaged from MHS during the study period	Mean (SD) 14.0 (1.4)	48.0%	Obesity (3.3%)	NA	NA	Israel	NA
Ranzani, 2022	Test-negative case control	Adults (aged ≥18 years) in Brazil: -had symptomatic illness -underwent Covid RT-PCR or rapid antigen testing Exclusion criteria: -missing or inconsistent information on age, sex, municipality of residence, vaccination or testing status -RT-PCR or antigen tests that were not collected within 10 days of symptom onset -positive or negative RT-PCR or antigen tests with a positive test in the previous 90 days -negative RT-PCR or antigen tests with a positive test occurring in the following 14 days -all RT-PCR or antigen tests that were obtained afte receipt of a primary series of ChAdOx1, BNT162b2, Ad26.COV2.S	18-39 (n=1477673) 40-59 (n=566575) 60-79 (n=523379) 80+ (n=90101)	42.20%	One or two chronic comorbidities (7.8%) Three or more chronic comorbidities (0.3%) Positive covid test result (5.5%)	NA	White (43.9%) Brown (30.2%) Black (3.9%) Yellow (1.6%) Indigenous (0.4%) Missing (20.0%)	Brazil	Delta Omicron
Reis, 2021	Retrospective cohort	Invididuals aged 12-18, who registered on the Clalit Health Services in Israel Exclusion criteria: 1) individuals with missing data for BMI or location of residence	12 (n=42,102) 13 (n=45,256) 14 (n=43,692) 15 (n=43,028) 16 (n=11,774) 17 (n=2,856)	51.00%	Chronic kidney disease (0.1%) Obesity (2.4%) Severe obesity (0.1%) Overweight (5.9%) Asthma (0.2%) Immunocompromised (0.7%) Neurologic conditions (0.2%)	NA	Arab (35.7%) General Jewish (60.1%) Ultra-orthodox Jewish (4.3%)	Israel	B.1.617. 2 (Delta)

Sadoff, 2021	Randomized control Trial NCT04505722	18 to 59 years of age and 60 years of age or older, respectively, who were in good or stable health and did not have coexisting conditions that have been associated with an increased risk of severe Covid-19. Not excluded on the basis of SARS-CoV-2 infection	Median: 52 18−59 (29,111) ≥60 (14,672)	54.9	≥1 Coexisting condition (40.8)	NA	American Indian or Alaskan Native (0.4) Indigenous South American (9.0) Asian (3.3) Black (19.4) Native Hawaiian or other Pacific Islander (0.2) White (58.7) Multiracial (5.6) Not reported, unknown, or missing (3.3)	Latin America (n= 17,905) South Africa (n= 6,576) United States (n= 19,302)	20H/501Y.V2
Sadoff, 2022	Randomized control trial NCT04505722	Participants were adults who were 18 years of age or older and were in good or stable health, without coexisting conditions or with stable and well-controlled coexisting conditions Key exclusion criteria: previous receipt of a Covid-19 vaccine or abnormal immune system function	≥18	NA	NA	NA	NA	NA	B.1.1.7 (alpha) P.1 (gamma) C.37 (lambda) B.1.621 (mu) B.1.617.2 (delta)
Shrotri, 2021	Prospective cohort	Adults aged 65 years and older in residents and staff in 310 long-term care facilities that provide residential or nursing care in England	Median: 86 IQR: 80–91	30·4%	NA	Adults aged 65 years and older in residents and staff in long-term care facilities	NA	UK	NA
Skowronski, 2021a	Test-negative case-control	Community dwelling adults ≥70-years-old in British Columbia who received one vaccine dose. Cases with collection date before the start of the analysis period were excluded.	70-79 (n=10,460) 80-89 (n=5,184) ≥90 (n=1,349)	49.1%	NA	NA	NA	Canada	B.1.1.7 (Alpha) P.1 (Gamma)
Skowronski, 2021b	Test-negative case-control	Community dwelling adults 50-69-years-old in British Columbia who received one vaccine dose. Cases with collection date before the start of the analysis period were excluded.	50-59 (n=13,298) 60-69 (n=14,160)	39.1%	NA	NA	NA	Canada	B.1.1.7 (Alpha) P.1 (Gamma) B.1.617.2 (Delta)
Tanriover, 2021	Randomized control tiral NCT04582344	Volunteers aged 18–59 years with no history of COVID-19 and with negative PCR and antibody test results for SARS-CoV-2 were enrolled at 24 centres in Turkey Exclusion criteria: - immunosuppressive therapy (including steroids) within the past 6 months) - bleeding disorders - asplenia - receipt of any blood products or immunoglobulins within the past 3 months	Median (IQR) 18–44 (vaccine group 49.0%; placebo group 49.4%) 45–59 (vaccine group 51.0%; placebo group 50.6%)	Vaccine group 57.4% Placebo group 58.6%	Hypertension (placebo group: 11.8%; placebo group: 11.6%) Cardiovascular disease other than hypertension (placebo group: 2.6%; placebo group: 2.1%) Chronic respiratory disease (placebo group: 2.9%; placebo group: 2.9%) Diabetes (placebo group: 4.9%; placebo group: 4.5%) Malignancy (placebo group: 0.9%; placebo group: 0.7%) Autoimmune or autoinflammatory disease (placebo group: 0.8%; placebo group: 1.1%)	NA	NA	Turkey	NA
Tartof, 2021	Retrospective cohort study	Patients aged ≥ 12 among members of a large US health-care system	12-15 (n=201 622) 16-18 (n=1 507 821) 45–64(n=1 051 243) ≥65(n= 676 271)	47.60%	Congestive heart failure (1.9%) Coronary artery disease (1.2%) Peripheral vascular disease (8.2%) Cerebrovascular disease (1.5%) Organ transplant (0.1%) Diabetes with unknown glycated haemoglobin (1.1%) Diabetes with glycated haemoglobin (7.1%) Diabetes with glycated haemoglobin (3.7%) Chronic obstructive pulmonary disease (9.1%) Renal disease (4.7%) Malignancy (2.4%) Hypertension (20.7%)	NA	Hispanic (40.5%) Black (8.0%) White (32.3%) Asian or Pacific Islander (11.6%) Other (2.3%) Unkown (5.3%)	USA	NA
Tartof, 2022	Retrospective cohort study	Patients (aged ≥18) with at least 1 year of Kaiser Permanente Southern California (KPSC) membership Exclusion criteria: - Patients with a documented request to be removed from all research studies	18-44 (n=1405561) 45-64 (n=1051243) ≥65 (n=676271) ≥75 (n=265438)	52.70%	Hypertension (22.7%) Congestive heart failure (2.1%) Myocardial infarction (1.3%) Peripheral vascular disease (8.9%) Cerebrovascular disease (1.7%) Diabetes (13.1%) Chronic obstructive pulmonary disease (9.2%) Renal disease (5.2%) Malignancy (2.6%) Organ transplant (0.2%) Immunocompromised (2.9%)	KPSC members (an integrated healthcare organization)	Asian (11.1%) Black (8.1%) Hispanic (39.4%) Other (2.3%) Pacific Islander (0.7%) Unknown (5.3%) White (33.1%)	USA	B.1.617. 2 (Delta) (accounted for > 99% of infections in the United States during the time of study)
Thompson, 2022	Test-negative case-control	Patients (aged ≥18) in VISION Network across 10 states	18-49 (n= 117000) 50-64 (n= 45056) 65-74 (n= 28858) 75-84 (n= 21175) ≥ 85 (n= 10683)	41%	Chronic respiratory condition (19%) Chronic nonrespiratory condition (27%)	NA	White, non-Hispanic (63%) Black, non-Hispanic (9%) Hispanic (16%) Other, non-Hispanic (6%) Nnknown (6%)	USA	Delta (B.1.617.2) Omicron (B.1.1.529)

Tseng 2022	test-negative case–control study	cases included individuals who tested positive by the RT–PCR TaqPath COVID-19 kit, had specimens collected between 6 December 2021 and 31 December 2021, were aged ≥18 years and had ≥12 months of KPSC membership before the specimen collection date (for accurate ascertainment of exposure status and covariates). Individuals were excluded if they received a COVID-19 vaccine other than mRNA-1273, any dose of mRNA-1273 <14 days before the specimen collection date, two or three doses of mRNA-1273 <24 days apart from previous dose or more than three doses of mRNA-1273 before the specimen collection date. Additional exclusions included a positive SARS-CoV-2 test or COVID-19 diagnosis code ≤90 days before the specimen collection date. COVID-19 hospitalization included hospitalization with a SARS-CoV-2-positive test or hospitalization ≤7 days after a SARS-CoV-2-positive test. COVID-19 hospitalization was confirmed by manual chart review conducted by a physician investigator (B.K.A.) to verify the presence of severe COVID-19 symptoms. Controls included all individuals who tested negative with specimens collected between 6 December 2021 and 31 December 2021, were aged ≥18 years and had ≥12 months of KPSC membership before the specimen collection date. Randomly sampled controls were 2:1 matched to cases by age (18–44 years, 45–64 years, 65–74 years and ≥75 years), sex, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian and Other/Unknown) and specimen collection date. Matching was conducted separately for the one-, two- and three-dose VE analysis. To accommodate variation in real-world practice, analyses did not require dose 3 to be ≥6 months from dose 2, as some members received dose 3 at a shorter interval in this study.	18–44 45–64 65–74 ≥75	45%	Kidney disease Heart disease Lung disease Liver disease Diabetes Leukemia/lymphoma, congenital and other immunodeficiencies, asplenia/hyposplenia Hematopoietic stem cell transplantation/organ transplant Immunosuppressant medications Rheumatoid arthritis Inflammatory bowel disease Psoriasis and psoriatic arthritis Multiple sclerosis Systemic lupus erythematosus	NA	NA	USA	Delta Omicron
Voysey, 2021a	Randomized control tiral ISRCTN89951424 and ClinicalTrials.gov, NCT04324606, NCT04400838, and NCT04444674	Participants aged 18 years and older across the UK and Brazil	18–55 56–69 ≥70	35.20%	Cardiovascular disease Respiratory disease Diabetes	NA	White Black Asian Mixed Other	UK (n= 7548) Brazil (n= 4088)	NA
Voysey, 2021b	Randomized control tiral four trials registered ISRCTN89951424 (COV003) and ClinicalTrials.gov, NCT04324606 (COV001), NCT04400838 (COV002), and NCT04444674 (COV005)	COV001 (UK) enrolled healthy adults aged 18–55 years COV002 (UK) and COV003 (Brazil) enrolled adults aged 18 years and older, with a focus on recruitment of health-care workers and others at increased exposure to SARS-CoV-2 infection. COV005 (South Africa) enrolled adults aged 18–65 years	18–55 56–69 ≥70	NA	NA	NA	NA	UK (1/2 study; COV001) UK (2/3 study; COV002) Brazil (COV003) South Africa (1/2 study;COV005)	NA
Walter, 2022	Randomized control tiral NCT04816643	Children aged between 5 and 25 years old with no or stable preexisting conditions Exclusion criteria: - with immunocompromising or immunodeficiency disorder - with a history of MIS-C - receiving immunosuppressive therapy (including cytotoxic agents and systemic glucocorticoids) - with a previous clinical or virologic Covid-19 diagnosis	Mean ± SD 8.2±1.93 for BNT162b2 8.1±1.97 for placebo 8.2±1.94 for total	52.10%	obesity (11.7%)	NA	White (78.9%) Black (6.5%) Asian (6.0%) Multiracial (7.0%) others/ not reported (1.6%) Hispanic or Latinx ethnicity (21.1%)	United States (70.7%) Finland (10.5%) Spain (10.6%) Poland (8.2%)	NA
Wickert, 2021	Prospective cohort	Cadets aged between 17 and 26 years living in two large dormitories on campus and attended in-person academic, military, and athletic training	17-26	NA	NA	NA	NA	USA	NA
Wu, 2022	retrospective cohort study	included only close contacts, 18 years and older, who had documented contact or exposure opportunities (contact with one or more confirmed cases or asymptomatic infections in the same public space, without protection, within close distance, within up to five days before illness onset for symptomatic cases or were identified by the first positive specimen for asymptomatic cases), and no history of COVID-19 infection. We excluded individuals vaccinated with vaccines other than BBIBP-CorV or CoronaVac. For analysis of impact of vaccination on risk of severe COVID-19, we included all infected individuals who were 18 years of age and older.	18-59 (n=1332) >60 (n= 130)	51%	NA	NA	NA	China	Delta

Table2B. Study characteristics table including author and year, sample size, study designs, research aim, treatment 1intervention (n), treatment 2 comparator (n), dose-interval, follow-up period from last vaccine dose, assessed outcome, outcome. Ten new studies were included in this update (highlighted in green).

Study, year	Sample size (N)	Study design	Research aim	Treatment-1-intervention (n)	Treatment-2-comparator (n)	Dose interval	Follow-up period from last vaccine dose/ study period	Assessed outcome	Outcome Measures
Abu Raddad, 2021	75348	Test-negative case-control	To estimate the effectiveness of BNT162b2 vaccine against infection of B.1.1.7 and B.1.351 variants.	One dose of BNT162b2 (n=not specified) Two doses of BNT162b2 (n=not specified)	Unvaccinated (n=not specified)	NA	≥14 days after second dose	Documented COVID-19 infection Severe COVID-19/ COVID-19 related death	1-odds ratio
Accorsi 2022	70 155	Test negative case control study	Assess the effectiveness of 3 doses of Pfizer-BioNTech BNT162b2 or Moderna mRNA-1273 vaccine and symptomatic SARS-CoV-2 infection, stratified by variant (Omicron and Delta).	Any 3 doses of mRNA vaccine 3 doses of BNT162b2 3 doses of mRNA-1273	unvaccinated	14 days	2 months after 2nd dose 1 month after 3rd dose	symptomatic COVID-19 infection	1-odds ratio
Al, 2021	40 382	Randomized control Tiral ClinicalTrials.gov Identifier: NCT04510207; Chinese Clinical Trial Registry: ChiCTR2000034780	To evaluate the efficacy and adverse events of 2 inactivated COVID-19 vaccines	two doses of SARS-CoV-2 WIV04 (n=13459) Two doses of HB02 (n=13465)	aluminum hydroxide (alum)–only control (n = 13 458)	21 days between 1st dose and 2nd dose	after day 14 following the second dose	Symptomatic COVID-19 infection severe COVID-19	1-odds ratio
Ali, 2021	3732	Randomized control Tiral NCT04649151	primary objectives were evaluation of the safety of mRNA-1273 in adolescents and the noninferiority of the immune response in adolescents as compared with that in young adults (18 to 25 years of age) in a phase 3 trial. Secondary objectives included the efficacy of mRNA-1273 in preventing Covid-19 or asymptomatic severe acute respiratory syndrome coronavirus 2 infection	mRNA-1273 (n=2489)	placebo (n=1243)	28 days between 1st dose and 2nd dose	83 median days of follow-up	Symptomatic COVID-19 infection	1-incidence ratio
Andrews, 2021	271747	Test-negative case-control	To estimate the effectiveness of booster vaccination against symptomatic disease in adults aged 50 years and older.	One BNT162b2 booster after two doses of BN162b2 (n=11,616 at 0-13 days post booster, n=5,905 at 14+days) One BNT162b2 booster after two doses of ChAdOx1 (n=5,450 at 0-13 days post booster, n=1,266 at 14+days) Two doses of BNT162b2 (n=84,506) Two doses of ChAdOx1 (n=149,434) One mRNA-1273 booster after two doses of BNT162b2 (n=not specified)	Unvaccinated (n=13,569)	>19 days between first and second dose ≥140 days after second dose	0-1, 2-6, 7-13, ≥14 day post booster vaccine intervals ≥140 days prior to the onset for homologous vaccines	Symptomatic COVID-19 infection COVID-19 related hospitalization COVID-19 related death	1-odds ratio
Andrews, 2022	2663549	Test-negative case-control	To estimate vaccine effectiveness against symptomatic disease caused by the delta and omicron variants after two doses (primary immunization) of BNT162b2, mRNA-1273, or ChAdOx1 nCoV-19 vaccine and after homologous or heterologous booster doses with the same three vaccines.	Two doses of ChAdOx1 nCoV-19 (n=102,033) One BNT162b2 booster after two doses of ChAdOx1 nCoV-19 (n=416549) One mRNA-1273 booster after two doses of ChAdOx1 nCoV-19 (n=131718) One ChAdOx1 nCoV-19 booster after two doses of ChAdOx1 nCoV-19 (n=1126) Two doses of BNT162b2 (n=80,592) One BNT162b2 booster after two doses of BNT162b2 (n=393939) One mRNA-1273 booster after two doses of BNT162b2(n=53946) Two doses of mRNA-1273 (n=8,787) One BNT162b2 booster after two doses of mRNA-1273 (n=6888) One mRNA-1273 booster after two doses of mRNA-1273(n=6079)	Unvaccinated (n=244,716)	≥175 days after second dose	2 to 4, 5 to 9, 10to 14, 15 to 19, 20 to 24, and 25 or more weeks after the second dose 2 to 4, 5 to 9, and 10 or more weeks after a BNT162b2 or mRNA-1273 booster after a ChAdOx1 nCoV-19 or BNT162b2 primary course mRNA-1273 primary course, vaccine effectiveness was assessed after BNT162b2 or mRNA-1273 booster vaccines after 1 week and after 2 to 4 weeks.	Symptomatic COVID-19 infection	1-odds ratio
Baden, 2021	30420	Randomized control Tiral NCT04470427	To assess the safety and efficacy of the mRNA-1273 vaccine in preventing SARS-CoV-2 infection.	Two doses of mRNA-1273 (n=15,181)	placebo (n=15,170)	29 days btween first dose and second dose	median follow-up duration of 63 days	Symptomatic COVID-19 infection	1-hazard ratio
Barda, 2021	1456642	Observational study, matched pair	Use the data repositories of Israel's largest health-care organisation to evaluate the effectiveness of a third dose of the BNT162b2 mRNA vaccine for preventing severe COVID-19 outcomes	One BNT162b2 booster after two doses of BNT162b2 (n=728,321)	Two doses of BNT162b2 (n=728,321)	≥14 days	≥56 days (July 30, 2020 -Sept 26, 2021)	Documented COVID-19 infection Symptomatic COVID-19 infection COVID-19 related hospitalization Severe COVID-19 COVID-19 related death	1-risk ratio 1-incidence rate ratio
Bjork, 2022	805741	Cohort study	To estimate the effectiveness of BNT162b2 vaccine against COVID infection.	One dose of BNT162b2 (n=not specifed) Two doses of BNT162b2 (n=not specified)	No prior positive test, unvaccinated (n=742,414)	≥21 days between first and second dose	0-13, ≥14 days after first dose (one-dose BNT162b2) 0-6, ≥7 days after first dose (two-does BNT162b2)	Documented COVID-19 infection	1-rate ratio
Bruxvoort, 2021	8153	Test negative case-control	To evaluate the effectiveness of the mRNA-1273 vaccine against SARS-CoV-2 variants and assess its effectiveness against the delta variant by time since vaccination.	Two dose of mRNA-1273 One dose of mRNA-1273	Unvaccinated	≥24 days between first dose and second dose	< 14 days before collection of specimen	Documented COVID-19 infection COVID-19 related hospitalization	1-odds ratio

Bruxvoort, 2022	705756	Test negative case-control	The primary objectives of this planned interim analysis were to evaluate the VE of 2 doses of mRNA-1273 in preventing COVID-19 infection and severe disease. Secondary objectives evaluated at this time point included the VE of 2 doses of mRNA-1273 in preventing asymptomatic vs. symptomatic COVID-19, and COVID-19 infection stratified by age, sex, race/ethnicity, and history of COVID-19 infection.	2 doses of mRNA-1273 (n=352,878)	Unvaccinated (352878)	<24 days between first and second dose	until June 30, 2021	Documented COVID-19 infection COVID-19 related hospitalization COVID-19 Related death	1- adjusted hazard ratio
Butt-2022	395686	national retrospective study	To determine the relative VE of a three vs. two doses of an mRNA vaccine in preventing symptomatic SARS-CoV-2 infection, hospitalization, and severe/critical disease of veterans	One BNT162b2 booster after two doses of BNT162b2 (n=236,693 at 14+days) One mRNA-1273 booster after two doses of mRNA-1273 (n=158,993 at 14+days)	two doses of BNT162b2 (n=236,693) two doses of mRNA-1273 (n=158,993)	≥14days	22 September 2021 to 24 November 2021	Symptomatic COVID-19 infection, COVID-19 related hospitalization	1-hazard ratio
Carazo, 2021	55494	Test-negative case-control	To compare one- and two-dose mRNA VE against SARS-CoV-2, including varying outcome severity and variants of concern (VOC), among HCWs in Quebec and assess the stability of single-dose protection across 16 weeks post-vaccination	One dose of BNT162b2 (n=26,719) One dose of mRNA-1273 (n=1,639) Two doses of BNT162b2 (n=2,022) Two doses of mRNA-1273 (n=128) One dose of ChAdOx1 then one dose of mRNA-1273 (n=48,501) One dose of ChAdOx1 (n=144,360)	Unvaccinated (n=24986)	≥3 weeks between first and second dose	≥14 days from last dose, between January 17 and June 5, 2021. Additional 14-day lag to capture associated hospitalizations	Documented COVID-19 infection Symptomatic COVID-19 infection COVID-19 related hospitalization	1-odds ratio
Cerqueira-Silva, 2021	167621	Test-negative case-control	Utilizing national COVID-19 notification, hospitalization, and vaccination datasets from Brazil, we performed a case-control study using a test-negative design to assess the effectiveness of four vaccines (CoronaVac, ChAdOx1, Ad26.COV2.S and BNT162b2) among individuals with laboratory-confirmed prior SARS-CoV-2 infection.	One doses of BNT162b2 (n=6466) One doses of ChAdOx (n= 18364) One doses of Coronavac (n= 6734) One dose of Ad26.COV2.S (n= 1292) Two doses of BNT162b2 (n=1485) Two doses of ChAdOx (n= 8215) Two doses of Coronavac (n= 25877)	Unvaccinated (n=97856)	≥14 days after first dose	at least 90 days after their first positive test	Documented COVID-19 Infection Symptomatic COVID-19 infection and COVID-19 related hospitalization	1-odds ratio
Cerqueira-Silva, 2022a	7747121	Test-negative case-control	we evaluated the effectiveness of two doses of CoronaVac against confirmed SARS-CoV-2 infection and severe COVID-19 outcomes (hospitalization and death) from time since vaccination compared to unvaccinated individuals,	2 doses of Coronavac 1 BNT162b2 booster after two doses of Coronavac	Unvaccinated	NA	24 February 2020 to 11 November 2021	Documented COVID-19 infection COVID-19 related hospitalization COVID-19 Related death	1-adjusted odds ratio
Cerqueira-Silva, 2022b	77635439	Retrospective Cohort	evaluating documented infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), COVID-19-related hospitalisation, ICU admission, and death	One dose Vaxzevia (n=5550662) Two dose of Vaxzevia (n= 572003) One dose of CoronaVac (n=1290469) Two doses of CoronaVac (n=4574691)	Unvaccinated (n=1662565)	≥14days	(1) ≤13 days after the first dose (reference period). (2) ≥14 days after the first dose and prior to the second dose (partially vaccinated). (3) ≥14 days after the second dose (fully vaccinated)	Documented COVID-19 Infection/Symptomatic COVID-19 infection COVID-19 related hospitalization Death	1-Rate Ratio
Chin, 2021	60707	retrospective cohort	estimated vaccine effectiveness using multivariable Cox models with time-varying covariates that adjusted for resident characteristics and infection rates across prisons	One mRNA-1273 or BNT-162b2 dose (n=29947 at 0-6 days after) One mRNA-1273 or BNT-162b2 dose (n=28902 at 7-13 days after) One mRNA-1273 or BNT-162b2 dose (n=27392 at 14+ days after) Two mRNA-1273 or BNT-162b2 doses (n=13181 at 0-13 days)	Unvaccinated (n=60673)	≥14days	December 22, 2020, through March 1, 2021,	Documented Covid-19 infection, covid-19 related hospitalisation, covid-19 related death	1-hazard ratio
Collie, 2022	211610	Test-negative case-control	evaluate the effectiveness of two doses of the BNT162b2 vaccine (i.e., full vaccination) against hospitalization for Covid-19 caused by the omicron variant	2 doses of BNT162b (n= 76333) 1 dose of BNT162b (n= 23103)	Unvacinated (n= 79702)	NA	November 15 to December 7, 2021	Documented COVID-19 infection COVID-19 related hospitalization	1-odds ratio
Desai, 2022	2136	Test-negative case-control	We aimed to evaluate the effectiveness of BBV152 against symptomatic RT-PCR-confirmed SARS-CoV-2 infection.	Two doses of Covaxin (n=584) One dose of Covaxin (n=520)	Unvaccinated (n=1002)	≥14days	April15- May 15,2021	Symptomatic COVID-19 infection	1-odds ratio
Dunkle, 2022	25452	Randomized control tiral NCT04611802	to determine vaccine efficacy against reversetranscriptase–polymerase-chain-reaction–confirmed Covid-19 occurring at least 7 days after the second dose	One or two dose of NVX-CoV2373 (n=17,312)	Placebo (n=8140)	NA	starting at dose 1 and the other starting 7 days after dose 2	Documented COVID-19 infection	1-risk ratio
Ella, 2021	25753	Randomized control Tiral NCT04641481	We assessed the efficacy, safety, and immunological lot consistency of two intramuscular 6 µg Algel-IMDG doses of BBV152 vaccine	Two dose of BBV152 (n=12879)	Unvaccinated (n=12874)	28 days after first dose	28 days and 56 days after second dose	Documented COVID-19 symptomatic COVID-19 Infection Severe COVID-19 Infection	1-odds ratio
Emary,2021	8534	Randomized control Tiral NCT04400838, and ISRCTN, 15281137	In this study, we provide both an in- vitro analysis of vaccine-induced neutralising antibody responses against B.1.1.7 and an analysis of the clinical efficacy of ChAdOx1 nCoV-19 against disease caused by the B.1.1.7 variant of concern, using data from the UK.	Two doses for ChAdOx (n=4244)	Unvaccinated (n=4290)	≥14days	≥14days	Symptomatic COVID-19 infection Documented COVID-19 infection	1-relative risk
Falsey, 2021	32451	Randomized control tiral NCT04516746	The objectives of the trial were to assess the safety, efficacy, and immunogenicity of AZD1222 as compared with placebo for the prevention of symptomatic Covid-19 in participants 18 years of age or older whose conditions were medically stable and who were at increased risk for SARS-CoV-2 infection, including high risk for symptomatic and severe Covid-19.	Two doses of AZD1222 (n=21635)	placebo (n=10,816)	29 days between first dose and second dose	≥15days after second dose	Symptomatic COVID-19 infection Severe COVID-19 Infection COVID-19 related hospitalization	1-odds ratio
Ferdinands, 2022	241,204	Test-negative case-control	examined vaccine effectiveness (VE) against COVID-19 emergency department/urgent care (ED/UC) visits and hospitalizations among U.S. adults aged ≥18 years	Two doses of BNT162b2 (n= 63,912) One DNT162b2 booster after two doses of BNT162b2 (n=15,894) Two doses of Morderna (n=41,046) One dose of Morderna Booster after two doses of Morderna (n=7944)	Unvaccinated (n=110,873)	NA	From <2 to >5 months between first dose and second dose From <2 to >5 months between second dose and third dose	Documented COVID-19 infection	1-odds ratio

Frenck, 2021	2260	Randomized control tiral NCT04368728	Aims to evaluate the Safety, Immunogenicity, and Efficacy of theBNT162b2 Covid-19 Vaccine in Adolescents	Two doses of BNT162b2 (n= 1131)	placebo (n=10,816)	19 to 42 days after 1st dose	blood sample obtained within 28 to 42 days after dose 2	Documented COVID-19 infection	1-incidence ratio
Glatman-Freedman, 2021b	NA	retrospective longitudinal cohort	Evaulating the BNT162b2 vaccine effectiveness in terms of infection, symptomatic disease, hospitalisation, severe/critical disease and death	One dose of BNT162b2 Two doses of BNT162b2	Unvaccinated	first vaccine dose from 21 December 2020 to 16 January 2021 second dose from January 11 to February 6, 2021	14-20 after first dose 8-14, 15-21 and 22-28 after second dose	Documented COVID-19 infection Symptomatic COVID-19 infection Severe COVID-19 Infection COVID-19 related hospitalization COVID-19 related death	1-rate reduction
Heath, 2021	14039	Randomized control tiral EudraCT number, 2020-004123-16	To evaluate the safety and efficacy of NVX-CoV2373 Covid-19 Vaccine	Two doses of NVX-CoV2373 (n=7020)	placebo (n=7019)	21 days between 1st dose and 2nd dose	< 7 days after the second injection	Symptomatic COVID-19 infection	1-Risk Ratio
Kirsebom, 2022	13082079	Test-negative case control	To estimate vaccine effectiveness against symptomatic disease and hospitalisation following Delta or Omicron infection after booster vaccination	2 ChAdOx1 2 ChAdOx1 + 1 BNT162b2 3 ChAdOx1	unvaccinated	NA	175+ days from 2nd dose 7-13, 14-34, 35-69, 70-104, 105+ days from 3rd dose	Symptomatic COVID-19 infection COVID-19 related hospitalisation	1-odds ratio
Klein, 2022	39217	Test-negative case control	To estimate vaccine effectiveness in preventing emergency department (ED) and urgent care (UC) encounters and hospitalisations among non-immunocompromised children (5-17 years)	2 BNT162b2 3 BNT162b2	unvaccinated	NA	14-149, 150+ days from 2nd dose 7+ days from 3rd dose	Severe COVID-19 cases COVID-19 related hospitalisation	1-odds ratio
Lauring, 2022	11544	Test-negative case-control	To assess the effectiveness of BNT162b2 and mRNA-1273 vaccines against COVID-19 related hospitalisation	Two doses of mRNA-1273 or BNT-162b2 (n=4,789) Three doses of mRNA-1273 or BNT-162b2 (n=609)	Unvaccinated (n=6,146)	NA	14-150, ≥150 days after second dose ≥7 days after third dose	COVID-19 related hospitalisation COVID-19 related death	1-odds ratio
Lee 2022	77399018	population-based test-negative case-control study	evaluations of vaccine effectiveness against breakthrough SARS-CoV-2 infections in patients with cancer at a population level	2 doses of BNT162b2 2 doses of ChAdOx1 nCoV-19 Mixed (above 2) or other	Unvacinnated	14 days	0-40 weeks after vaccination	Documented COVID-19 infection	1-odds ratio
Lopez, 2021	187392	Test-negative case-control	To assess the effectiveness of ChAdOx1 nCoV-19 and BNT162b2 vaccines against B.1.1.7 (Alpha) and B.1.617. 2 (Delta) infection	One dose of BNT162b2 or ChAdOx1 nCoV-19 (n=55,189) Two doses of BNT162b2 or ChAdOx1 nCoV-19 (n=24,476) One dose of BNT162b2 (n=9,228) Two doses of BNT162b2 (n=15,920) One dose of ChAdOx1 nCoV-19 (n=45,961) Two doses of ChAdOx1 nCoV-19 (n=8,556)	Unvaccinated (n=107,727)	NA	≥21 days after first dose ≥14 days after second dose	Symptomatic COVID-19 infection	1-odds ratio
Magen 2022	364244	case control	To evaluate the early effectiveness of a fourth dose of the BNT162b2 vaccine for the prevention of Covid-19–related outcomes	4 dose of BNT162b2	3 dose of BNT162b2	14 days	The maximum follow-up was 30 days after the fourth vaccine dose, with a median follow up of 26 days (interquartile range: 7 to 30)	Documented COVID-19 infection Symptomatic COVID-19 infection COVID-19 related hospitalization Severe COVID-19 COVID-19- related death	1-Risk Ratio
Martinez-baz, 2021	30240	Prospective cohort	To assess the product-specific COVID-19 vaccine effectiveness in preventing infection and hospitalisation in a prospective dynamic cohort of adults (≥ 18 years old) who were close contacts of COVID-19 cases	One dose of Ad26.COV2.S (n=997) One dose of mRNA-1273 (n=517) Two doses of mRNA-1273 (n=1,127) One dose of BNT162b2 (n=2,022) Two doses of BNT162b2 (n=7,972) One dose of ChAdOx1 (n=1,599) Two doses of ChAdOx1 (n=1,539) One dose of ChAdOx1 then one dose of BNT162b2 (n=119)	Unvaccinated (n=14,348)	NA	Within 90 days after last dose	Documented COVID-19 infection Symptomatic COVID-19 infection COVID-19 related hospitalization	1-risk ratio
Natarajan 2022	80287	Test negative case control study	To evaluate the effectiveness of homologous and heterologous COVID-19 booster doses following 1 Ad.26.COV2.S (Janssen [Johnson & Johnson]) vaccine dose against COVID-19–associated emergency department and urgent care encounters and hospitalizations among adults	1 Janssen vaccine dose 2 Janssen doses 1 Janssen dose/1 mRNA dose 3 mRNA doses	unvaccinated	14 days	≥14days	ED/UC events Hospitalizations	1-odds ratio
Nordstrom, 2021a	1684958	Retrospective cohort	To investigate vaccine effectiveness of heterologous ChAdOx1 nCoV-19 and mRNA prime-boost vaccination against symptomatic Covid-19 infection in Sweden	Two doses of BNT162b2 (n=637,107) Two doses of mRNA-1273 (n=76,880) Two doses of ChAdOx1 (n=76,597) One dose of BNT162b2 then one dose of mRNA-1273 (n=51,766)	Unvaccinated (n=842,974)	NA	Period after author-defined baseline dates	Symptomatic COVID-19 infection COVID-19 related hospitalization	1-hazard ratio
Nordstrom, 2021b	721787	Retrospective cohort	To assess the effectiveness of heterologous vaccination: ChAdOx1 nCoV-19 / BNT162b2, ChAdOx1 nCoV-19 / mRNA-1273 and homologous vaccination: ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19 against COVID-19 infection	One dose of ChAdOx1 nCoV-19, then one dose of BNT162b2 (n=94,569) One dose of ChAdOx1 nCoV-19, then one dose of mRNA-1273 (n=16,402) Two doses of ChAdOx1 nCoV-19 (n=430,100)	Unvaccinated (n=60,190) Unvaccinated (n=10,984) Unvaccinated (n=109,542)	NA	>14 days after second dose	Symptomatic COVID-19 infection	1-hazard ratio
Olson, 2022	1222	Test-negative case-control	To assess the effectiveness of BNT162b2 Vaccine against Critical Covid-19 in Adolescents	One dose of BNT162b2 (n=55) Two doses of BNT162b2 (n=299)	Unvaccinated (n=868)	NA	≥14 days after first dose ≥14 days after second dose	Severe COVID-19 infection COVID-19 related death	1-odds ratio
Palacios, 2021	9823	Randomized control Trial NCT0445659	Investigating efficacy and safety of CoronaVac against any symptomatic SARS-CoV-2 infections and moderate and severe COVID-19	One or Two dose of CoronaVac (N=6195)	Placebo (n=6201)	14 to 28 days	Within 96 days after first dose	Symptomatic COVID-19 infection Severe COVID-19 Infection	1- hazard ratio
Polack, 2020	37706	Randomized control Trial NCT04368728	assess the safety and efficacy of the BNT162b2 vaccine	Two doses of BNT162b2 (n= 18,860)	placebo (n=18,846)	21 days	median 2 months	Documented COVID-19 symptomatic COVID-19 Infection Severe COVID-19 Infection	incidence rate ratio

Poukka, 2021	427905	Nation-wide register-based cohort study	To estimate vaccine effectiveness before and after emergence of the Delta variant and to estimate brand-specific effectiveness of mRNA vaccines	Two doses of ChAdOx1 (n=12837) One dose ChAdOx1 then one dose of BNT162b2 or one dose of mRNA-1273 (n=47,070 for ChAdOx1 vaccinees) Two doses of BNT162b2 (n=316650) Two doses of mRNA-1273 (n=316650)	Unvaccinated (n=42,790)	84 days for combination with ChAdOx1 21-28 days for homologous mRNA vaccines	27th December 2020-26th August 2021 (COVID-19 infection) and 27th December 2020-26th October 2021(hospitalization) days after last dose	Documented COVID-19 infection	1-hazard ratio
Powell, 2021	842969	Test-negative case-control	To assess the effectiveness of BNT162b2 vaccine against Delta (B.1.617.2) and Omicron (B.1.1.529) infection in adolescents	One dose of BNT162b2 (n=254,196) Two doses of BNT162b2 (n=25,813)	Unvaccinated (n=562,960)	NA	0-1, 2-6, 7-13, 14-20, 21-27, 28-34, 35-41, 42-55, 56-69, 70-83, 84-104, ≥105 days after first dose 0-1, 2-6, 7-13, 14-34, 35-69, ≥70 days after second dose	Symptomatic COVID-19 infection	1-odds ratio
Pozzetto, 2021	13121	Longitudinal survey	To investigate the effectiveness and immunogenicity of ChAdOX1/BNT162b2 vaccine regimen	Two doses of BNT162b2 (n=10,609)	One dose of ChAdOx1 then one dose of BNT162b2 (n=2,512)	≥14 days	≥14 days after second dose	Documented COVID-19 infection	Infection rate
Pramod 2022	692	Test-negative case control	determining the effectiveness of the Covishield vaccine in preventing laboratory confirmed Covid-19, separately for those who had received a single dose and for those who had received two doses of this vaccine.	1 ChAdOx1 2 ChAdOx1	unvaccinated	NA	during March 1-May 31, 2021	laboratory confirmed COVID-19 infection	1-odds ratio
Prieto-alhambra, 2021	28650	Retrospective cohort	To study the comparative effectiveness and safety of homologous (two-dose ChAdOx1) and heterologous (ChadOx1 followed by BNT162b2) vaccination	One dose of ChAdOx1 then one dose of BNT162b2 (n=14,325)	Two doses of BNT162b2 (n=14,325)	≥14 days	1st June-11th October, 2021	Documented COVID-19 infection	Incident rate ratio Absolute risk reduction
Prunas, 2022	238023	Test-negative case-control	To assess the effectiveness of BNT162b2 vaccine against COVID-19 infection in adolescents	One dose of BNT162b2 (n=50,994) Two doses of BNT162b2 (n=86,144)	Unvaccinated (n=137,293)	NA	0-6, ≥7 days after first dose 14-89, 90-149, 150-180 after second dose	Documented COVID-19 infection	1-odds ratio
Ranzani, 2022	2657728	Test-negative case control	To estimate vaccine effectiveness against symptomatic infection by Delta and Omicron variant of CoronaVac as primary course with homologous or heterologous booster	1 CoronaVac 2 CoronaVac 3 CoronaVac 2 CoronaVac + 1 BNT162b2	unvaccinated	NA	0-13, 14+ days from 1st dose 0-13, 14-89, 90-179, 180+ days from 2nd dose 0-7, 8-59, 60+ days from 3rd dose	Symptomatic COVID-19 infection	1-odds ratio
Reis, 2021	188708	Retrospective cohort	To assess the effectiveness of BNT162b2 vaccine against B.1.617. 2 (Delta) infection in adolescents	One dose of BNT162b2 (n=94,354) Two doses of BNT162b2 (n=94,354)	Unvaccinated (n=94,354)	NA	14-20, 21-27 days after first dose 7-21 days after second dose	Documented COVID-19 infection Symptomatic COVID-19 infection	1-risk ratio
Sadoff, 2021	43783	Randomized control Trial NCT04505722	To assess the effectiveness of efficacy and safety of one dose Ad26.COV2.S	One dose of ChAdOx1 (n= 21,895)	placebo (n=21,888)	NA	median 8 week	moderate to severe-critical covid-19 symptomatic covid-19 of any severity documented covid-19 infection	incidence rate ratio
Sadoff, 2022	8940	Randomized control trial NCT04505722	To assess the effectiveness of efficacy and safety of one dose Ad26.COV2.S	One dose of ChAdOx1	Unvaccinated	NA	median 4 months	Documented COVID-19 infection	1-rate ratio
Shrotri, 2021	10 412	Prospective cohort	To estimate the protective effect of the first dose of the Oxford-AstraZeneca non-replicating viral-vectored vaccine and the Pfizer-BioNTech mRNA-based vaccine in residents of long-term care facilities in terms of PCR-confirmed SARS-CoV-2 infection over time since vaccination	One dose of BNT162b2 (n= 6138) One dose of ChAdOx1 (n= 3022) Two doses (n= 897)	Unvaccinated (n=355)	median= 63 days (55-65% participants)	Dec 8, 2020 - March 15, 2021	Documented COVID-19 infection	1-hazard ratio
Skowronski, 2021a	16993	Test-negative case-control	To estimate the vaccine effectiveness of a single dose of mRNA vaccine against SARS-CoV-2, including variant-specific estimates, among communitydwelling adults ≥70-years-old in British Columbia	One dose of mRNA-1273 (n=941)	Unvaccinated (n=4,542)	≥14 days	April 4, 2021-May 1, 2021	Symptomatic COVID-19 infection	1-odds ratio
Skowronski, 2021b	68074	Test-negative case-control	To compare single-dose mRNA and ChAdOx1 VE against SARS-CoV-2 infection and hospitalization, including due to variants, among adults 50-69-years-old in British Columbia	one-dose ChAdOx1 (n=6979) one-dose BNT162b2 (n=16396) one-dose mRNA-1273 (n=4083)	Unvaccinated (n=40,616)	≥14 days	April 4, 2021- May 22,2021	Documented COVID-19 infection COVID-19 related hospitalization	1-odds ratio
Tanriover, 2021	10 218	Randomized control tiral NCT04582344	To assess the effectiveness and safety of an inactivated whole-virion SARS-CoV-2 vaccine (CoronaVac)	One dose of BNT162b2 (n=5,623) One dose of ChAdOx1 (n=6,979) One dose of BNT162b2 (n=16,396) One dose of mRNA-1273 (n=4,083)	Unvaccinated	14 days	43 days (median) after randomisation to the date of unmasking	Symptomatic COVID-19 infection Documented COVID-19 infection	1-rate ratio
Tartof, 2021	3 436 957	Retrospective cohort study	To assess effectiveness of mRNA BNT162b2 COVID-19 vaccine up to 6 months	One dose of BNT162b2 (n= 76025) Two doses of BNT162b2 (n= 1043289)	Unvaccinated (n=2290189) One dose plus <14 days (n=27 274)	NA	≥14 days after first dose ≥7 days after second dose	Documented COVID-19 infection COVID-19 related hospitalization	1-hazard ratio
Tartof, 2022	3133075	Retrospective cohort study	To assess the effectiveness of a third dose of BNT162b2 vaccine against COVID infection.	Three doses of BNT162b2 (n=276,037)	Unvaccinated (n=1,959,271) Two doses of BNT162b2 (n=829,100)	≥21 days between second and third dose	≥6 months after second dose ≥14 days after third dose	Documented COVID-19 infection COVID-19 related hospitalization	1-hazard ratio
Thompson, 2022	87904	Test-negative case-control	To assess the effectiveness of a third dose of mRNA vaccine against COVID-19 associated emergency department and urgent care encounters and hospitalizations among adults during periods of Delta and Omicron variant predominance	Any mRNA vaccines Two doses (n= 41438) Three doses (n= 8606)	Unvaccinated (n= 37860)	NA	≥14days	Documented COVID-19 infection All ED/UC events	1-odds ratio
Tseng 2022	136345	test-negative case–control study	evaluate the VE of mRNA-1273 against infection and hospitalization with Omicron and Delta	1 dose of mRNA -1273 2 doses of mRNA -1273 3 doses of mRNA -1273	Unvaccinated	14 days	pecimens collected between 6 December 2021 and 31 December 2021	Documented COVID-19 infection and Symptomatic COVID-19 infection COVID-19 related hospitalization	1-odds ratio
Voysey, 2021a	11 636	Randomized control tiral ISRCTN89951424 and ClinicalTrials.gov, NCT04324606, NCT04400838, and NCT04444674	To assess the safety and efficacy of the ChAdOx1 nCoV-19 vaccine in a pooled interim analysis of four trials	One dose of ChAdOx1 (n= 5818)	Unvaccinated (n= 5818)	21 days	median 3.4 months	Documented COVID-19 infection Symptomatic COVID-19 infection	1-relative risk
Voysey, 2021b	24 422	Randomized control tiral four trials registered ISRCTN89951424 (COV003) and ClinicalTrials.gov, NCT04324606 (COV001), NCT04400838 (COV002), and NCT04444674 (COV005)	To assess the impact on immunogenicity and efficacy of AstraZeneca of extending the interval between priming and booster doses, and show the immunogenicity and protection provided by the first dose, before a booster dose has been offered	Two doses of ChAdOx1	One dose of ChAdOx1	longer prime-boost interval (≥12 weeks) a short interval (<6 weeks)	≥ 21 days after first dose	Documented COVID-19 infection Symptomatic COVID-19 infection	1–adjusted relative risk

Walter, 2022	2268	Randomized control tiral NCT04816643	To assess the safety, immunogenicity, and efficacy of two doses of the BNT162b2 vaccine administered 21 days apart in children 6 months to 11 years of age	Two doses of BNT162b2 (n= 1517)	Unvaccinated (n=751)	21 days	median 2.3 months	Documented COVID-19 infection	1-Rate Ratio
Wickert, 2021	4188	Prospective cohort	To assess reduction in infection risk observed in fully vaccinated cadets	Two doses of BNT162b2 (n=4,188)	Baseline status	≥21 days	1st March-1st May 2021	Documented COVID-19 infection	Infection rate Odds ratio
Wu, 2022	1462	retrospective cohort study	estimated the effectiveness of vaccination to prevent progression of illness by comparing the odds of vaccination of asymptomatic and mild cases versus the odds of vaccination in moderate and severe cases using an age-stratified analysis.	one dose of CoronaVac two doses of CoronaVac one dose of BBIBP-CorV Two doses of BBIBP-CorV One dose of BBIBP-CorV then one dose of CoronaVac (or one dose of Coronavac then one dose of BBIBP-CorV	Unvaccinated	14 days	received either 1 dose of a COVID-19 inactivated vaccine or had received 2 doses of inactivated vaccines with receipt of the second dose less than 14 days before exposure to an infected individual 14 days or more after the second dose	Documented COVID-19 infection Symptomatic COVID-19 infection Severe	1-odds ratio
Total sample size:	193955736								

Table 3. Combinations of vaccine regimens. Abbreviations: BNT-BioNTech; MD-Moderna; AZ-AstraZeneca; CV-CoronaVac; NVX-Novavax; BBV-Bharat Biotech

Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)
2MD	Two-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)
2AZ	ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273
2CV	Two-dose CoronaVac	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2
2NVX	Two-dose NVX-CoV2373 (Novavax)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac
2BBI	Two-dose BBIBP-CorV	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273
2BBV	Two-dose BBV152 (Covaxin)	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2
1J	One-dose Ad26.COV2.S (Janssen)	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273
1CV	One-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2
1BNT	One-dose BNT162b2	3MD	Three-dose mRNA-1273
1MD	One-dose mRNA-1273	3BNT	Three-dose BNT162b2
1AZ	One-dose ChAdOx1	3AZ	Three-dose ChAdOx1
1BBI	One-dose BBIBP-CorV	UNVAC	Unvaccinated

Figure 1A. Vaccine-product-based network plot for **documented** COVID-19 infections. Abbreviations: AZ-AstraZeneca; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen; NVX-Novavax; MD-Moderna; UNVAC-Unvaccinated

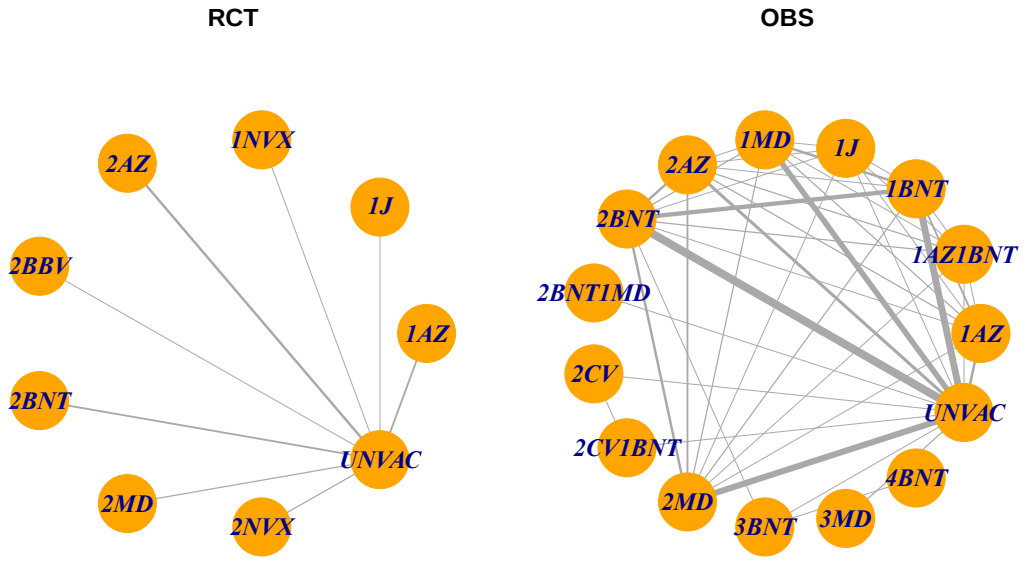


Figure 1B. Vaccine-product-based network plot for **symptomatic** COVID-19 infections. Abbreviations: AZ-AstraZeneca; BBI-BBIBP-CorV; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen; NVX-Novavax; MD-Moderna; UNVAC-Unvaccinated

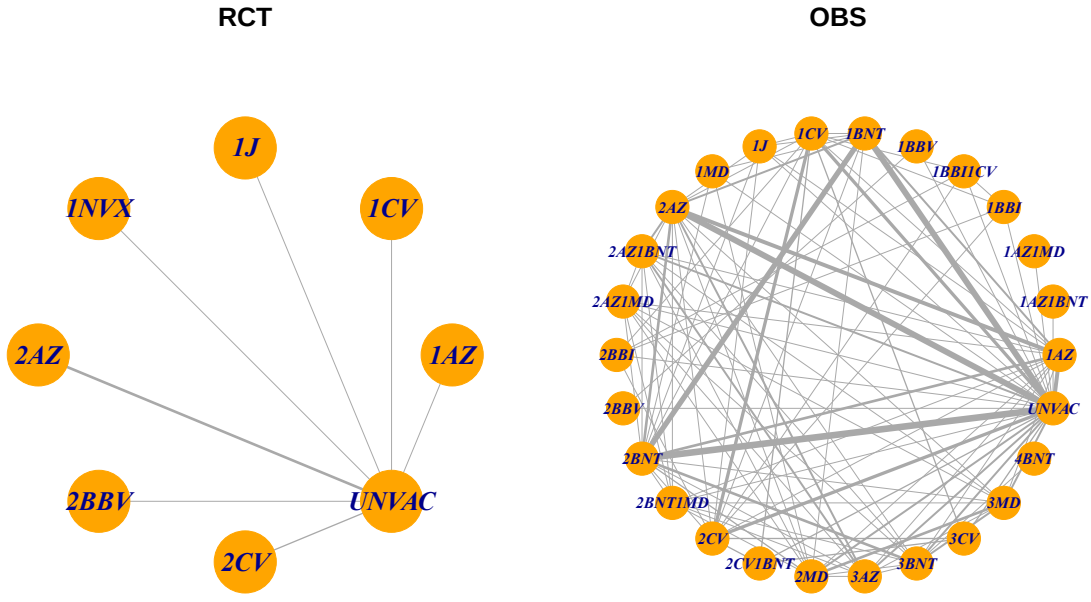


Figure 1C. Vaccine-product-based network plot for **severe** COVID-19 infections. Abbreviations: AZ-AstraZeneca; BBI-BBIBP-CorV; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen: UNVAC-Unvaccinated

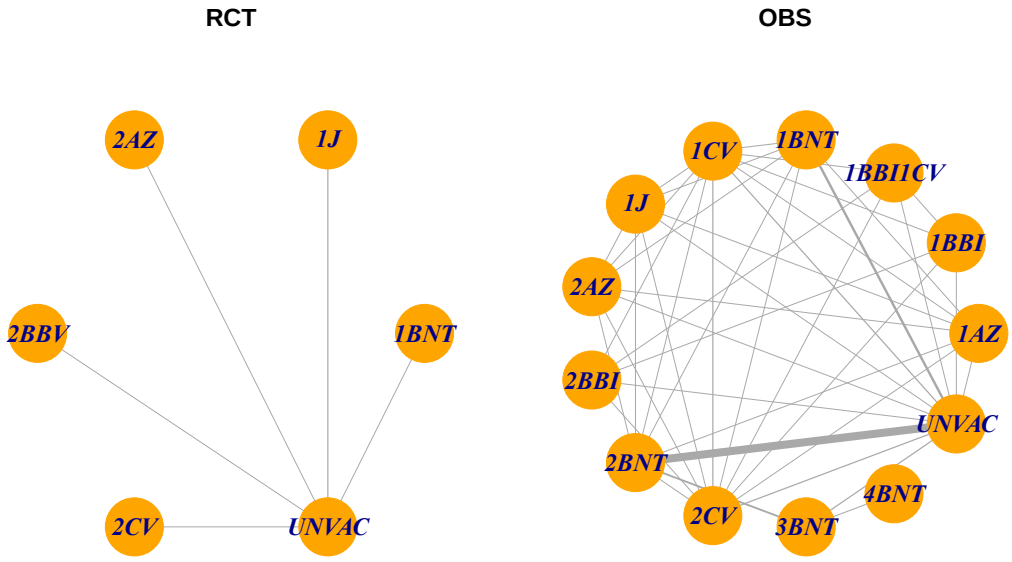


Figure 1D. Vaccine-product-based network plot for COVID-19 related **hospitalization**. Network plot of RCT is not shown due to limited number of studies. Abbreviations: AZ-AstraZeneca; BNT-BioNTech; J-Janssen; MD-Moderna; UNVAC-Unvaccinated

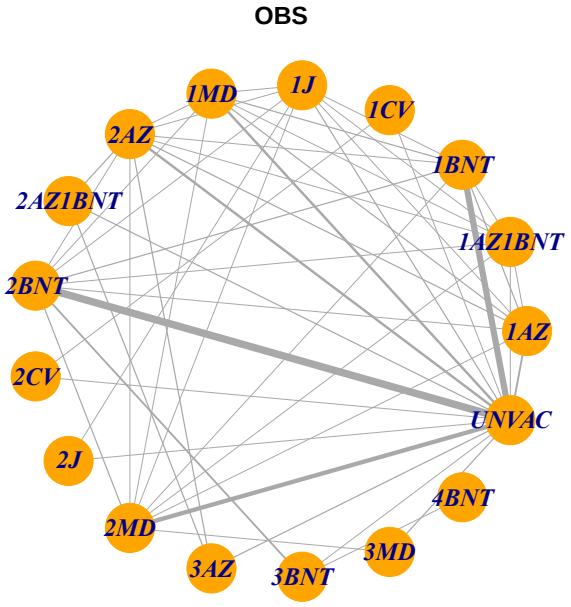


Figure 1E. Vaccine-product-based network plot for COVID-19 related **deaths**. No RCT studies reported COVID-19 related deaths. Abbreviations: AZ-AstraZeneca; BNT-BioNTech; CV-CoronaVac; MD-Moderna; UNVAC-Unvaccinated

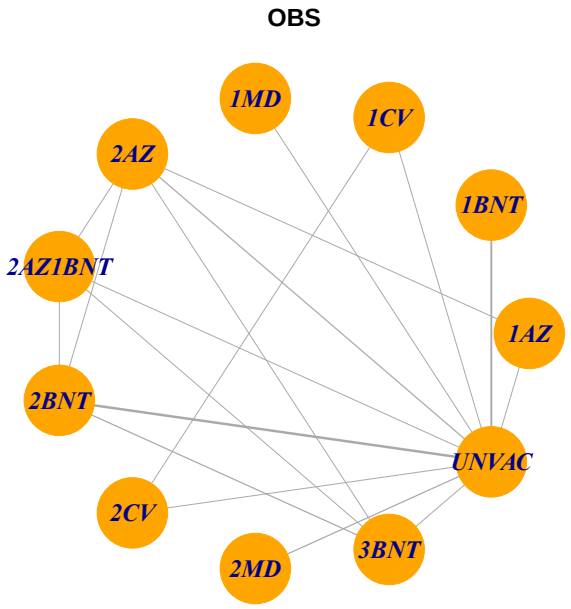


Figure 1F. Platform-based network plot for **documented** COVID-19 infections. Abbreviations: UNVAC-Unvaccinated; ADENO-Adenovirus vector vaccines; INACT-Inactivated virus vaccines; PRO-Protein-based vaccines; RNA-mRNA vaccines

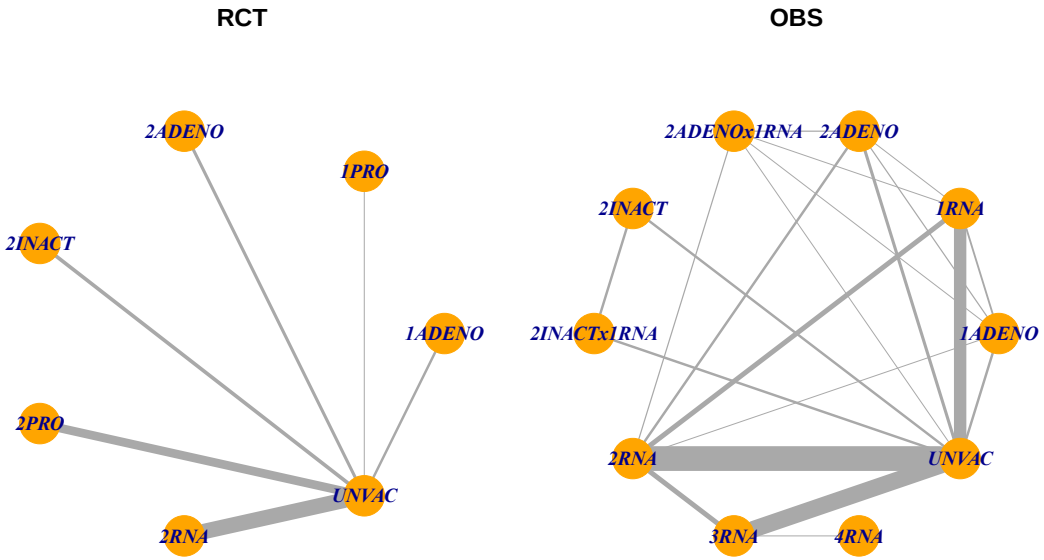


Figure 1G. Platform-based network plot for **symptomatic** COVID-19 infections. Abbreviations: UNVAC-Unvaccinated; ADENO-Adenovirus vector vaccines; INACT-Inactivated virus vaccines; PRO-Protein-based vaccines; RNA-mRNA vaccines

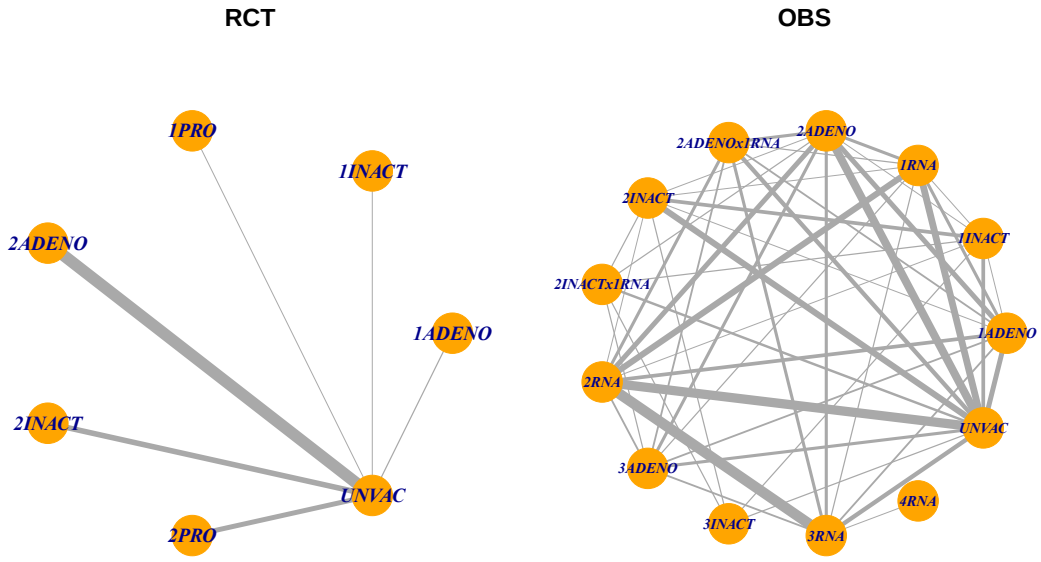


Figure 1H. Platform-based network plot for **severe** COVID-19 infections. Abbreviations: UNVAC-Unvaccinated; ADENO-Adenovirus vector vaccines; INACT-Inactivated virus vaccines; RNA-mRNA vaccines

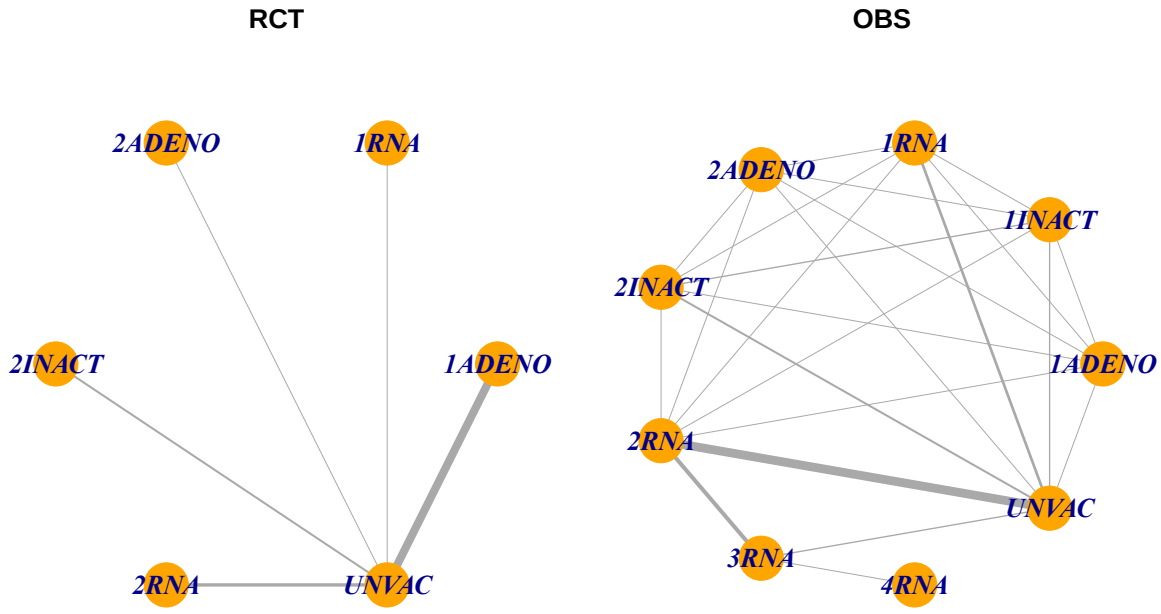


Figure 1I. Platform-based network for COVID-19 related **hospitalization**. Network plot of RCT is not shown due to limited number of studies. Abbreviations: UNVAC-Unvaccinated; ADENO-Adenovirus vector vaccines; INACT-Inactivated virus vaccines; RNA-mRNA vaccines

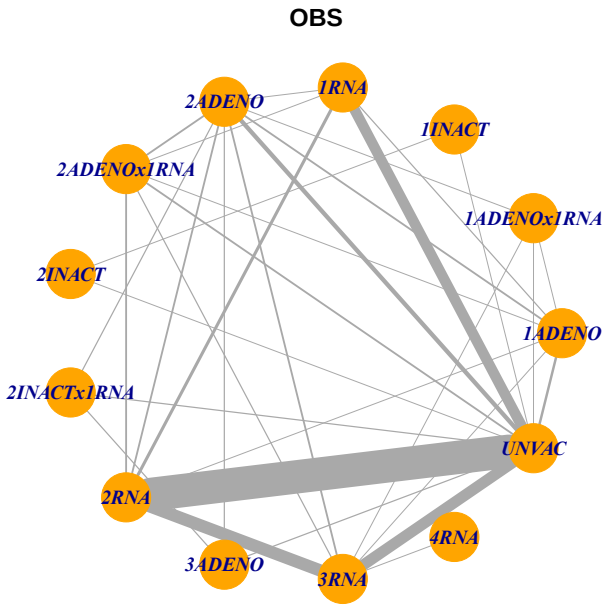


Figure 1J. Platform-based network plot for COVID-19 related **deaths**. No RCT studies reported COVID-19 related deaths. Abbreviations: UNVAC-Unvaccinated; ADENO-Adenovirus vector vaccines; INACT-Inactivated virus vaccines; PRO-Protein-based vaccines; RNA-mRNA vaccines

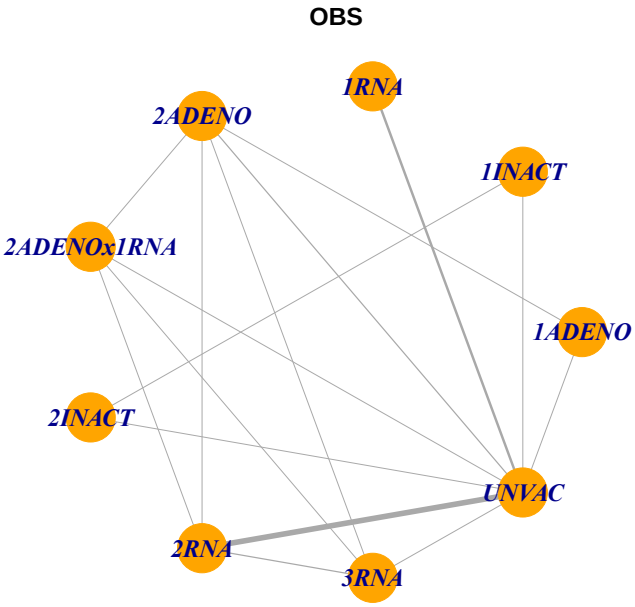
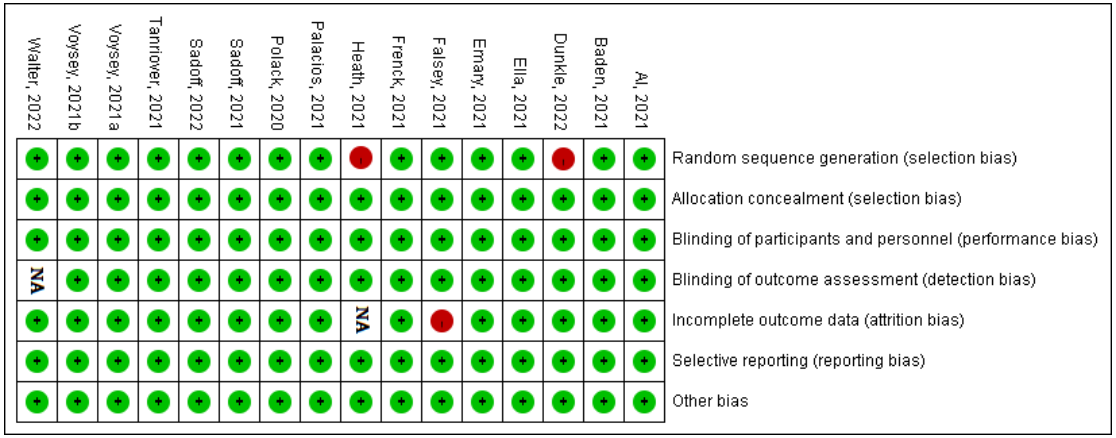


Figure 2. Risk of bias assessment of RCTs using Cochrane ROB-II tool



Dunkle, 2022: Imbalance in the number of unblinding requests by trial participants at early stages of the trial. However, the number of participants unblinded is similar in both vaccinated and placebo groups

Emary, 2021: Any cases where participants were unblinded to receive a vaccine through the government COVID-19 vaccination scheme were not included in this analysis. All endpoints were reviewed for inclusion by an independent, blinded adjudication committee, hence low risk of bias

Falsey, 2021: Participants were unblinded early, right after second dose to allow choice of vaccination. However, the unblinding occurred to a similar percentage of subjects in both vaccinated and placebo groups. All unblinded data is censored, but unlikely to affect outcome.

Frenck, 2021: Observer-blinded trial type is mentioned, but no supplementary information on method of blinding

Heath, 2021: 48 and 42 individuals in treatment and placebo groups censored without providing supplementary information

Walter, 2022: One participant who was randomly assigned to receive placebo was administered BNT162b2 in error; this participant

received two doses of BNT162b2 and is included in the BNT162b2 column.

Table 4. Risk of bias assessment of observational studies using ROBINS-I (1=low; 2=moderate; 3=severe; 4=critical; NA=no information)

Study, year	Confounding (1=low; 2=moderate; 3=severe; 4=critical; NA=no info)	Selection bias	Bias in measurement classification of interventions	Bias due to deviations from inteneded interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in selection of reported result	Average score	Risk assessment	Reasons
Abu Raddad, 2021	2	3	1	1	1	1	1	1.428571429	moderate	Confounding (moderate risk): comobidities/ baseline characteristics not listed Selection bias (severe risk): mainly selected younger people; percentage of cases <30 years: 42.6%, 60-69: 1.1%, ≥70: 0.3%
Accorsi 2022	1	1	1	1	1	2	1	1.142857143	low	1. Self-reported COVID-19 vaccination status (no. of doses, product, month and year of receipt of each dose) 2. Vaccination reporting was not mandatory, and information was not verified 3. Self-reported symptom status (asymptomatic or symptomatic) 4. Although some Omicron samples may have been misclassified as Delta, this would not affect the association between Omicron and vaccination status and would bias the association of Delta and vaccination toward that of Omicron such that the reported differences between Omicron and Delta are conservative.
Ali, 2021	2	1	1	1	1	1	1	1.142857143	low	Confounding (moderate risk): comobidities/ baseline characteristics not listed
Andrews, 2021	1	1	1	1	1	1	1	1	low	
Andrews, 2022	1	1	1	1	1	1	1	1	low	
Barda, 2021	1	1	1	1	1	1	1	1	low	
Bjork, 2022	2	1	1	1	1	1	1	1.142857143	low	Confounders such as comorbidities not adjusted due to limited data on disease history and co-exisiting conditions
Bruxvoort, 2021	1	1	1	1	1	1	1	1	low	
Bruxvoort, 2022	1	2	1	1	1	1	1	1.142857143	low	Selection bias (moderate risk): It is indicated that the vaccination timing between priorty groups (HCWs, people aged >65, workers in education and childcare, emergency services, and food and agriculture) and the rest of participants
Butt-2022	2	2	1	1	1	1	1	1.285714286	moderate	Confounding (moderate risk): controls were matched based on the calender week of second dose (experimental group received the third dose), so the time since last dose was different Selection bias (moderate risk): high proportion of male (94%)
Carazo, 2021	3	2	2	1	1	1	1	1.571428571	moderate	Confounding (severe risk): different types of HCW had different risk of COVID exposure/ vaccine priority/ testing frequency, but results were not stratified Selection bias (moderate risk): HCWs were divided into different priority groups, and some groups received vaccines first Classification of intervention (moderate risk): unclear classification: cases and controls were divided into one-dose (≥14 days), two-dose (≥7 days) and unvaccinated, and these three categories added up to 100%; one-dose (0-13 days) nor two-dose (0-6 days) were missing
Cerqueira-Silva, 2021	1	2	2	1	1	1	1	1.285714286	moderate	Selection bias (moderate risk): It is indicated that the vaccination timing between priorty groups, but the priority groups are not specified in result presentation Classification of intervention (Moderate risk): Individuals who were selected as cases could also serve as controls if they had negative tests that were collected >7 days before their positive test
Cerqueira-Silva, 2022a	2	2	1	1	1	1	1	1.285714286	moderate	Confounding (moderate risk): althoguh regression had been done, there is no clear presentaiton about the demographic and the different confounding factors associated with the participants of the study. Classification of interventions (moderate) : Terms such as "partially vaccinated" and "fully vaccinated" were used to describe the amout of doses refceived by participants. There is no clear definition of the terms.
Cerqueira-Silva, 2022b	1	1	1	1	1	1	1	1	low	
Chin, 2021	3	3	1	1	1	1	1	1.571428571	moderate	Confounding (moderate risk): prison consisted of separate cells and compounds. It was possible that different cells and compounds had highly variable infection rate, which was not fully considered in the study. Besides, the design of the study did not account for difference in health-related behaviours/ beliefs or testing frequency/ medical monitoring. Selection bias (severe risk): study participants were all prisoners, with very different composition as general population (95.6% male, 32.1% had disability caused by mental health)
Collie, 2022	2	1	3	1	3	1	1	1.714285714	moderate	Confounding (moderate risk): althoguh regression had been done, there is no clear presentaiton about the demographic and the different confounding factors associated with the participants of the study. Classification of intervention (severe risk): The paper classified vaccine types other than BNT162b2 as "other vaccines". Missing data (severe): Data were not available from the Department of Health regarding vaccine type and vaccinations administered in the public sector since August 25, 2021
Desai, 2022	1	1	1	1	1	1	1	1	low	
Ferdinands, 2022	1	1	3	1	1	1	3	1.571428571	moderate	Classification of interventions (severe risk): The results are sometime reported as "any mRNA vaccines", or using the different vaccine type Selection of reported result (severe): instead of reporting the actual vaccine taken by the participants, the paper reported the VE of "any mRNA vaccine"
Glatman-Freedman, 2021b	2	1	1	1	2	1	1	1.285714286	moderate	Confounding (moderate risk): comorbidities were not reported due to the lack of data Missing data (moderate risk): comorbidities were not reported due to the lack of data
Kirsebom, 2022	2	2	1	1	1	1	1	1.285714286	moderate	Confounding (moderate risk): comobidities/ baseline characteristics not listed Selection bias (moderate risk): in this study, 99.7% of subjects choose BNT162b2 as booster while 0.3% choose ChAdOx1-S, so ChAdOx1 data is very limited
Klein, 2022	2	2	1	1	1	3	2	1.714285714	moderate	Confounding (moderate risk): comobidities/ baseline characteristics not listed nor adjusted Selection bias (moderate risk): in this study, only 0.2% of subjects receive 3 doses, so 3 dose data is severely lacking Measurement of outcome (severe risk): the authors reported vaccine effectiveness for "delta-predominant period" and "omicron-predominant period". However, there is no testing about the actual variant causing each covid case Selection of reported result (moderate risk): some vaccinated effectiveness are marked NC (not calculated)
Lauring, 2022	1	2	1	1	1	1	1	1.142857143	low	Selection bias (moderate risk): only hospital patients were included

Lee 2022	1	1	1	1	1	1	1	1	low	
Lopez, 2021	1	2	1	1	1	1	1	1.142857143	low	Selection bias (moderate risk): a low proportion of participants were elderly people (60-69 years: 4.4%; 70-79: 1.1%; ≥80: 0.3%)
Magen 2022	1	1	1	1	1	1	1	1	low	1. Given the rigorous matching we performed and the very small difference in risk after the transient period of healthy vaccinee bias, we believe that little residual confounding remains. 2. Outcomes may be differentially misclassified as a function of whether persons opt to undergo a PCR test. However, the numbers of tests in the four-dose group were similar to those in the control group during the follow-up period of interest. The more severe outcomes are less prone to such potential misclassification.
Martinez-baz, 2021	3	2	1	1	1	1	1	1.428571429	moderate	Confounding (severe risk): the vaccination status of the index case affected viral load, and the vaccination status of index case and family members (usually listed as close contacts) were related (it was assumed that families had similar health behaviours). These confounding variables were not considered. Selection bias (moderate risk): the identification of close contacts greatly depended on the tracking ability of the public health agencies.
Natarajan 2022	1	1	2	1	1	2	1	1.285714286	moderate	1. Genetic characterization of viral variants causing infection among patients was not available, and analyses relied on dates when the Omicron variant became locally predominant based on surveillance data; therefore, the early phase of Omicron variant predominance in this study likely includes some medical encounters associated with the B.1.617.2 (Delta) variant. 2. Residual bias might exist from misclassification or incomplete ascertainment of data on the presence of immunocompromise, other health conditions, vaccination status, and unmeasured behaviors 3. Although adjustments to account for differences between unvaccinated and vaccinated persons were made, they did not account for differences among persons vaccinated with different strategies.
Nordstrom, 2021a	1	1	1	1	1	1	1	1	low	
Nordstrom, 2021b	1	2	1	1	1	1	1	1.142857143	low	Selection bias (moderate risk): high percentage of female in some groups (eg vaccinated with ChAdOx1 nCoV-19 / BNT162b2: 76.7%)
Olson, 2022	1	2	1	1	1	1	1	1.142857143	low	Selection bias (moderate risk): only hospital patients were included
Poukka, 2021	3	2	1	1	1	1	1	1.428571429	moderate	Confounding (severe risk): different types of healthcare workers (HCW) had different risk of exposure and different vaccination priority, but there was no effort in stratification/ regression based on HCW types Selection bias (moderate risk): high percentage of female (86%)
Powell, 2021	2	1	1	1	1	1	1	1.142857143	low	Confounding (moderate risk): comobidities/ baseline characteristics not listed or adjusted
Pozzetto, 2021	1	1	1	1	1	1	1	1	low	
Pramod 2022	2	1	1	1	3	1	1	1.428571429	moderate	Comorbidities reported, with age group stratification and the sex distribution is more or less around 50% For missing data, the sample size is sometime too small for an accurate depiction of the whole situation, especially for the cases with moderately sever disease and matched controls, which has only 10 pairs, not to mention the whole study only consisted of 360 matched pairs, making the sample size overly small
Prieto-alhambra, 2021	1	1	1	1	1	1	1	1	low	
Prunas, 2022	3	1	1	1	1	1	1	1.285714286	moderate	Confounding (severe risk): matching of vaccination and unvaccinated groups was imperfect, mean age of cases and controls differed by 0.3; comorbidities only included obesity.
Ranzani, 2022	1	1	1	1	2	1	3	1.428571429	moderate	Missing data (moderate risk): the study is based on Brazil passive surveillance data, so some information is missing (20.2% did not report race) Selective reporting (severe risk): vaccine effectiveness for hospitalisation and death is reported but without raw data. The authors selectively reported the raw data for symptomatic infection.
Reis, 2021	2	2	1	1	1	1	1	1.285714286	moderate	Confounding (moderate risk): vaccinated and unvaccinated groups may have different healthcare seeking behaviours Selection bias (moderate risk): proportion of participants aged 12, 13, 14 and 15 were similar (23% each), but much smaller for age 16 (6.8%), 17 (2.1%)
Shrotri, 2021	2	1	1	1	1	1	1	1.142857143	low	Confounding (moderate risk): comorbidities were not listed or adjusted
Skowronski, 2021a	2	1	2	1	1	1	1	1.285714286	moderate	Confounding (moderate risk): comobidities/ baseline characteristics not listed Classification of intervention (moderate bias): Results only showed whether participant had a dose of mRNA vaccine or not
Skowronski, 2021b	2	1	1	1	1	1	1	1.142857143	low	Confounding (moderate risk): comobidities/ baseline characteristics not listed
Tartof, 2021	2	1	1	1	2	1	1	1.285714286	moderate	Due to limitations in sample size, variant-specific vaccine effectiveness analyses were not stratified by age, were estimated only up to 4 months for SARS-CoV-2 infections, and were not stratified by month for COVID-19-related hospital admissions KPSC electronic health records might miss some vaccinations administered outside of the health system
Tartof, 2022	1	1	1	1	1	1	1	1	low	
Thompson, 2022	2	1	1	1	1	1	1	1.142857143	low	Confounding (moderate risk): comorbidities were not listed or adjusted
Tseng 2022	1	2	1	1	1	1	1	1.142857143	low	Selection Bias (moderate Risk): Although 3 different COVID variant, namely omicron, kappa and delta were reported, omicron might be more prevalent during the time frame of the study, leading to missleading conclusion is saying vaccine are less effective on omicron infection.
Wickert, 2021	2	1	3	1	1	3	1	1.714285714	moderate	Confounding (moderate risk): Comorbidities and other baseline characteristics were not included since it assumed participants from the USAF Academy had similar baseline characteristics Classification of intervention and Measurement of Outcome (severe risk): surveillance testing was done with Sofia SARS Antigen Fluorescent Immunoassay which has a known low sensitivity (41%) when used for screening of asymptomatic persons.
Wu, 2022	1	1	1	1	1	1	1	1	low	

Table 5A. League table for documented COVID-19 infections in vaccine-product-based network. Vaccine-product-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **documented** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown. Full vaccine regimen names are attached to the bottle of the table. Abbreviations: AZ-AstraZeneca; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen; NVX-Novavax; MD-Moderna; UNVAC-Unvaccinated

	1AZ (n=6)	1AZ1BNT (n=3)	1BNT (n=10)	1J (n=2)	1MD (n=6)	1NVX (n=1)	2AZ (n=9)	2BBV (n=1)	2BNT (n=16)	2BNT1MD (n=1)	2CV (n=1)	2CV1BNT (n=1)	2MD (n=9)	2NVX (n=1)	3BNT (n=2)	3MD (n=1)	4BNT (n=1)	rank
UNVAC	0.403 (0.133,1.213)	0.070 (0.008,0.583)	0.425 (0.120,1.318)	0.342 (0.085,1.407)	0.402 (0.085,1.632)	0.476 (0.080,2.882)	0.307 (0.102,0.832)	0.291 (0.051,1.645)	0.110 (0.041,0.293)	0.020 (0.000,1.597)	0.472 (0.046,4.088)	0.044 (0.005,0.428)	0.124 (0.040,0.343)	0.116 (0.020,0.598)	0.038 (0.001,2.412)	0.205 (0.027,1.480)	0.022 (0.000,2.859)	17(14,18)
1AZ		0.175 (0.017,1.861)	1.055 (0.206,4.661)	0.850 (0.143,4.949)	0.999 (0.163,5.682)	1.181 (0.152,9.985)	0.762 (0.162,3.138)	0.722 (0.091,5.553)	0.274 (0.067,1.055)	0.049 (0.001,3.930)	1.173 (0.099,13.489)	0.109 (0.009,1.332)	0.308 (0.062,1.289)	0.287 (0.034,2.052)	0.094 (0.001,5.552)	0.509 (0.051,4.614)	0.056 (0.000,6.610)	13(7,17)
1AZ1BNT			6.037 (0.542,70.066)	4.863 (0.425,63.382)	5.716 (0.454,75.063)	6.761 (0.471,114.897)	4.359 (0.464,42.023)	4.132 (0.259,77.625)	1.566 (0.163,14.544)	0.278 (0.002,36.286)	6.711 (0.304,176.010)	0.622 (0.027,16.153)	1.760 (0.165,17.832)	1.645 (0.119,25.940)	0.535 (0.006,46.331)	2.913 (0.166,52.637)	0.318 (0.002,53.979)	6(1,15)
1BNT				0.806 (0.134,5.150)	0.947 (0.152,5.861)	1.120 (0.149,9.462)	0.722 (0.149,3.263)	0.684 (0.092,5.876)	0.259 (0.058,1.246)	0.046 (0.001,4.109)	1.112 (0.087,13.023)	0.103 (0.009,1.318)	0.292 (0.059,1.309)	0.272 (0.031,2.128)	0.089 (0.001,5.465)	0.483 (0.052,4.894)	0.053 (0.000,7.502)	13(7,18)
1J					1.175 (0.147,8.432)	1.390 (0.152,13.802)	0.896 (0.151,4.609)	0.850 (0.092,7.490)	0.322 (0.058,1.744)	0.057 (0.000,5.666)	1.380 (0.093,18.581)	0.128 (0.009,1.732)	0.362 (0.059,2.070)	0.338 (0.035,2.942)	0.110 (0.002,7.635)	0.599 (0.055,6.897)	0.065 (0.000,8.447)	12(5,18)
1MD						1.183 (0.119,12.010)	0.763 (0.124,4.242)	0.723 (0.068,8.001)	0.274 (0.051,1.609)	0.049 (0.000,4.762)	1.174 (0.084,14.677)	0.109 (0.007,1.468)	0.308 (0.053,1.760)	0.288 (0.028,2.596)	0.094 (0.001,6.842)	0.510 (0.051,6.944)	0.056 (0.000,8.224)	13(5,18)
1NVX							0.645 (0.081,4.274)	0.611 (0.051,8.049)	0.232 (0.029,1.837)	0.041 (0.000,4.247)	0.993 (0.057,17.034)	0.092 (0.005,1.590)	0.260 (0.029,1.892)	0.243 (0.020,2.674)	0.079 (0.001,6.620)	0.431 (0.028,6.573)	0.047 (0.000,8.304)	13(5,18)
2AZ								0.948 (0.137,7.625)	0.359 (0.096,1.512)	0.064 (0.001,5.395)	1.540 (0.123,16.872)	0.143 (0.013,1.576)	0.404 (0.099,1.756)	0.377 (0.050,3.000)	0.123 (0.002,7.597)	0.668 (0.075,6.672)	0.073 (0.000,8.985)	12(6,16)
2BBV									0.379 (0.055,2.734)	0.067 (0.001,7.246)	1.624 (0.086,25.644)	0.150 (0.009,2.658)	0.426 (0.050,3.036)	0.398 (0.035,4.364)	0.130 (0.002,10.849)	0.705 (0.048,10.581)	0.077 (0.000,11.358)	11(4,18)
2BNT										0.178 (0.002,15.948)	4.287 (0.334,49.998)	0.397 (0.035,4.616)	1.125 (0.243,4.493)	1.050 (0.136,7.728)	0.342 (0.006,21.290)	1.861 (0.202,17.262)	0.203 (0.001,27.985)	6(2,12)
2BNT1MD											24.140 (0.178,3241.367)	2.237 (0.017,322.011)	6.333 (0.075,624.598)	5.916 (0.071,578.119)	1.925 (0.005,781.286)	10.479 (0.092,1454.996)	1.144 (0.002,713.533)	4(1,18)
2CV												0.093 (0.006,1.534)	0.262 (0.020,2.906)	0.245 (0.016,4.575)	0.080 (0.001,7.607)	0.434 (0.024,9.300)	0.047 (0.000,8.362)	13(4,18)
2CV1BNT													2.831 (0.225,32.604)	2.644 (0.147,39.820)	0.860 (0.010,87.548)	4.684 (0.233,93.067)	0.511 (0.003,104.682)	4(1,13)
2MD														0.934 (0.130,7.121)	0.304 (0.005,19.025)	1.655 (0.178,16.022)	0.181 (0.001,23.233)	7(3,12)
2NVX															0.325 (0.004,25.613)	1.772 (0.142,23.926)	0.193 (0.001,27.751)	7(2,15)
3BNT																5.444 (0.067,508.058)	0.594 (0.036,8.699)	5(1,17)
3MD																	0.109 (0.001,17.561)	10(3,18)
4BNT																		5(1,18)

Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	2NVX	Two-dose NVX-CoV2373 (Novavax)	1CV	One-dose CoronaVac	1BBI	One-dose BBIBP-CorV	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273	3MD	Three-dose mRNA-1273
2MD	Two-dose mRNA-1273	2BBI	Two-dose BBIBP-CorV	1BNT	One-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2	UNVAC	Unvaccinated
2AZ	ChAdOx1	2BBV	Two-dose BBV152 (Covaxin)	1MD	One-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273	3AZ	Three-dose ChAdOx1		
2CV	Two-dose CoronaVac	1J	One-dose Ad26.COV2.S (Janssen)	1AZ	One-dose ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2	3BNT	Three-dose BNT162b2		

Table 5B. League table for symptomatic COVID-19 infections in vaccine-product-based network. Vaccine-product-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **symptomatic** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown. Full vaccine regimen names are attached to the bottle of the table. Abbreviations: AZ-AstraZeneca; BBI-BBIBP-CorV; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen; NVX-Novavax; MD-Moderna; UNVAC-Unvaccinated

	1AZ (n=6)	1AZ1BNT (n=1)	1AZ1MD (n=1)	1BBI (n=1)	1BBI1CV (n=1)	1BBV (n=1)	1BNT (n=5)	1CV (n=5)	1J (n=2)	1MD (n=1)	1NVX (n=1)	2AZ (n=11)	2AZ1BNT (n=2)	2AZ1MD (n=1)	2BBI (n=1)	2BBV (n=2)	2BNT (n=8)	2BNT1MD (n=1)	2CV (n=6)	2CV1BNT (n=1)	2MD (n=5)	3AZ (n=2)	3BNT (n=4)	3CV (n=1)	3MD (n=3)	4BNT (n=1)	rank
UNVAC	0.604 (0.333,1.109)	0.412 (0.151,1.120)	0.241 (0.086,0.724)	0.375 (0.091,1.341)	0.254 (0.079,0.813)	0.815 (0.125,5.415)	0.292 (0.145,0.597)	0.592 (0.304,1.122)	0.342 (0.081,1.416)	0.314 (0.059,1.689)	0.089 (0.001,10.267)	0.359 (0.212,0.656)	0.252 (0.080,0.735)	0.215 (0.043,1.005)	0.315 (0.097,0.953)	0.461 (0.083,2.652)	0.104 (0.054,0.209)	0.268 (0.052,1.325)	0.452 (0.233,0.832)	0.239 (0.065,0.853)	0.282 (0.107,0.812)	0.205 (0.067,0.655)	0.155 (0.062,0.420)	0.607 (0.171,2.126)	0.235 (0.083,0.681)	0.080 (0.010,0.614)	26(23,27)
1AZ		0.683 (0.212,2.132)	0.400 (0.113,1.315)	0.621 (0.133,2.475)	0.421 (0.103,1.528)	1.351 (0.196,9.975)	0.484 (0.204,1.168)	0.982 (0.380,2.286)	0.567 (0.124,2.517)	0.521 (0.094,2.917)	0.148 (0.001,17.469)	0.595 (0.280,1.333)	0.417 (0.119,1.369)	0.356 (0.068,1.848)	0.522 (0.137,1.849)	0.764 (0.122,4.743)	0.172 (0.071,0.405)	0.445 (0.084,2.336)	0.749 (0.290,1.821)	0.396 (0.091,1.809)	0.467 (0.153,1.500)	0.340 (0.102,1.250)	0.257 (0.092,0.805)	1.006 (0.256,4.000)	0.389 (0.123,1.280)	0.133 (0.017,1.146)	22(14,26)
1AZ1BNT			0.585 (0.149,2.248)	0.910 (0.167,4.562)	0.616 (0.139,2.808)	1.977 (0.225,17.496)	0.708 (0.237,2.443)	1.437 (0.412,4.844)	0.830 (0.155,4.719)	0.763 (0.116,5.262)	0.217 (0.001,28.592)	0.870 (0.288,2.710)	0.610 (0.137,2.574)	0.521 (0.081,3.321)	0.764 (0.177,3.280)	1.119 (0.145,8.566)	0.252 (0.079,0.890)	0.651 (0.103,4.092)	1.096 (0.341,3.454)	0.580 (0.114,2.733)	0.684 (0.183,2.871)	0.497 (0.118,2.315)	0.377 (0.105,1.651)	1.472 (0.322,6.789)	0.570 (0.141,2.554)	0.195 (0.020,1.916)	17(6,26)
1AZ1MD				1.554 (0.263,8.136)	1.052 (0.229,4.700)	3.378 (0.382,31.418)	1.210 (0.368,4.669)	2.455 (0.676,8.228)	1.418 (0.233,8.615)	1.303 (0.196,9.411)	0.371 (0.002,46.533)	1.487 (0.476,4.945)	1.043 (0.228,5.190)	0.890 (0.137,6.153)	1.305 (0.293,5.882)	1.912 (0.238,14.394)	0.430 (0.124,1.538)	1.112 (0.153,7.124)	1.872 (0.523,6.351)	0.991 (0.180,5.195)	1.168 (0.277,5.381)	0.849 (0.188,3.873)	0.644 (0.158,2.882)	2.516 (0.493,12.627)	0.974 (0.225,4.168)	0.333 (0.033,3.381)	11(2,23)
1BBI					0.677 (0.136,3.663)	2.174 (0.212,22.062)	0.779 (0.186,3.788)	1.580 (0.373,7.041)	0.912 (0.132,6.472)	0.838 (0.103,7.167)	0.238 (0.001,30.862)	0.957 (0.249,4.604)	0.671 (0.133,4.169)	0.573 (0.068,5.029)	0.840 (0.161,4.645)	1.230 (0.142,11.303)	0.277 (0.063,1.326)	0.716 (0.091,5.773)	1.205 (0.302,5.362)	0.637 (0.108,4.060)	0.752 (0.153,4.172)	0.546 (0.102,3.308)	0.414 (0.087,2.309)	1.619 (0.272,10.098)	0.627 (0.122,3.656)	0.214 (0.018,2.947)	16(3,26)
1BBI1CV						3.212 (0.389,32.516)	1.151 (0.314,4.809)	2.334 (0.661,7.989)	1.348 (0.216,8.514)	1.239 (0.166,9.920)	0.352 (0.002,42.787)	1.414 (0.413,5.505)	0.992 (0.194,5.445)	0.846 (0.127,5.914)	1.241 (0.258,5.375)	1.818 (0.234,13.841)	0.409 (0.109,1.622)	1.058 (0.146,7.475)	1.780 (0.508,6.409)	0.942 (0.175,5.323)	1.111 (0.255,5.503)	0.808 (0.172,4.598)	0.612 (0.142,2.964)	2.392 (0.462,13.189)	0.926 (0.203,4.364)	0.317 (0.028,3.469)	12(2,24)
1BBV							0.358 (0.045,2.736)	0.727 (0.100,5.180)	0.420 (0.038,4.436)	0.386 (0.033,4.790)	0.110 (0.001,19.286)	0.440 (0.060,3.062)	0.309 (0.034,2.629)	0.263 (0.021,3.024)	0.386 (0.044,3.465)	0.566 (0.073,4.542)	0.127 (0.017,0.943)	0.329 (0.026,3.912)	0.554 (0.073,3.899)	0.293 (0.029,2.706)	0.346 (0.040,2.916)	0.251 (0.028,2.411)	0.191 (0.023,1.639)	0.745 (0.077,6.902)	0.288 (0.035,2.664)	0.099 (0.006,1.720)	22(5,27)
1BNT								2.028 (0.732,5.050)	1.171 (0.250,5.390)	1.077 (0.199,6.276)	0.306 (0.002,37.621)	1.229 (0.538,3.089)	0.862 (0.254,3.019)	0.735 (0.130,3.969)	1.078 (0.268,3.727)	1.579 (0.253,10.199)	0.355 (0.147,0.817)	0.919 (0.163,5.206)	1.547 (0.552,3.851)	0.818 (0.182,3.764)	0.965 (0.308,3.423)	0.702 (0.195,2.798)	0.532 (0.175,1.778)	2.078 (0.497,8.411)	0.805 (0.242,2.883)	0.275 (0.031,2.444)	13(5,21)
1CV									0.578 (0.121,2.772)	0.531 (0.091,3.201)	0.151 (0.001,19.444)	0.606 (0.277,1.516)	0.425 (0.124,1.569)	0.363 (0.066,1.995)	0.532 (0.151,1.748)	0.779 (0.125,5.099)	0.175 (0.070,0.469)	0.453 (0.081,2.320)	0.763 (0.317,1.833)	0.403 (0.106,1.586)	0.476 (0.157,1.622)	0.346 (0.101,1.355)	0.262 (0.090,0.898)	1.025 (0.291,3.663)	0.397 (0.122,1.386)	0.136 (0.014,1.256)	21(13,26)
1J										0.919 (0.119,7.982)	0.261 (0.002,36.026)	1.049 (0.251,4.932)	0.736 (0.127,4.756)	0.628 (0.078,5.401)	0.920 (0.145,5.178)	1.348 (0.157,11.752)	0.303 (0.062,1.477)	0.785 (0.097,6.742)	1.320 (0.283,6.116)	0.699 (0.106,4.673)	0.824 (0.144,4.549)	0.599 (0.098,3.713)	0.454 (0.081,2.656)	1.774 (0.276,11.380)	0.687 (0.120,3.980)	0.235 (0.018,3.046)	15(2,26)
1MD											0.284 (0.002,38.464)	1.142 (0.200,6.418)	0.801 (0.117,5.410)	0.683 (0.078,5.670)	1.002 (0.129,6.772)	1.467 (0.145,15.919)	0.330 (0.055,1.850)	0.854 (0.089,8.323)	1.437 (0.255,8.172)	0.760 (0.088,6.700)	0.896 (0.143,5.934)	0.652 (0.089,4.417)	0.494 (0.076,3.401)	1.931 (0.250,16.745)	0.747 (0.113,5.103)	0.256 (0.021,3.442)	14(2,27)
1NVX												4.013 (0.034,596.693)	2.815 (0.020,451.986)	2.401 (0.018,413.571)	3.521 (0.024,593.874)	5.158 (0.037,1007.59)	1.160 (0.010,166.991)	3.002 (0.023,554.957)	5.052 (0.044,722.638)	2.673 (0.017,420.071)	3.152 (0.027,448.790)	2.292 (0.018,356.827)	1.737 (0.014,264.838)	6.788 (0.045,1085.75)	2.628 (0.025,398.223)	0.899 (0.005,178.766)	9(1,27)
2AZ													0.701 (0.215,2.207)	0.598 (0.116,3.159)	0.877 (0.227,3.027)	1.285 (0.198,7.935)	0.289 (0.121,0.621)	0.748 (0.138,3.767)	1.259 (0.504,2.733)	0.666 (0.166,2.762)	0.785 (0.258,2.508)	0.571 (0.174,1.887)	0.433 (0.144,1.265)	1.691 (0.418,6.423)	0.655 (0.200,2.029)	0.224 (0.026,1.829)	16(9,22)
2AZ1BNT														0.853 (0.133,5.013)	1.251 (0.273,5.763)	1.833 (0.221,14.094)	0.412 (0.118,1.403)	1.066 (0.161,6.975)	1.795 (0.494,6.381)	0.950 (0.166,5.033)	1.120 (0.285,5.231)	0.814 (0.194,3.815)	0.617 (0.157,2.542)	2.412 (0.457,12.666)	0.934 (0.209,4.024)	0.319 (0.033,3.197)	12(3,24)
2AZ1MD															1.466 (0.210,10.203)	2.148 (0.203,22.308)	0.483 (0.093,2.474)	1.250 (0.160,10.920)	2.104 (0.385,12.309)	1.113 (0.146,8.610)	1.313 (0.224,7.963)	0.954 (0.159,6.096)	0.723 (0.120,4.484)	2.827 (0.398,21.510)	1.094 (0.174,6.657)	0.374 (0.032,4.994)	11(1,25)
2BBI																1.465 (0.193,11.642)	0.329 (0.094,1.272)	0.852 (0.124,6.158)	1.435 (0.415,4.902)	0.759 (0.139,4.362)	0.895 (0.223,3.878)	0.651 (0.137,3.582)	0.493 (0.118,2.159)	1.928 (0.370,10.286)	0.746 (0.171,3.359)	0.255 (0.025,3.089)	14(3,25)
2BBV																	0.225 (0.033,1.407)	0.582 (0.057,6.334)	0.979 (0.155,6.014)	0.518 (0.060,4.508)	0.611 (0.083,4.673)	0.444 (0.055,3.615)	0.337 (0.047,2.325)	1.316 (0.152,11.287)	0.509 (0.068,3.962)	0.174 (0.012,2.435)	17(2,27)
2BNT																		2.588 (0.523,14.180)	4.355 (1.603,11.189)	2.304 (0.533,10.016)	2.717 (0.912,9.157)	1.976 (0.568,7.622)	1.497 (0.535,4.787)	5.852 (1.469,23.746)	2.265 (0.728,7.484)	0.775 (0.094,6.640)	4(1,9)
2BNT1MD																			1.683 (0.318,9.173)	0.890 (0.115,7.318)	1.050 (0.174,6.581)	0.764 (0.119,5.173)	0.579 (0.101,3.593)	2.261 (0.304,17.342)	0.876 (0.137,5.648)	0.300 (0.022,3.806)	13(1,26)
2CV																				0.529 (0.135,2.184)	0.624 (0.201,2.092)	0.454 (0.126,1.694)	0.344 (0.111,1.145)	1.344 (0.374,4.972)	0.520 (0.152,1.713)	0.178 (0.020,1.668)	19(10,24)
2CV1BNT																					1.179 (0.233,6.581)	0.857 (0.160,5.086)	0.650 (0.138,3.462)	2.540 (0.568,12.612)	0.983 (0.173,5.076)	0.336 (0.028,3.896)	11(2,24)
2MD																						0.727 (0.168,3.105)	0.551 (0.156,1.964)	2.154 (0.412,10.597)	0.834 (0.250,2.764)	0.285 (0.029,2.547)	13(4,24)
3AZ																							0.758 (0.175,3.173)	2.962 (0.527,14.463)	1.147 (0.264,5.002)	0.392 (0.036,3.973)	10(2,22)
3BNT																								3.908 (0.817,18.795)	1.513 (0.423,5.240)	0.518 (0.063,4.104)	7(2,17)
3CV																									0.387 (0.073,2.008)	0.132 (0.011,1.421)	21(7,27)
3MD																										0.342 (0.039,3.362)	11(2,22)
4BNT																											5(1,22)

Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	2NVX	Two-dose NVX-CoV2373 (Novavax)	1CV	One-dose CoronaVac	1BBI	One-dose BBIBP-CorV	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273	3MD	Three-dose mRNA-1273
2MD	Two-dose mRNA-1273	2BBI	Two-dose BBIBP-CorV	1BNT	One-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2	UNVAC	Unvaccinated
2AZ	ChAdOx1	2BBV	Two-dose BBV152 (Covaxin)	1MD	One-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273	3AZ	Three-dose ChAdOx1		
2CV	Two-dose CoronaVac	1J	One-dose Ad26.COV2.S (Janssen)	1AZ	One-dose ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2	3BNT	Three-dose BNT162b2		

Table 5C. League table for severe COVID-19 infections in vaccine-product-based network. Vaccine-product-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **severe** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown. Full vaccine regimen names are attached to the bottle of the table. Abbreviations: AZ-AstraZeneca; BBI-BBIBP-CorV; BBV-Bharat Biotech; BNT-BioNTech; CV-CoronaVac; J-Janssen; UNVAC-Unvaccinated

	1AZ (n=1)	1BBI (n=1)	1BBI1CV (n=1)	1BNT (n=3)	1CV (n=2)	1J (n=3)	2AZ (n=2)	2BBI (n=1)	2BBV (n=1)	2BNT (n=5)	2CV (n=3)	3BNT (n=3)	4BNT (n=1)	rank
UNVAC	0.495 (0.036,6.344)	0.373 (0.005,18.985)	0.310 (0.010,10.401)	0.410 (0.091,1.919)	0.478 (0.056,3.737)	0.395 (0.076,2.466)	0.143 (0.018,1.140)	0.127 (0.002,5.855)	0.070 (0.002,2.585)	0.323 (0.078,1.666)	0.201 (0.033,1.049)	0.146 (0.021,0.978)	0.088 (0.003,2.860)	12(9,14)
1AZ		0.753 (0.005,76.739)	0.627 (0.008,49.059)	0.828 (0.040,15.342)	0.965 (0.035,21.562)	0.798 (0.039,16.283)	0.289 (0.010,5.957)	0.257 (0.002,22.374)	0.141 (0.002,10.373)	0.653 (0.036,13.126)	0.405 (0.019,6.754)	0.295 (0.010,6.728)	0.179 (0.002,12.569)	9(2,14)
1BBI			0.832 (0.008,113.361)	1.099 (0.016,89.758)	1.282 (0.018,106.897)	1.059 (0.015,103.377)	0.384 (0.004,35.682)	0.341 (0.002,52.829)	0.187 (0.001,47.723)	0.866 (0.011,83.907)	0.538 (0.010,44.591)	0.392 (0.006,40.213)	0.237 (0.002,57.230)	8(1,14)
1BBI1CV				1.320 (0.029,57.679)	1.540 (0.036,76.487)	1.273 (0.027,59.013)	0.461 (0.010,22.888)	0.409 (0.003,38.649)	0.225 (0.001,30.469)	1.041 (0.022,50.551)	0.647 (0.016,27.903)	0.471 (0.011,27.274)	0.285 (0.003,37.137)	8(1,14)
1BNT					1.166 (0.097,14.334)	0.964 (0.103,9.177)	0.349 (0.032,3.490)	0.310 (0.004,19.200)	0.170 (0.003,8.244)	0.788 (0.108,7.330)	0.490 (0.050,4.204)	0.357 (0.029,4.212)	0.216 (0.005,8.629)	9(3,14)
1CV						0.826 (0.065,12.650)	0.299 (0.019,5.001)	0.266 (0.003,16.566)	0.146 (0.002,9.942)	0.676 (0.059,9.782)	0.420 (0.032,5.267)	0.306 (0.017,5.068)	0.185 (0.003,9.088)	9(3,14)
1J							0.362 (0.027,4.647)	0.322 (0.003,20.031)	0.177 (0.003,11.774)	0.818 (0.084,8.933)	0.508 (0.044,4.718)	0.370 (0.025,4.608)	0.224 (0.005,10.727)	9(3,14)
2AZ								0.888 (0.009,58.880)	0.488 (0.006,31.245)	2.257 (0.199,29.485)	1.402 (0.118,17.629)	1.021 (0.060,17.675)	0.619 (0.011,34.293)	5(1,12)
2BBI									0.550 (0.003,123.947)	2.543 (0.043,219.450)	1.580 (0.031,117.073)	1.151 (0.018,108.853)	0.697 (0.005,147.767)	6(1,14)
2BBV										4.627 (0.094,257.731)	2.874 (0.050,177.453)	2.093 (0.038,135.085)	1.268 (0.010,189.125)	4(1,14)
2BNT											0.621 (0.050,5.323)	0.452 (0.040,4.227)	0.274 (0.006,9.918)	8(3,13)
2CV												0.728 (0.054,10.249)	0.441 (0.010,23.543)	6(2,12)
3BNT													0.606 (0.021,22.022)	5(1,12)
4BNT														5(1,14)

Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	2NVX	Two-dose NVX-CoV2373 (Novavax)	1CV	One-dose CoronaVac	1BBI	One-dose BBIBP-CorV	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273	3MD	Three-dose mRNA-1273
2MD	Two-dose mRNA-1273	2BBI	Two-dose BBIBP-CorV	1BNT	One-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2	UNVAC	Unvaccinated
2AZ	ChAdOx1	2BBV	Two-dose BBV152 (Covaxin)	1MD	One-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273	3AZ	Three-dose ChAdOx1		
2CV	Two-dose CoronaVac	1J	One-dose Ad26.COV2.S (Janssen)	1AZ	One-dose ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2	3BNT	Three-dose BNT162b2		

Table 5D. League table for COVID-19 related hospitalization in vaccine-product-based network. Vaccine-product-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having COVID-19 related **hospitalization** after vaccination. The number of studies (n) that contributed the data to each comparison is shown. Full vaccine regimen names are attached to the bottle of the table. Abbreviations: AZ-AstraZeneca; BNT-BioNTech; CV-CoronaVac; MD-Moderna; J-Janssen; UNVAC-Unvaccinated

	1AZ (n=3)	1AZ1BNT (n=1)	1BNT (n=7)	1CV (n=1)	1J (n=2)	1MD (n=4)	2AZ (n=4)	2AZ1BNT (n=1)	2BNT (n=9)	2CV (n=1)	2J (n=1)	2MD (n=6)	3AZ (n=1)	3BNT (n=4)	3MD (n=2)	4BNT (n=1)	rank
UNVAC	0.303 (0.108,0.848)	0.499 (0.116,2.339)	0.243 (0.104,0.627)	0.617 (0.050,7.744)	0.395 (0.129,1.338)	0.316 (0.108,0.949)	0.300 (0.114,0.760)	0.064 (0.013,0.322)	0.272 (0.115,0.623)	0.324 (0.026,3.547)	0.384 (0.053,2.714)	0.102 (0.037,0.291)	0.146 (0.026,0.856)	0.046 (0.011,0.203)	0.030 (0.005,0.159)	0.018 (0.001,0.224)	16(14,17)
1AZ		1.651 (0.273,8.564)	0.804 (0.228,3.109)	2.040 (0.125,29.526)	1.306 (0.288,6.195)	1.045 (0.260,4.312)	0.991 (0.238,3.516)	0.211 (0.030,1.393)	0.897 (0.236,3.237)	1.069 (0.061,14.010)	1.270 (0.132,11.069)	0.339 (0.086,1.383)	0.483 (0.063,3.653)	0.154 (0.028,0.876)	0.099 (0.012,0.756)	0.058 (0.004,0.867)	11(5,16)
1AZ1BNT			0.487 (0.097,3.006)	1.236 (0.068,23.806)	0.791 (0.129,5.074)	0.633 (0.102,3.598)	0.600 (0.094,3.043)	0.128 (0.013,1.040)	0.544 (0.100,2.879)	0.648 (0.033,11.459)	0.769 (0.062,8.206)	0.205 (0.035,1.288)	0.293 (0.030,2.729)	0.093 (0.012,0.689)	0.060 (0.006,0.549)	0.035 (0.002,0.699)	13(6,17)
1BNT				2.537 (0.173,39.344)	1.624 (0.371,7.008)	1.299 (0.309,4.756)	1.232 (0.302,4.285)	0.262 (0.038,1.582)	1.116 (0.335,3.562)	1.330 (0.096,17.082)	1.579 (0.173,12.031)	0.421 (0.106,1.436)	0.601 (0.085,4.189)	0.191 (0.035,1.006)	0.123 (0.017,0.765)	0.072 (0.005,1.063)	9(5,15)
1CV					0.640 (0.042,11.067)	0.512 (0.034,7.660)	0.486 (0.034,7.451)	0.103 (0.006,2.063)	0.440 (0.031,5.902)	0.524 (0.033,7.978)	0.623 (0.027,14.243)	0.166 (0.011,2.484)	0.237 (0.011,5.154)	0.075 (0.004,1.359)	0.049 (0.002,1.078)	0.029 (0.001,0.942)	13(4,17)
1J						0.800 (0.165,3.612)	0.759 (0.154,3.072)	0.162 (0.022,1.086)	0.687 (0.152,2.832)	0.819 (0.050,12.370)	0.972 (0.114,7.547)	0.259 (0.052,1.165)	0.370 (0.040,2.864)	0.118 (0.019,0.698)	0.076 (0.009,0.539)	0.045 (0.003,0.792)	12(6,17)
1MD							0.948 (0.201,3.655)	0.202 (0.027,1.406)	0.859 (0.221,3.145)	1.023 (0.062,14.763)	1.216 (0.134,9.967)	0.324 (0.076,1.368)	0.462 (0.059,3.429)	0.147 (0.025,0.854)	0.095 (0.012,0.675)	0.056 (0.004,0.861)	11(5,16)
2AZ								0.213 (0.037,1.325)	0.906 (0.266,3.098)	1.079 (0.073,15.844)	1.282 (0.156,11.013)	0.342 (0.085,1.416)	0.488 (0.074,3.246)	0.155 (0.029,0.936)	0.100 (0.013,0.652)	0.059 (0.004,1.008)	11(6,15)
2AZ1BNT									4.254 (0.706,28.011)	5.068 (0.248,94.125)	6.020 (0.501,71.114)	1.605 (0.226,10.737)	2.290 (0.264,19.222)	0.728 (0.090,6.490)	0.470 (0.040,4.512)	0.276 (0.015,5.467)	4(1,11)
2BNT										1.191 (0.087,14.879)	1.415 (0.159,10.857)	0.377 (0.106,1.451)	0.538 (0.073,3.646)	0.171 (0.038,0.832)	0.111 (0.016,0.663)	0.065 (0.005,0.872)	10(6,15)
2CV											1.188 (0.055,27.880)	0.317 (0.025,4.738)	0.452 (0.022,9.642)	0.144 (0.009,2.612)	0.093 (0.005,1.794)	0.054 (0.002,1.775)	11(2,17)
2J												0.267 (0.032,2.559)	0.380 (0.028,5.025)	0.121 (0.011,1.397)	0.078 (0.006,1.016)	0.046 (0.002,1.118)	12(4,17)
2MD													1.427 (0.181,11.845)	0.454 (0.079,2.569)	0.293 (0.040,1.964)	0.172 (0.012,2.440)	5(2,11)
3AZ														0.318 (0.032,3.274)	0.205 (0.017,2.287)	0.120 (0.006,2.645)	7(2,15)
3BNT															0.646 (0.062,5.479)	0.379 (0.036,3.746)	3(1,8)
3MD																0.586 (0.029,14.289)	3(1,7)
4BNT																	2(1,9)

Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	2NVX	Two-dose NVX-CoV2373 (Novavax)	1CV	One-dose CoronaVac	1BBI	One-dose BBIBP-CorV	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273	3MD	Three-dose mRNA-1273
2MD	Two-dose mRNA-1273	2BBI	Two-dose BBIBP-CorV	1BNT	One-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2	UNVAC	Unvaccinated
2AZ	ChAdOx1	2BBV	Two-dose BBV152 (Covaxin)	1MD	One-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273	3AZ	Three-dose ChAdOx1		
2CV	Two-dose CoronaVac	1J	One-dose Ad26.COV2.S (Janssen)	1AZ	One-dose ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2	3BNT	Three-dose BNT162b2		

Table 5E. League table for COVID-19 related deaths in vaccine-product-based network. Vaccine-product-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having COVID-19 related **deaths** after vaccination. The number of studies (n) that contributed the data to each comparison is shown. Full vaccine regimen names are attached to the bottle of the table. Abbreviations: AZ-AstraZeneca; BNT-BioNTech; CV-CoronaVac; MD-Moderna; UNVAC-Unvaccinated

	1AZ (n=1)	**1BNT (n=1)**	**1CV (n=1)**	**1MD (n=1)**	**2AZ (n=2)**	**2AZ1BNT (n=1)**	**2BNT (n=3)**	**2CV (n=1)**	**2MD (n=1)**	**3BNT (n=3)**	**rank**
UNVAC	0.545 (0.001,340.267)	1.207 (0.006,307.067)	0.602 (0.001,402.546)	1.960 (0.000,12426.231)	0.388 (0.003,27.874)	0.133 (0.000,320.162)	0.495 (0.007,36.969)	0.356 (0.001,187.255)	0.285 (0.000,109.151)	0.428 (0.005,92.471)	7(4,10)
1AZ		2.215 (0.001,16359.262)	1.103 (0.000,18794.115)	3.594 (0.000,256335.399)	0.711 (0.000,834.630)	0.243 (0.000,3360.971)	0.908 (0.001,1946.365)	0.654 (0.000,9820.896)	0.523 (0.000,4526.679)	0.786 (0.000,3401.142)	6(1,11)
1BNT			0.498 (0.000,1859.750)	1.623 (0.000,44533.184)	0.321 (0.000,303.919)	0.110 (0.000,972.903)	0.410 (0.001,468.181)	0.295 (0.000,1085.004)	0.236 (0.000,526.297)	0.355 (0.000,593.537)	7(1,11)
1CV				3.257 (0.000,172064.980)	0.644 (0.000,1810.596)	0.220 (0.000,3032.665)	0.823 (0.000,2982.881)	0.592 (0.000,3601.836)	0.474 (0.000,3507.337)	0.712 (0.000,3086.315)	6(1,11)
1MD					0.198 (0.000,2848.236)	0.068 (0.000,18747.417)	0.253 (0.000,5488.434)	0.182 (0.000,15599.514)	0.146 (0.000,3884.438)	0.219 (0.000,11956.049)	8(1,11)
2AZ						0.342 (0.000,3359.015)	1.278 (0.004,812.392)	0.919 (0.000,1778.369)	0.736 (0.000,1332.326)	1.105 (0.003,1729.322)	6(1,11)
2AZ1BNT							3.736 (0.001,11946.084)	2.688 (0.000,51210.638)	2.152 (0.000,30836.816)	3.232 (0.001,26307.651)	4(1,11)
2BNT								0.719 (0.000,1731.645)	0.576 (0.000,583.935)	0.865 (0.003,356.392)	6(1,11)
2CV									0.801 (0.000,5113.691)	1.202 (0.000,4686.387)	5(1,11)
2MD										1.502 (0.001,8483.104)	5(1,11)
3BNT											5(1,11)

Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description	Treatment code	Description
2BNT	Two-dose BNT162b2	2NVX	Two-dose NVX-CoV2373 (Novavax)	1CV	One-dose CoronaVac	1BBI	One-dose BBIBP-CorV	1AZ1BNT	One-dose ChAdOx2 with one-dose BNT162b2	2AZ1MD	Two-dose ChAdOx1 with one-dose mRNA-1273	3MD	Three-dose mRNA-1273
2MD	Two-dose mRNA-1273	2BBI	Two-dose BBIBP-CorV	1BNT	One-dose BNT162b2	1BBV	One-dose BBV152 (Covaxin)	1BBI1CV	One-dose BBIBP-CorV with one-dose CoronaVac	2AZ1BNT	Two-dose ChAdOx1 with one-dose BNT162b2	UNVAC	Unvaccinated
2AZ	ChAdOx1	2BBV	Two-dose BBV152 (Covaxin)	1MD	One-dose mRNA-1273	1NVX	One-dose NVX-CoV2373 (Novavax)	2BNT1MD	Two-dose BNT162b2 with one-dose mRNA-1273	3AZ	Three-dose ChAdOx1		
2CV	Two-dose CoronaVac	1J	One-dose Ad26.COV2.S (Janssen)	1AZ	One-dose ChAdOx1	1AZ1MD	One-dose ChAdOx2 with one-dose mRNA-1273	2CV1BNT	Two-dose CoronaVac with one-dose BNT162b2	3BNT	Three-dose BNT162b2		

Table 6A. League table for documented COVID-19 infections in platform-based network. Platform-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **documented** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown.

	one-dose-adeno (n=7)	one-dose-protein-based (n=1)	one-dose-mRNA (n=12)	two-dose-adeno (n=9)	two-dose-inactivated (n=3)	two-dose-protein-based (n=1)	two-dose-mRNA (n=22)	three-dose-mRNA (n=5)	two-dose-adeno-with-one-dose-mRNA (n=3)	two-dose-inactivated-with-one-dose-mRNA (n=1)	four-dose-mRNA (n=1)	rank
unvaccinated	0.399 (0.137,1.041)	0.474 (0.095,2.529)	0.474 (0.149,1.519)	0.277 (0.091,0.753)	0.486 (0.129,1.737)	0.119 (0.024,0.598)	0.135 (0.054,0.319)	0.076 (0.016,0.310)	0.071 (0.008,0.582)	0.045 (0.005,0.399)	0.058 (0.005,0.595)	12(10,12)
one-dose-adeno		1.188 (0.176,7.757)	1.190 (0.260,5.226)	0.696 (0.155,2.557)	1.220 (0.232,6.056)	0.298 (0.041,2.012)	0.340 (0.089,1.345)	0.190 (0.031,1.090)	0.178 (0.016,1.741)	0.113 (0.010,1.248)	0.145 (0.010,2.059)	9(5,11)
one-dose-protein-based			1.002 (0.138,7.439)	0.586 (0.082,3.538)	1.027 (0.111,8.243)	0.251 (0.026,2.310)	0.286 (0.046,2.001)	0.160 (0.017,1.255)	0.150 (0.010,2.003)	0.095 (0.007,1.529)	0.122 (0.007,2.114)	9(4,12)
one-dose-mRNA				0.585 (0.113,2.446)	1.025 (0.178,5.882)	0.250 (0.035,1.863)	0.285 (0.068,1.191)	0.159 (0.025,0.949)	0.150 (0.014,1.370)	0.095 (0.008,1.193)	0.122 (0.009,1.883)	9(5,12)
two-dose-adeno					1.754 (0.347,10.161)	0.428 (0.068,3.080)	0.488 (0.134,1.964)	0.273 (0.049,1.644)	0.256 (0.030,2.297)	0.163 (0.015,2.015)	0.209 (0.015,2.845)	7(4,11)
two-dose-inactivated						0.244 (0.028,1.949)	0.278 (0.063,1.270)	0.155 (0.022,0.982)	0.146 (0.012,1.525)	0.093 (0.009,0.923)	0.119 (0.009,1.773)	9(5,12)
two-dose-protein-based							1.140 (0.187,7.184)	0.636 (0.072,4.711)	0.598 (0.043,7.643)	0.380 (0.029,6.047)	0.487 (0.029,8.856)	5(1,10)
two-dose-mRNA								0.558 (0.096,2.773)	0.524 (0.056,4.689)	0.333 (0.033,3.602)	0.427 (0.034,5.432)	5(2,8)
three-dose-mRNA									0.939 (0.076,11.067)	0.597 (0.043,8.589)	0.766 (0.056,9.885)	4(1,8)
two-dose-adeno-with-one-dose-mRNA										0.635 (0.031,12.050)	0.815 (0.033,20.326)	4(1,10)
two-dose-inactivated-with-one-dose-mRNA											1.283 (0.047,34.176)	3(1,8)
four-dose-mRNA												3(1,10)

Table 6B. League table for symptomatic COVID-19 infections in platform-based network. Platform-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **symptomatic** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown.

	one-dose-adeno (n=7)	one-dose-inactivated (n=6)	one-dose-protein-based (n=1)	one-dose-mRNA (n=5)	two-dose-adeno (n=11)	two-dose-inactivated (n=9)	two-dose-mRNA (n=9)	three-dose-inactivated (n=1)	three-dose-adeno (n=2)	three-dose-mRNA (n=4)	two-dose-adeno-with-one-dose-mRNA (n=2)	two-dose-inactivated-with-one-dose-mRNA (n=2)	four-dose-mRNA (n=1)	rank
unvaccinated	0.593 (0.338,1.019)	0.596 (0.335,1.047)	0.093 (0.001,6.830)	0.312 (0.165,0.599)	0.360 (0.226,0.633)	0.426 (0.247,0.719)	0.125 (0.070,0.225)	0.589 (0.182,1.846)	0.205 (0.071,0.572)	0.115 (0.053,0.260)	0.357 (0.186,0.713)	0.218 (0.086,0.556)	0.061 (0.009,0.408)	14(12,14)
one-dose-adeno		1.005 (0.461,2.151)	0.157 (0.002,12.212)	0.527 (0.246,1.182)	0.607 (0.314,1.248)	0.720 (0.332,1.505)	0.211 (0.100,0.461)	0.994 (0.278,3.653)	0.346 (0.110,1.082)	0.194 (0.079,0.511)	0.602 (0.252,1.372)	0.369 (0.120,1.095)	0.103 (0.015,0.720)	11(8,13)
one-dose-inactivated			0.156 (0.002,11.427)	0.524 (0.229,1.297)	0.604 (0.297,1.364)	0.716 (0.353,1.431)	0.209 (0.094,0.498)	0.989 (0.279,3.357)	0.344 (0.106,1.119)	0.193 (0.072,0.538)	0.599 (0.254,1.463)	0.367 (0.124,1.064)	0.103 (0.014,0.717)	11(8,13)
one-dose-protein-based				3.352 (0.041,253.440)	3.864 (0.050,275.457)	4.581 (0.061,335.197)	1.340 (0.017,98.139)	6.325 (0.077,586.712)	2.204 (0.027,199.027)	1.234 (0.015,96.577)	3.833 (0.052,275.195)	2.346 (0.029,178.672)	0.657 (0.006,59.812)	5(1,14)
one-dose-mRNA					1.153 (0.549,2.619)	1.367 (0.556,3.061)	0.400 (0.184,0.871)	1.887 (0.514,7.596)	0.657 (0.202,2.283)	0.368 (0.151,1.036)	1.144 (0.449,2.886)	0.700 (0.238,2.107)	0.196 (0.029,1.526)	7(4,12)
two-dose-adeno						1.186 (0.537,2.382)	0.347 (0.156,0.678)	1.637 (0.459,5.694)	0.570 (0.181,1.679)	0.319 (0.128,0.763)	0.992 (0.416,2.195)	0.607 (0.209,1.675)	0.170 (0.025,1.176)	8(5,12)
two-dose-inactivated							0.293 (0.135,0.672)	1.381 (0.398,4.771)	0.481 (0.154,1.594)	0.269 (0.109,0.712)	0.837 (0.361,1.984)	0.512 (0.190,1.440)	0.144 (0.020,1.010)	9(6,12)
two-dose-mRNA								4.720 (1.284,18.222)	1.644 (0.523,5.372)	0.920 (0.415,2.412)	2.860 (1.158,6.808)	1.751 (0.604,5.033)	0.491 (0.074,3.453)	3(1,6)
three-dose-inactivated									0.348 (0.071,1.650)	0.195 (0.046,0.812)	0.606 (0.163,2.243)	0.371 (0.094,1.374)	0.104 (0.012,0.984)	11(5,14)
three-dose-adeno										0.560 (0.170,1.951)	1.739 (0.530,5.765)	1.065 (0.304,3.840)	0.298 (0.036,2.478)	5(2,11)
three-dose-mRNA											3.107 (1.064,8.234)	1.902 (0.585,5.938)	0.533 (0.085,3.531)	3(1,6)
two-dose-adeno-with-one-dose-mRNA												0.612 (0.206,1.901)	0.172 (0.025,1.256)	8(4,12)
two-dose-inactivated-with-one-dose-mRNA													0.280 (0.036,2.290)	6(2,11)
four-dose-mRNA														2(1,8)

Table 6C. League table for severe COVID-19 infections in platform-based network. Platform-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having **severe** COVID-19 infections after vaccination. The number of studies (n) that contributed the data to each comparison is shown.

	one-dose-adeno (n=3)	one-dose-inactivated (n=2)	one-dose-mRNA (n=3)	two-dose-adeno (n=2)	two-dose-inactivated (n=5)	two-dose-mRNA (n=5)	three-dose-mRNA (n=3)	four-dose-mRNA (n=1)	rank
unvaccinated	0.423 (0.092,1.938)	0.418 (0.054,3.100)	0.406 (0.097,1.685)	0.128 (0.023,0.807)	0.184 (0.046,0.717)	0.313 (0.083,1.259)	0.147 (0.024,0.844)	0.082 (0.004,2.064)	8(7,9)
one-dose-adeno		0.989 (0.090,10.230)	0.960 (0.127,7.041)	0.302 (0.034,2.917)	0.435 (0.056,3.136)	0.741 (0.101,5.804)	0.347 (0.029,3.315)	0.193 (0.006,6.415)	6(2,9)
one-dose-inactivated			0.971 (0.082,10.563)	0.306 (0.022,4.095)	0.439 (0.048,3.750)	0.749 (0.069,9.096)	0.350 (0.026,4.983)	0.195 (0.006,8.929)	6(2,9)
one-dose-mRNA				0.315 (0.037,2.580)	0.453 (0.065,3.022)	0.772 (0.115,5.864)	0.361 (0.037,3.412)	0.201 (0.006,7.627)	6(2,9)
two-dose-adeno					1.437 (0.160,11.650)	2.451 (0.248,25.578)	1.146 (0.094,12.985)	0.638 (0.017,25.789)	3(1,8)
two-dose-inactivated						1.705 (0.250,11.810)	0.798 (0.085,7.727)	0.444 (0.016,14.120)	4(1,8)
two-dose-mRNA							0.468 (0.051,3.641)	0.260 (0.009,8.206)	5(2,9)
three-dose-mRNA								0.556 (0.028,16.437)	3(1,8)
four-dose-mRNA									3(1,9)

Table 6D. League table for COVID-19 related hospitalization in platform-based network. Platform-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having COVID-19 related **hospitalization** after vaccination. The number of studies (n) that contributed the data to each comparison is shown.

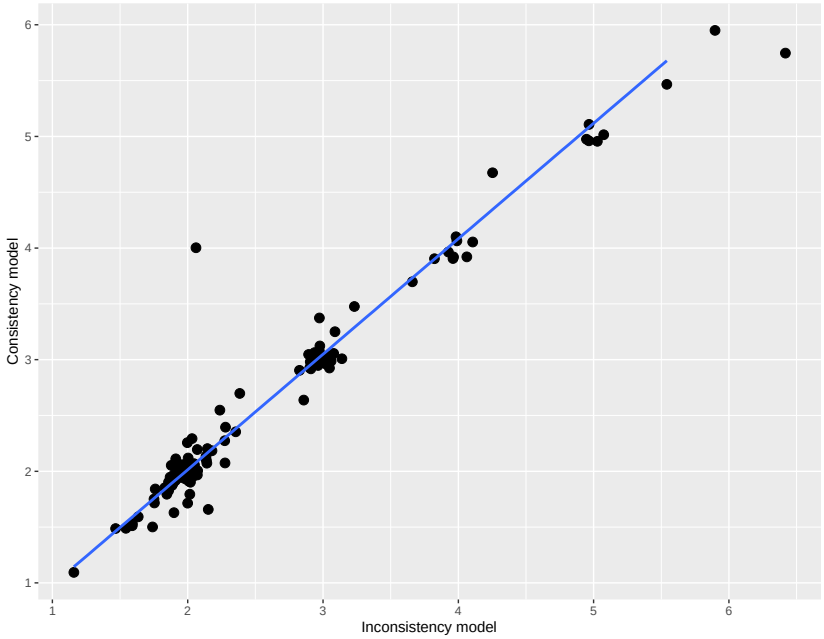
	one-dose-adeno (n=4)	one-dose-inactivated (n=1)	one-dose-mRNA (n=9)	two-dose-adeno (n=5)	two-dose-inactivated (n=1)	two-dose-mRNA (n=13)	one-dose-adeno-with-one-dose-mRNA (n=1)	three-dose-adeno (n=1)	three-dose-mRNA (n=8)	two-dose-adeno-with-one-dose-mRNA (n=1)	two-dose-inactivated-with-one-dose-mRNA (n=1)	four-dose-mRNA (n=1)	rank
unvaccinated	0.340 (0.121,0.982)	0.614 (0.048,6.476)	0.300 (0.123,0.777)	0.254 (0.098,0.620)	0.319 (0.024,4.259)	0.232 (0.109,0.593)	0.136 (0.024,0.791)	0.144 (0.030,0.671)	0.056 (0.020,0.153)	0.385 (0.038,3.694)	0.061 (0.014,0.258)	0.024 (0.003,0.175)	12(10,13)
one-dose-adeno		1.807 (0.124,25.210)	0.885 (0.256,3.234)	0.746 (0.199,2.523)	0.940 (0.066,14.390)	0.682 (0.204,2.583)	0.399 (0.056,2.616)	0.423 (0.067,2.552)	0.165 (0.039,0.695)	1.133 (0.091,12.147)	0.181 (0.031,0.998)	0.070 (0.008,0.615)	9(5,12)
one-dose-inactivated			0.490 (0.035,7.128)	0.413 (0.034,6.389)	0.520 (0.038,8.208)	0.377 (0.030,5.860)	0.221 (0.011,4.553)	0.234 (0.014,4.263)	0.092 (0.007,1.500)	0.627 (0.022,17.389)	0.100 (0.006,1.724)	0.039 (0.002,0.891)	10(3,13)
one-dose-mRNA				0.844 (0.223,2.920)	1.062 (0.077,19.045)	0.771 (0.250,2.424)	0.451 (0.062,3.014)	0.478 (0.077,2.504)	0.187 (0.046,0.700)	1.281 (0.121,11.757)	0.205 (0.034,1.011)	0.079 (0.008,0.721)	8(4,12)
two-dose-adeno					1.259 (0.083,17.574)	0.914 (0.285,3.619)	0.535 (0.084,3.618)	0.566 (0.101,3.193)	0.222 (0.061,0.924)	1.518 (0.141,16.851)	0.242 (0.048,1.262)	0.094 (0.011,0.905)	8(4,12)
two-dose-inactivated						0.726 (0.048,9.961)	0.425 (0.020,7.595)	0.450 (0.022,9.186)	0.176 (0.011,2.821)	1.206 (0.036,32.412)	0.193 (0.010,3.264)	0.074 (0.003,1.590)	8(2,13)
two-dose-mRNA							0.585 (0.084,3.646)	0.620 (0.097,3.300)	0.243 (0.060,0.785)	1.661 (0.141,16.635)	0.265 (0.046,1.298)	0.102 (0.011,0.865)	7(4,11)
one-dose-adeno-with-one-dose-mRNA								1.060 (0.097,11.226)	0.415 (0.056,2.806)	2.840 (0.160,51.769)	0.453 (0.048,3.812)	0.175 (0.012,2.238)	5(1,12)
three-dose-adeno									0.391 (0.063,2.420)	2.680 (0.170,47.168)	0.428 (0.066,2.970)	0.165 (0.013,2.058)	6(2,11)
three-dose-mRNA										6.847 (0.617,94.638)	1.093 (0.196,6.244)	0.422 (0.051,3.545)	3(1,6)
two-dose-adeno-with-one-dose-mRNA											0.160 (0.010,2.568)	0.062 (0.003,1.268)	9(2,13)
two-dose-inactivated-with-one-dose-mRNA												0.386 (0.034,5.014)	3(1,7)
four-dose-mRNA													2(1,6)

Table 6E. League table for COVID-19 related deaths in platform-based network. Platform-based network pairwise comparisons measured in odds ratios (regimens in the top row over regimens in the leftmost column) in having COVID-19 related **deaths** after vaccination. The number of studies (n) that contributed the data to each comparison is shown.

	one-dose-adeno (n=1)	one-dose-inactivated (n=1)	one-dose-mRNA (n=2)	two-dose-adeno (n=2)	two-dose-inactivated (n=1)	two-dose-mRNA (n=6)	three-dose-mRNA (n=3)	two-dose-adeno-with-one-dose-mRNA (n=1)	rank
unvaccinated	0.603 (0.006,49.329)	0.577 (0.005,95.601)	1.485 (0.085,25.016)	0.532 (0.024,6.795)	0.301 (0.002,37.845)	0.493 (0.056,6.019)	0.225 (0.016,8.041)	0.125 (0.003,5.539)	7(4,9)
one-dose-adeno		0.957 (0.001,1187.914)	2.463 (0.014,497.838)	0.883 (0.005,127.273)	0.499 (0.001,360.830)	0.818 (0.007,133.026)	0.373 (0.002,166.747)	0.208 (0.001,65.327)	5(1,9)
one-dose-inactivated			2.574 (0.006,968.199)	0.922 (0.003,225.194)	0.522 (0.001,187.140)	0.855 (0.003,265.517)	0.390 (0.001,183.294)	0.217 (0.000,113.900)	5(1,9)
one-dose-mRNA				0.358 (0.006,16.100)	0.203 (0.001,57.983)	0.332 (0.010,13.938)	0.152 (0.003,15.959)	0.084 (0.001,8.375)	7(2,9)
two-dose-adeno					0.565 (0.002,174.912)	0.927 (0.034,39.679)	0.423 (0.013,56.271)	0.236 (0.003,33.175)	5(1,9)
two-dose-inactivated						1.639 (0.009,437.447)	0.748 (0.003,312.625)	0.417 (0.001,224.984)	4(1,9)
two-dose-mRNA							0.456 (0.022,29.191)	0.254 (0.003,24.029)	5(2,9)
three-dose-mRNA								0.557 (0.003,35.069)	4(1,9)
two-dose-adeno-with-one-dose-mRNA									3(1,8)

Figure 3. Deviance plot for comparison between inconsistency and consistency model

(a) Deviance plot for vaccine-product-based network



(b) Deviance plot for platform-based network

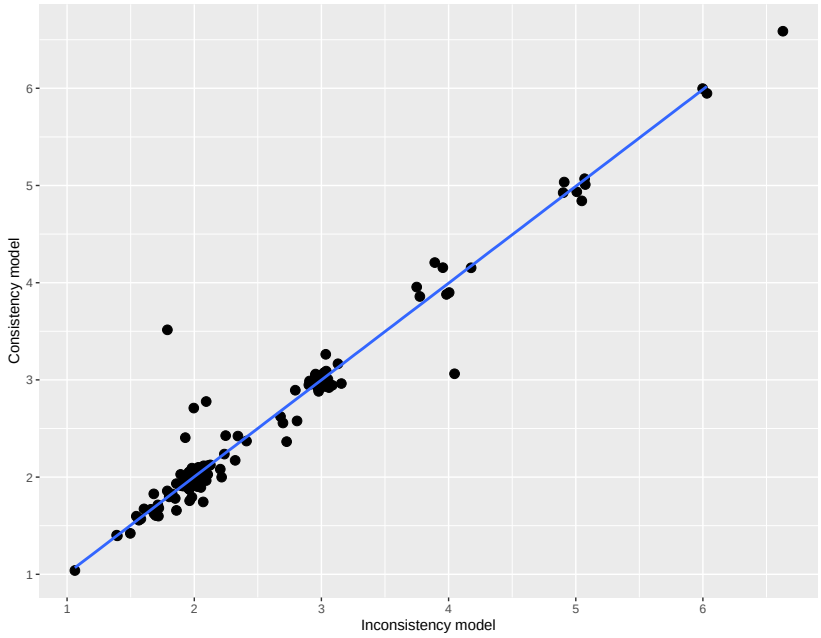


Table 7. Assessment of inconsistency in network with GRADE

comparison		direct			indirect			consistency					
Documented COVID-19 infections													
treatment1	treatment2	odds ratio	lower	upper	odds ratio	lower	upper	odds ratio	lower	upper	Bayesian P-value	GRADE	
one-dose-ChAdOx1	two-dose-ChAdOx1	0.87	0.14	5.65	0.53	0.13	2.21	0.63	0.21	1.89	0.67	moderate	imprecision
one-dose-ChAdOx1	two-dose-BNT162b2	0.67	0.05	8.93	0.37	0.12	1.18	0.39	0.14	1.1	0.69	low	ROB
one-dose-ChAdOx1	two-dose-mRNA-1273	0.35	0.03	4.83	0.32	0.09	1.13	0.33	0.11	0.99	0.95	low	imprecision
one-dose-ChAdOx1-with-one-dose-BNT162b2	two-dose-ChAdOx1	2.43	0.37	15.94	3.06	0.18	53.28	2.41	0.57	10.41	0.89	low	ROB
one-dose-ChAdOx1-with-one-dose-BNT162b2	two-dose-BNT162b2	2.4	0.36	15.81	0.93	0.06	14.49	1.5	0.36	6.34	0.58	low	ROB
one-dose-ChAdOx1-with-one-dose-BNT162b2	two-dose-mRNA-1273	1.39	0.09	21.08	1.18	0.15	9.43	1.24	0.26	5.86	0.92	moderate	ROB
one-dose-BNT162b2	two-dose-ChAdOx1	1.02	0.08	13.91	0.49	0.16	1.46	0.55	0.21	1.48	0.6	low	ROB
one-dose-BNT162b2	two-dose-BNT162b2	0.34	0.12	0.97	0.42	0.09	1.9	0.35	0.16	0.77	0.8	low	ROB
one-dose-BNT162b2	two-dose-mRNA-1273	0.33	0.05	2.31	0.27	0.08	0.84	0.29	0.11	0.74	0.86	moderate	ROB
one-dose-Ad26.COV2	two-dose-ChAdOx1	0.81	0.06	10.92	0.71	0.05	11	0.63	0.12	3.34	0.94	low	ROB
one-dose-Ad26.COV2	two-dose-BNT162b2	0.59	0.04	7.72	0.47	0.03	6.68	0.39	0.08	1.98	0.9	low	ROB
one-dose-Ad26.COV2	two-dose-mRNA-1273	0.31	0.02	4.14	0.4	0.03	5.82	0.33	0.06	1.73	0.88	moderate	ROB
one-dose-mRNA-1273	two-dose-ChAdOx1	1.37	0.1	18.22	0.45	0.13	1.53	0.57	0.19	1.68	0.44	low	ROB
one-dose-mRNA-1273	two-dose-BNT162b2	0.77	0.12	4.79	0.25	0.08	0.84	0.35	0.13	0.93	0.31	low	ROB
one-dose-mRNA-1273	two-dose-mRNA-1273	0.41	0.06	2.97	0.23	0.06	0.84	0.29	0.1	0.83	0.62	moderate	ROB
one-dose-adeno	two-dose-adeno-with-one-dose-mRNA	0.24	0.02	2.83	0.21	0.03	1.43	0.21	0.05	0.92	0.93	moderate	ROB
one-dose-adeno	two-dose-mRNA	0.59	0.06	6.19	0.28	0.12	0.69	0.3	0.13	0.67	0.56	low	ROB
one-dose-mRNA	two-dose-adeno-with-one-dose-mRNA	0.29	0.03	3.54	0.18	0.03	1.12	0.19	0.05	0.77	0.76	low	ROB
one-dose-mRNA	two-dose-mRNA	0.38	0.16	0.91	0.23	0.11	0.51	0.27	0.15	0.46	0.41	moderate	imprecision
two-dose-adeno	Unvaccinated	4.57	2.16	9.68	9.4	0.57	155.32	5.44	2.73	10.85	0.62	low	imprecision
two-dose-adeno-with-one-dose-mRNA	two-dose-mRNA	2.21	0.39	12.67	0.89	0.08	10.51	1.38	0.37	5.24	0.56	low	ROB
two-dose-adeno-with-one-dose-mRNA	Unvaccinated	8.57	0.73	105.52	13.01	2.3	75.58	12.92	3.51	48.69	0.79	low	ROB
two-dose-mRNA	Unvaccinated	10.7	7.96	14.48	3.26	0.18	57.75	9.36	6.99	12.61	0.41	low	ROB
Symptomatic COVID-19 infections													
treatment1	treatment2	odds ratio	lower	upper	odds ratio	lower	upper	odds ratio	lower	upper	Bayesian P-value	GRADE	
one-dose-ChAdOx1	two-dose-mRNA-1273	0.5	0.05	4.95	0.45	0.1	1.9	0.43	0.13	1.41	0.93	low	ROB
one-dose-ChAdOx1	three-dose-ChAdOx1	0.47	0.05	4.73	0.35	0.07	1.77	0.34	0.09	1.26	0.83	low	imprecision
one-dose-ChAdOx1	three-dose-BNT162b2	0.77	0.08	7.4	0.17	0.05	0.63	0.25	0.08	0.75	0.26	low	ROB
one-dose-BNT162b2	two-dose-ChAdOx1	0.69	0.18	2.59	1.61	0.53	4.88	1.17	0.51	2.69	0.33	low	ROB
one-dose-BNT162b2	two-dose-BNT162b2	0.24	0.11	0.55	2.02	0.14	28.48	0.32	0.15	0.69	0.13	moderate	ROB
one-dose-BNT162b2	two-dose-mRNA-1273	0.13	0	2.66	0.95	0.26	3.57	0.69	0.21	2.21	0.24	low	ROB
one-dose-CoronaVac	one-dose-Ad26.COV2	0.83	0.08	8.39	0.66	0.05	8.16	0.73	0.15	3.59	0.9	low	ROB
one-dose-CoronaVac	two-dose-ChAdOx1	0.68	0.07	6.72	1.12	0.34	3.6	1.06	0.39	2.93	0.7	low	ROB
one-dose-CoronaVac	two-dose-BNT162b2	0.56	0.05	5.59	0.26	0.08	0.86	0.29	0.1	0.83	0.56	low	ROB
one-dose-CoronaVac	two-dose-CoronaVac	0.85	0.29	2.52	0.64	0.04	12.06	0.8	0.31	2.11	0.86	low	imprecision
one-dose-Ad26.COV2	two-dose-ChAdOx1	0.83	0.08	8.46	1.68	0.16	18.32	1.45	0.33	6.31	0.67	low	imprecision
one-dose-Ad26.COV2	two-dose-BNT162b2	0.68	0.07	6.9	0.4	0.04	4.31	0.4	0.09	1.77	0.75	low	ROB
one-dose-Ad26.COV2	two-dose-CoronaVac	0.93	0.09	9.42	1.24	0.1	14.95	1.1	0.23	5.15	0.87	low	imprecision
two-dose-ChAdOx1	two-dose-mRNA-1273	0.73	0.07	7.05	0.65	0.17	2.52	0.59	0.19	1.81	0.93	low	ROB

two-dose-ChAdOx1	three-dose-BNT162b2	1.11	0.11	10.84	0.25	0.08	0.82	0.34	0.12	0.95	0.25	low	imprecision
two-dose-ChAdOx1	three-dose-mRNA-1273	2.93	0.22	41.83	0.33	0.09	1.18	0.5	0.16	1.59	0.14	low	ROB
two-dose-ChAdOx1-with-one-dose-BNT162b2	two-dose-BNT162b2	0.57	0.06	5.72	0.56	0.12	2.59	0.48	0.14	1.63	0.99	low	ROB
two-dose-ChAdOx1-with-one-dose-BNT162b2	two-dose-mRNA-1273	0.52	0.05	5.21	1.61	0.25	10.28	1.03	0.25	4.29	0.45	moderate	imprecision
two-dose-ChAdOx1-with-one-dose-BNT162b2	three-dose-BNT162b2	0.8	0.08	7.77	0.61	0.11	3.41	0.59	0.15	2.34	0.85	low	imprecision
two-dose-ChAdOx1-with-one-dose-BNT162b2	three-dose-mRNA-1273	2.08	0.15	29.02	0.8	0.14	4.76	0.87	0.21	3.73	0.55	low	ROB
two-dose-BNT162b2	two-dose-mRNA-1273	0.77	0.12	4.66	4.82	1.05	22.78	2.13	0.69	6.44	0.13	low	ROB
three-dose-ChAdOx1	three-dose-BNT162b2	1.65	0.16	16.83	0.48	0.08	2.9	0.72	0.18	2.94	0.4	moderate	imprecision
three-dose-ChAdOx1	three-dose-mRNA-1273	4.33	0.32	61.34	0.65	0.1	4.11	1.07	0.24	4.65	0.25	moderate	imprecision
three-dose-BNT162b2	three-dose-mRNA-1273	1.41	0.38	5.26	1.45	0.16	12.79	1.47	0.46	4.87	0.98	moderate	imprecision
one-dose-adeno	two-dose-adeno	0.47	0.23	0.98	1.27	0.28	5.85	0.62	0.34	1.11	0.25	low	ROB
one-dose-adeno	two-dose-adeno-with-one-dose-mRNA	0.23	0.07	0.77	0.16	0.05	0.48	0.19	0.09	0.43	0.62	moderate	ROB
one-dose-adeno	two-dose-inactivated	0.22	0.03	1.66	0.63	0.3	1.36	0.55	0.27	1.13	0.33	low	ROB
one-dose-adeno	two-dose-mRNA	0.21	0.09	0.48	0.46	0.16	1.37	0.28	0.15	0.53	0.25	low	ROB
one-dose-adeno	three-dose-adeno	0.37	0.11	1.21	0.35	0.08	1.47	0.35	0.14	0.85	0.96	moderate	imprecision
one-dose-adeno	three-dose-mRNA	0.3	0.09	0.96	0.11	0.05	0.26	0.15	0.08	0.3	0.18	moderate	imprecision
one-dose-inactivated	two-dose-adeno	0.68	0.09	5.24	0.78	0.34	1.8	0.79	0.37	1.68	0.89	low	ROB
one-dose-inactivated	two-dose-inactivated	0.79	0.33	1.85	0.77	0.09	6.8	0.71	0.34	1.47	0.99	low	ROB
one-dose-inactivated	two-dose-inactivated-with-one-dose-mRNA	0.43	0.1	1.81	0.42	0.1	1.82	0.42	0.16	1.16	0.99	low	imprecision
one-dose-inactivated	two-dose-mRNA	0.55	0.07	4.31	0.34	0.14	0.83	0.36	0.16	0.8	0.67	low	ROB
one-dose-mRNA	two-dose-adeno	0.94	0.38	2.36	1	0.42	2.35	1.05	0.57	1.91	0.92	low	ROB
one-dose-mRNA	two-dose-adeno-with-one-dose-mRNA	0.42	0.1	1.75	0.32	0.12	0.85	0.33	0.15	0.72	0.76	low	ROB
one-dose-mRNA	two-dose-inactivated	1.03	0.14	7.84	0.93	0.43	1.96	0.94	0.46	1.9	0.92	low	ROB
one-dose-mRNA	two-dose-mRNA	0.31	0.17	0.59	2.08	0.24	17.89	0.48	0.27	0.85	0.1	low	ROB
one-dose-mRNA	three-dose-adeno	1.12	0.26	4.95	0.44	0.14	1.41	0.59	0.24	1.44	0.33	moderate	ROB
one-dose-mRNA	three-dose-mRNA	0.67	0.16	2.74	0.2	0.09	0.42	0.26	0.13	0.5	0.13	moderate	ROB
two-dose-adeno	two-dose-adeno-with-one-dose-mRNA	0.25	0.1	0.63	0.79	0.17	3.69	0.31	0.16	0.62	0.2	low	ROB
two-dose-adeno	two-dose-inactivated	1.12	0.15	8.63	0.88	0.49	1.62	0.9	0.51	1.59	0.82	low	ROB
two-dose-adeno	two-dose-inactivated-with-one-dose-mRNA	0.48	0.11	2.02	0.54	0.15	1.95	0.53	0.22	1.31	0.9	low	ROB
two-dose-adeno	two-dose-mRNA	0.5	0.25	1.04	0.43	0.21	0.88	0.46	0.28	0.75	0.77	low	ROB
two-dose-adeno	three-dose-mRNA	0.3	0.12	0.75	0.21	0.09	0.44	0.25	0.14	0.44	0.55	moderate	ROB
two-dose-adeno-with-one-dose-mRNA	two-dose-mRNA	2.3	0.93	5.7	0.5	0.11	2.37	1.46	0.72	2.97	0.09	low	ROB
two-dose-adeno-with-one-dose-mRNA	three-dose-adeno	1.53	0.45	5.16	2.23	0.46	10.86	1.81	0.71	4.63	0.71	moderate	ROB
two-dose-inactivated	two-dose-inactivated-with-one-dose-mRNA	0.45	0.11	1.87	0.63	0.17	2.39	0.6	0.24	1.5	0.72	low	imprecision
two-dose-inactivated	two-dose-mRNA	0.73	0.09	5.64	0.49	0.25	0.97	0.51	0.27	0.96	0.72	low	imprecision
two-dose-inactivated-with-one-dose-mRNA	three-dose-adeno	1.06	0.23	4.85	1.04	0.22	4.87	1.06	0.36	3.05	0.98	moderate	imprecision
two-dose-mRNA	three-dose-adeno	1.18	0.35	3.96	1.29	0.32	5.13	1.24	0.54	2.83	0.93	moderate	ROB
Severe COVID-19 infections													
treatment1	treatment2	odds ratio	lower	upper	odds ratio	lower	upper	odds ratio	lower	upper	Bayesian P-value	GRADE	
one-dose-BNT162b2	one-dose-CoronaVac	1.36	0.12	15.8	0.36	0.01	9.81	0.88	0.15	5.22	0.52	moderate	imprecision
one-dose-BNT162b2	one-dose-Ad26.COV2	1	0.07	13.17	0.6	0.07	5.2	0.71	0.15	3.47	0.75	low	imprecision

one-dose-BNT162b2	two-dose-ChAdOx1	0.55	0.05	6.22	0.06	0	1.77	0.29	0.05	1.74	0.29	low	ROB
one-dose-BNT162b2	two-dose-BNT162b2	0.31	0.02	5.01	0.45	0.11	1.95	0.48	0.15	1.63	0.82	low	ROB
one-dose-BNT162b2	two-dose-CoronaVac	0.75	0.07	8.45	0.16	0.01	2.01	0.39	0.07	1.95	0.37	low	ROB
one-dose-CoronaVac	one-dose-Ad26.COV2	0.73	0.06	9.46	1.58	0.05	99.17	0.81	0.12	5.65	0.72	moderate	imprecision
one-dose-CoronaVac	two-dose-ChAdOx1	0.4	0.04	4.41	0.16	0	22.1	0.33	0.04	2.59	0.73	low	ROB
one-dose-CoronaVac	two-dose-BNT162b2	0.23	0.01	3.66	1.23	0.06	60.57	0.55	0.1	3.07	0.42	low	ROB
one-dose-Ad26.COV2	two-dose-ChAdOx1	0.55	0.04	7.08	0.11	0	3.92	0.41	0.06	2.75	0.45	low	ROB
one-dose-Ad26.COV2	two-dose-BNT162b2	0.32	0.01	5.85	0.76	0.12	4.75	0.68	0.16	2.8	0.61	low	ROB
one-dose-Ad26.COV2	two-dose-CoronaVac	0.75	0.06	9.34	0.27	0.01	4.23	0.54	0.09	3.18	0.58	low	ROB
two-dose-ChAdOx1	two-dose-BNT162b2	0.58	0.03	9.25	7.45	0.29	472.98	1.66	0.31	9.54	0.23	low	ROB
two-dose-ChAdOx1	two-dose-CoronaVac	1.36	0.13	14.54	2.61	0.05	215.19	1.33	0.19	9.4	0.78	low	ROB
two-dose-BNT162b2	two-dose-CoronaVac	2.39	0.16	46.8	0.35	0.03	3.43	0.8	0.17	3.58	0.28	low	ROB
one-dose-adeno	one-dose-inactivated	1.16	0.14	9.34	0.59	0.01	9.34	1.16	0.25	4.9	0.7	moderate	imprecision
one-dose-adeno	one-dose-mRNA	0.85	0.1	7.15	1.69	0.47	5.82	1.39	0.48	3.89	0.58	moderate	ROB
one-dose-adeno	two-dose-adeno	0.46	0.06	3.87	0.11	0	2.02	0.4	0.09	1.72	0.43	low	ROB
one-dose-adeno	two-dose-inactivated	0.63	0.08	5.05	0.43	0.1	1.67	0.53	0.17	1.59	0.75	low	ROB
one-dose-adeno	two-dose-mRNA	0.27	0.02	3.31	0.52	0.23	1.17	0.5	0.23	1.05	0.62	low	ROB
one-dose-inactivated	one-dose-mRNA	0.72	0.09	5.95	2.95	0.16	165.23	1.21	0.25	5.91	0.45	low	imprecision
one-dose-inactivated	two-dose-adeno	0.4	0.05	3.24	0.16	0	16.29	0.34	0.05	2.15	0.72	low	ROB
one-dose-inactivated	two-dose-mRNA	0.23	0.01	2.78	0.88	0.06	35.46	0.43	0.1	1.95	0.48	low	ROB
one-dose-mRNA	two-dose-adeno	0.55	0.06	4.58	0.06	0	1.33	0.29	0.06	1.4	0.25	low	ROB
one-dose-mRNA	two-dose-inactivated	0.74	0.09	6.08	0.25	0.05	1.31	0.38	0.11	1.36	0.41	low	ROB
two-dose-adeno	two-dose-inactivated	1.35	0.17	10.84	4.13	0.17	303.87	1.33	0.27	6.8	0.57	low	ROB
two-dose-adeno	two-dose-mRNA	0.57	0.04	7	4.91	0.26	211.9	1.26	0.29	5.75	0.28	low	ROB
two-dose-inactivated	two-dose-mRNA	0.43	0.03	5.12	1.26	0.33	4.94	0.95	0.32	2.86	0.46	low	ROB
COVID-19 related hospitalization													
treatment1	treatment2	odds ratio	lower	upper	odds ratio	lower	upper	odds ratio	lower	upper	Bayesian P-value	GRADE	
one-dose-ChAdOx1	one-dose-BNT162b2	0.73	0.18	3.06	0.72	0.11	4.82	0.85	0.29	2.45	0.99	low	ROB
one-dose-ChAdOx1	one-dose-Ad26.COV2	1.26	0.17	9.34	1.64	0.16	16.53	1.24	0.3	5.29	0.86	moderate	ROB
one-dose-ChAdOx1	one-dose-mRNA-1273	1.18	0.28	5.08	0.63	0.04	8.23	1	0.3	3.37	0.67	low	ROB
one-dose-ChAdOx1	two-dose-ChAdOx1	0.83	0.2	3.51	0.57	0.07	4.84	0.73	0.24	2.26	0.77	low	ROB
one-dose-ChAdOx1	two-dose-BNT162b2	1.61	0.22	11.6	0.51	0.13	1.92	0.68	0.23	2	0.33	low	ROB
one-dose-ChAdOx1	two-dose-mRNA-1273	0.28	0.03	2.85	0.34	0.08	1.49	0.36	0.11	1.18	0.89	low	ROB
one-dose-BNT162b2	one-dose-Ad26.COV2	2.35	0.33	16.77	1.87	0.25	14.55	1.47	0.41	5.47	0.87	moderate	ROB
one-dose-BNT162b2	one-dose-mRNA-1273	1.65	0.4	6.7	0.85	0.11	5.92	1.18	0.41	3.44	0.59	low	ROB
one-dose-BNT162b2	two-dose-ChAdOx1	3.09	0.44	21.77	0.53	0.16	1.73	0.86	0.32	2.36	0.13	low	ROB
one-dose-BNT162b2	two-dose-BNT162b2	1.15	0.28	4.77	0.68	0.26	1.84	0.8	0.37	1.75	0.54	low	ROB
one-dose-BNT162b2	two-dose-mRNA-1273	0.53	0.05	4.99	0.4	0.14	1.13	0.43	0.17	1.09	0.82	low	ROB
one-dose-Ad26.COV2	one-dose-mRNA-1273	0.89	0.13	6.43	0.6	0.06	6.19	0.8	0.19	3.33	0.79	low	imprecision
one-dose-Ad26.COV2	two-dose-ChAdOx1	1.32	0.19	9.51	0.28	0.03	2.55	0.59	0.15	2.33	0.29	low	imprecision
one-dose-Ad26.COV2	two-dose-BNT162b2	1.27	0.18	8.87	0.32	0.04	2.47	0.54	0.15	1.93	0.32	low	imprecision
one-dose-Ad26.COV2	two-dose-mRNA-1273	0.22	0.02	2.14	0.21	0.03	1.73	0.29	0.07	1.14	0.97	low	imprecision
one-dose-mRNA-1273	two-dose-ChAdOx1	1.48	0.21	10.42	0.47	0.1	2.25	0.73	0.22	2.44	0.36	low	ROB
one-dose-mRNA-1273	two-dose-BNT162b2	1.44	0.21	10.27	0.54	0.14	2.27	0.68	0.23	1.98	0.42	low	ROB
one-dose-mRNA-1273	two-dose-mRNA-1273	0.25	0.02	2.44	0.36	0.08	1.63	0.36	0.11	1.18	0.79	low	ROB
two-dose-ChAdOx1	two-dose-BNT162b2	0.97	0.15	6.44	1.1	0.36	3.45	0.92	0.35	2.49	0.91	low	ROB
two-dose-ChAdOx1	two-dose-mRNA-1273	0.17	0.02	1.59	0.73	0.21	2.67	0.49	0.17	1.49	0.26	low	ROB
two-dose-BNT162b2	two-dose-mRNA-1273	0.39	0.09	1.73	0.63	0.21	1.97	0.53	0.22	1.27	0.6	low	ROB
two-dose-mRNA-1273	three-dose-mRNA-1273	0.06	0	0.64	0.37	0.05	2.34	0.19	0.04	0.79	0.25	moderate	imprecision
two-dose-mRNA-1273	Unvaccinated	9.24	4.11	20.84	1.49	0.06	31.92	8.24	3.99	17.08	0.25	low	ROB
three-dose-BNT162b2	Unvaccinated	21.5	2.78	168.98	31.77	6.77	150.77	25.09	7.67	81.37	0.76	moderate	imprecision
three-dose-mRNA-1273	Unvaccinated	24.97	4.58	155.63	156.81	13.07	2478.29	44.58	10.74	201.5	0.24	moderate	imprecision
one-dose-adeno	one-dose-mRNA	0.95	0.29	3.09	0.88	0.28	2.74	1.01	0.45	2.23	0.93	moderate	imprecision
one-dose-adeno	two-dose-adeno	0.75	0.28	2.02	0.84	0.16	4.5	0.84	0.38	1.87	0.9	low	ROB

one-dose-adeno	two-dose-mRNA	1.25	0.24	6.69	0.45	0.19	1.07	0.57	0.28	1.2	0.28	low	ROB
one-dose-adeno	three-dose-mRNA	0.2	0.04	1.05	0.14	0.06	0.34	0.14	0.07	0.3	0.72	moderate	ROB
one-dose-mRNA	two-dose-adeno	1.59	0.3	8.4	0.72	0.34	1.53	0.83	0.42	1.65	0.39	low	imprecision
one-dose-mRNA	two-dose-mRNA	0.76	0.29	1.94	0.54	0.3	1.01	0.57	0.35	0.94	0.56	low	ROB
two-dose-adeno	two-dose-mRNA	0.52	0.2	1.37	0.95	0.44	2.08	0.68	0.39	1.2	0.34	low	ROB
two-dose-adeno	three-dose-mRNA	0.14	0.05	0.39	0.21	0.1	0.48	0.17	0.09	0.3	0.54	moderate	imprecision
COVID-19 related deaths													
treatment1	treatment2	odds ratio	lower	upper	odds ratio	lower	upper	odds ratio	lower	upper	Bayesian P-value	GRADE	
two-dose-ChAdOx1	two-dose-BNT162b2	0.56	0.01	26.25	1.92	0.02	147.59	0.81	0.06	10.45	0.64	low	ROB
two-dose-ChAdOx1	three-dose-BNT162b2	0.1	0	2.4	15.73	0.14	1855.55	0.48	0.02	9.32	0.08	low	imprecision
three-dose-BNT162b2	Unvaccinated	18.72	0.66	503.36	0.28	0.01	12.75	3.81	0.28	50.59	0.09	low	ROB
two-dose-adeno	two-dose-mRNA	0.56	0.02	13.72	1.77	0.06	51.27	0.76	0.1	5.61	0.59	low	ROB
two-dose-adeno	three-dose-mRNA	0.1	0.01	1.36	12.07	0.26	523.36	0.47	0.04	5.45	0.04	low	ROB
three-dose-mRNA	Unvaccinated	18.78	1.29	266.99	0.37	0.02	7.06	4.03	0.51	32.18	0.05	low	imprecision

Table 8A. Subgroup analysis of vaccine effectiveness against non-Delta or -Omicron related **asymptomatic or symptomatic infections** in three age groups (<18 years old, 18-65 years old, >65 years old), and in immunocompromised population.

Non Delta or Omicron related asymptomatic or symptomatic infections				
	Odds ratio	Lower	Upper	GRADE
Young (<18 years)				
two-dose-inactivated	0.02	0.00	5.08	low
two-dose-adeno	0.01	0.00	1.83	low
two-dose-mRNA	0.01	0.00	0.94	low
two-dose-adeno-with-one-dose-mRNA	0.00	0.00	0.41	moderate
two-dose-inactivated-with-one-dose-mRNA	0.00	0.00	0.43	low
three-dose-mRNA	0.00	0.00	0.33	moderate
Adult (18-65 years)				
two-dose-inactivated	0.01	0.00	0.24	low
two-dose-adeno	0.01	0.00	0.14	low
two-dose-mRNA	0.00	0.00	0.04	low
two-dose-adeno-with-one-dose-mRNA	0.00	0.00	0.05	moderate
two-dose-inactivated-with-one-dose-mRNA	0.00	0.00	0.03	low
three-dose-mRNA	0.00	0.00	0.02	moderate
Elderly (>65 years)				
two-dose-inactivated	0.13	0.01	0.92	low
two-dose-adeno	0.03	0.00	0.41	low
two-dose-mRNA	0.03	0.00	0.23	low
two-dose-adeno-with-one-dose-mRNA	0.01	0.00	0.12	moderate
two-dose-inactivated-with-one-dose-mRNA	0.01	0.00	0.10	low
three-dose-mRNA	0.01	0.00	0.08	moderate

Table 8B. Subgroup analysis of vaccine effectiveness against Delta or Omicron related **asymptomatic or symptomatic infections** in three age groups (<18 years old, 18-65 years old, >65 years old), and in immunocompromised population.

Delta or Omicron related asymptomatic or symptomatic infections				
	Odds ratio	Lower	Upper	GRADE
Delta				
Young (<18 years)				
one-dose-mRNA	0.16	0.00	26.21	low
two-dose-mRNA	0.02	0.00	8.13	low
three-dose-mRNA	0.01	0.00	147.67	moderate
Adult (18-65 years)				
one-dose-mRNA	0.06	0.00	2.68	low
two-dose-mRNA	0.02	0.00	0.46	low
three-dose-mRNA	0.04	0.00	0.25	moderate
Elderly (>65 years)				
one-dose-mRNA	0.27	0.04	1.69	low
two-dose-mRNA	0.06	0.01	0.33	low
three-dose-mRNA	0.06	0.01	0.29	moderate
Omicron				
Young (<18 years)				
one-dose-mRNA	0.46	0.32	0.71	low
two-dose-mRNA	0.35	0.24	0.54	low
three-dose-mRNA	0.23	0.15	0.37	moderate
Adult (18-65 years)				
one-dose-mRNA	0.81	0.50	1.27	low
two-dose-mRNA	0.64	0.43	0.93	low
three-dose-mRNA	0.44	0.31	0.62	moderate
Elderly (>65 years)				
one-dose-mRNA	0.65	0.24	1.79	low
two-dose-mRNA	0.53	0.21	1.35	low
three-dose-mRNA	0.39	0.17	0.91	moderate

Table 8C. Subgroup analysis of vaccine effectiveness against non-Delta or -Omicron related **hospitalization** in three age groups (<18 years old, 18-65 years old, >65 years old), and in immunocompromised population.

Non Delta or Omicron related hospitalization				
	Odds ratio	Lower	Upper	GRADE
Young (<18 years)				
one-dose-adeno	0.20	0.05	0.80	low
one-dose-mRNA	0.21	0.09	0.48	low
two-dose-adeno	0.15	0.06	0.43	low
two-dose-adeno-with-one-dose-mRNA	0.01	0.00	0.05	moderate
two-dose-mRNA	0.08	0.04	0.16	low
three-dose-mRNA	0.01	0.01	0.03	moderate
Adult (18-65 years)				
one-dose-adeno	0.35	0.07	1.61	low
one-dose-mRNA	0.34	0.13	0.82	low
two-dose-adeno	0.27	0.09	0.76	low
two-dose-adeno-with-one-dose-mRNA	0.03	0.01	0.09	moderate
two-dose-mRNA	0.13	0.06	0.27	low
three-dose-mRNA	0.02	0.01	0.05	moderate
Elderly (>65 years)				
one-dose-adeno	0.43	0.09	1.60	low
one-dose-mRNA	0.43	0.07	0.83	low
two-dose-adeno	0.35	0.05	0.91	low
two-dose-adeno-with-one-dose-mRNA	0.03	0.00	0.11	moderate
two-dose-mRNA	0.17	0.02	0.30	low
three-dose-mRNA	0.03	0.00	0.06	moderate
Immunocompromised				
two-dose-mRNA	0.23	0.05	0.60	low
three-dose-mRNA	0.07	0.01	0.27	moderate
Immunocompetent				
two-dose-mRNA	0.09	0.03	0.27	low
three-dose-mRNA	0.03	0.01	0.13	moderate

Table 8D. Subgroup analysis of vaccine effectiveness against Delta or Omicron related **hospitalization** in three age groups (<18 years old, 18-65 years old, >65 years old), and in immunocompromised population.

Delta or Omicron related hospitalization				
	Odds ratio	Lower	Upper	GRADE
Young (<18 years)				
two-dose-mRNA	0.18	0.01	6.10	low
three-dose-mRNA	0.05	0.00	2.34	moderate
four-dose-mRNA	0.02	0.00	1.59	moderate
Adult (18-65 years)				
two-dose-mRNA	0.11	0.03	0.34	low
three-dose-mRNA	0.04	0.01	0.23	moderate
four-dose-mRNA	0.02	0.00	0.24	moderate
Elderly (>65 years)				
two-dose-mRNA	0.19	0.02	1.15	low
three-dose-mRNA	0.07	0.00	0.93	moderate
four-dose-mRNA	0.03	0.00	0.71	moderate
Immunocompromised				
two-dose-mRNA	0.36	0.05	1.88	low
three-dose-mRNA	0.10	0.02	0.49	moderate
Immunocompetent				
two-dose-mRNA	0.10	0.02	0.72	low
three-dose-mRNA	0.03	0.00	0.89	moderate

Figure 4A. Funnel plots for **documented** COVID-19 infections. Each data point represents a comparison between two vaccine regimens.

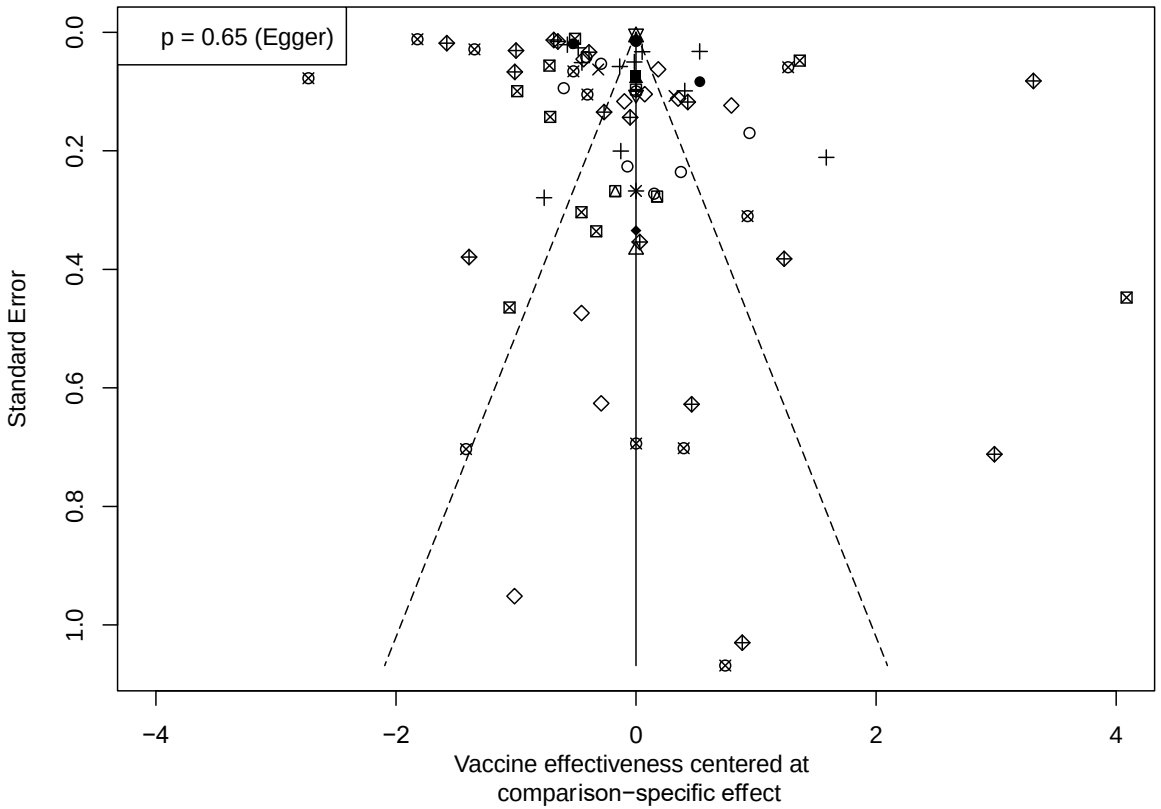


Figure 4B. Funnel plots for **symptomatic** COVID-19 infections. Each data point represents a comparison between two vaccine regimens.

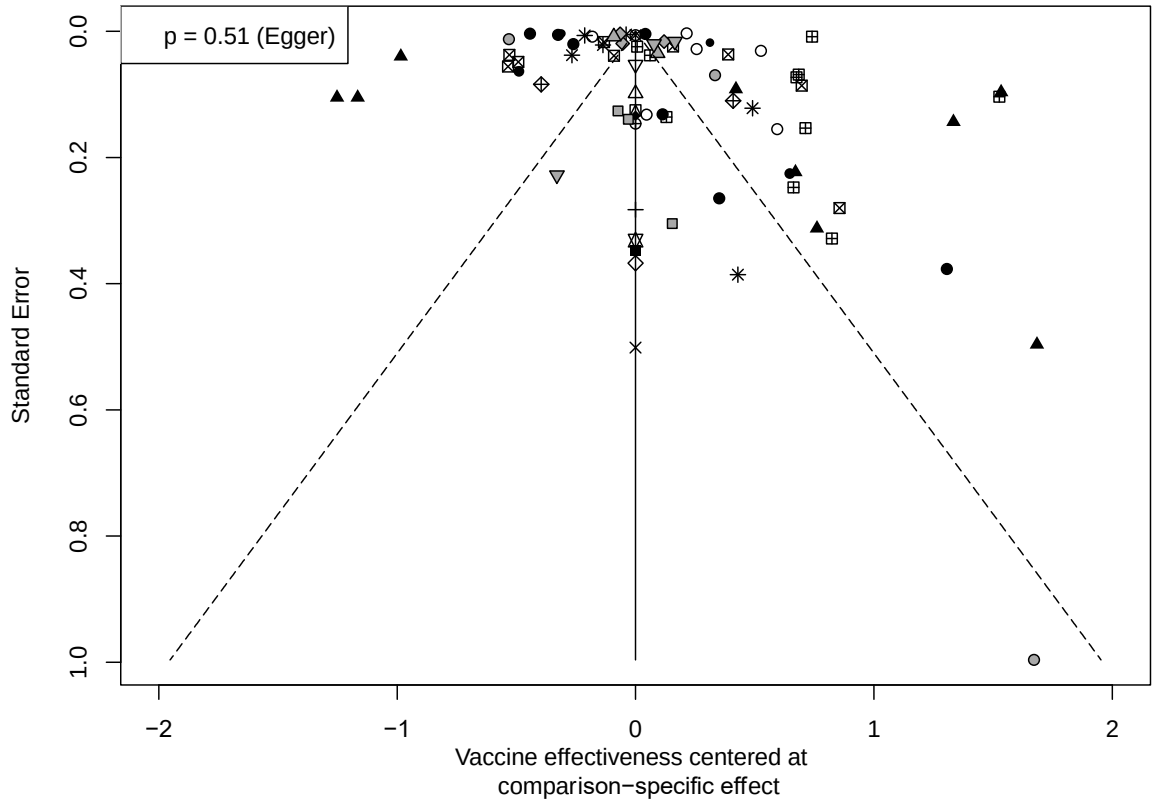


Figure 4C. Funnel plots for **severe** COVID-19 infections. Each data point represents a comparison between two vaccine regimens.

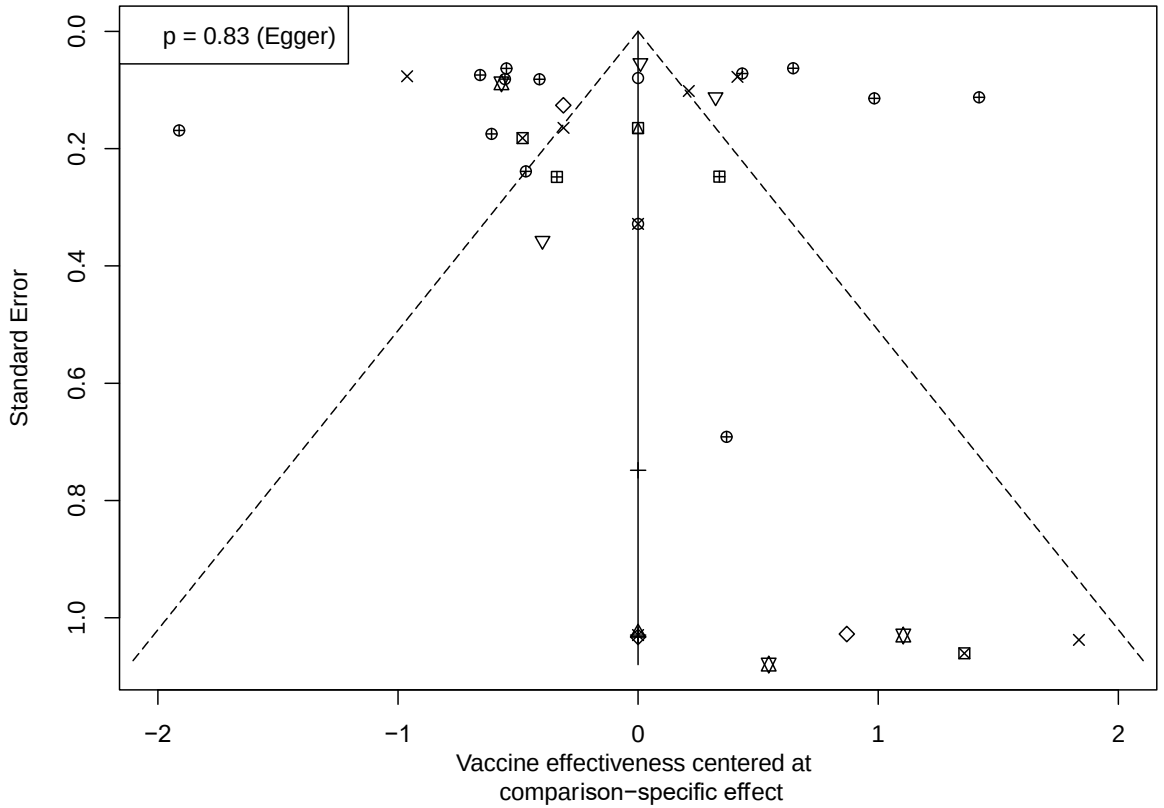


Figure 4D. Funnel plots for COVID-19 related **hospitalization**. Each data point represents a comparison between two vaccine regimens.

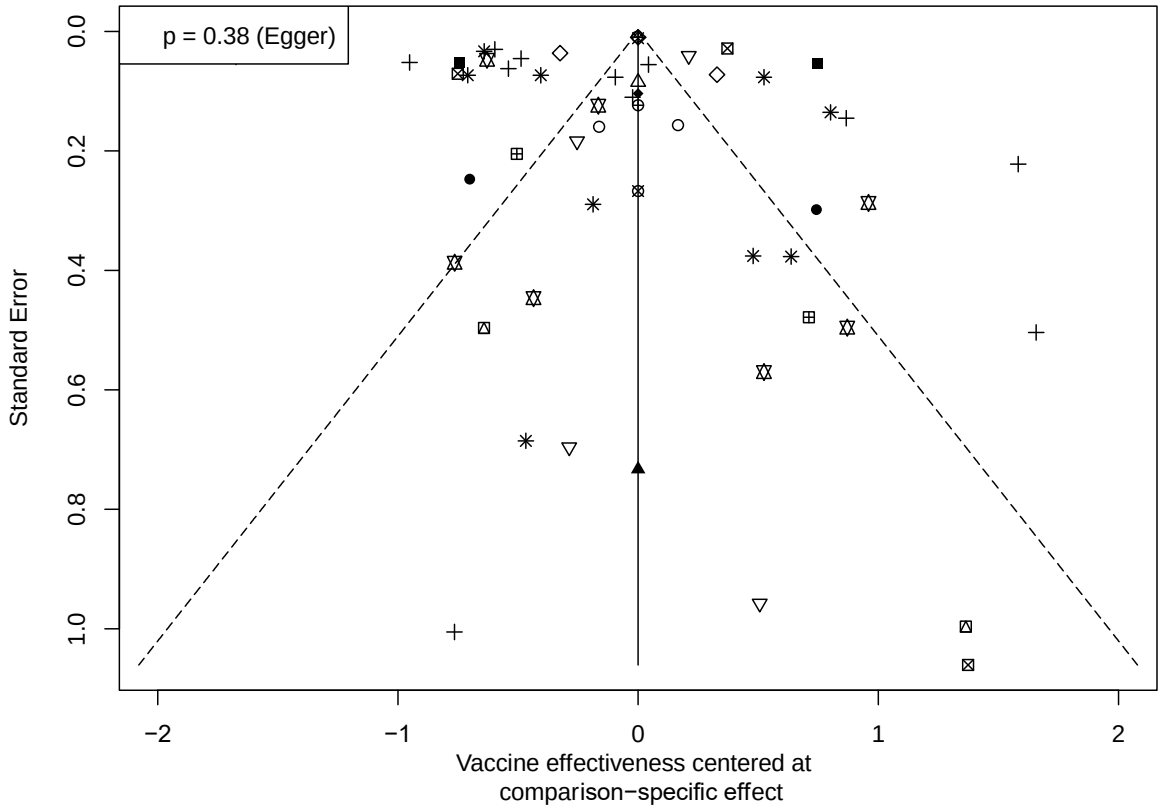


Figure 4E. Funnel plots for COVID-19 related **deaths**. Each data point represents a comparison between two vaccine regimens.

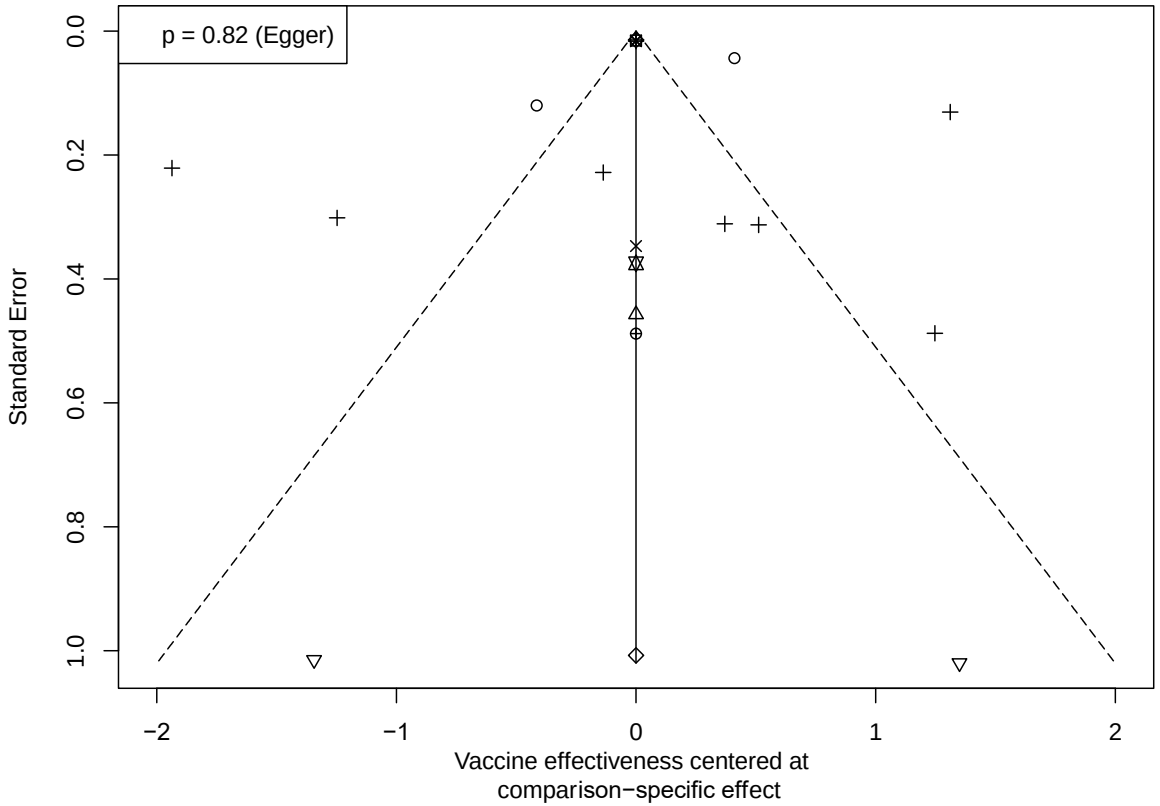


Table 9. PRISMA-NMA checklist

PRISMA NMA Checklist of Items to Include When Reporting A Systematic Review Involving a Network Meta-analysis

Section/Topic	Item #	Checklist Item	Reported on Page #
TITLE			
Title	1	Identify the report as a systematic review *incorporating a network meta-analysis (or related form of meta-analysis).*	***p.1***
ABSTRACT			***p.1***
Structured summary	2	Provide a structured summary including, as applicable: **Background:** main objectives **Methods:** data sources; study eligibility criteria, participants, and interventions; study appraisal; and *synthesis methods, such as network meta-analysis.* **Results:** number of studies and participants identified; summary estimates with corresponding confidence/credible intervals; *treatment rankings may also be discussed. Authors may choose to summarize pairwise comparisons against a chosen treatment included in their analyses for brevity.* **Discussion/Conclusions:** limitations; conclusions and implications of findings. **Other:** primary source of funding; systematic review registration number with registry name.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already	***p.1-2***

		known, *including mention of why a network meta-analysis has been conducted.*	
Objectives	4	Provide an explicit statement of questions being addressed, with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	***p.1-2***
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists and if and where it can be accessed (e.g., Web address); and, if available, provide registration information, including registration number.	Supplementary document
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. *Clearly describe eligible treatments included in the treatment network, and note whether any have been clustered or merged into the same node (with justification).*	***Main-text Methods: Search strategy and selection criteria***
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	***Main-text Methods: Search strategy and selection criteria (WHO COVID-19 database with full search strategy in the supplementary document)***
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary document Protocol 2.2
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	***Main-text Methods: Search strategy and selection criteria***
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	***Main-text Methods: Data synthesis*** Description of what study characteristics were extracted and reported

Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	***Supplementary document Protocol 2.1***
Geometry of the network	**S1**	Describe methods used to explore the geometry of the treatment network under study and potential biases related to it. This should include how the evidence base has been graphically summarized for presentation, and what characteristics were compiled and used to describe the evidence base to readers.	***Supplementary document Protocol 2.4***
Risk of bias within individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	***Supplementary document Protocol 2.4***
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means). *Also describe the use of additional summary measures assessed, such as treatment rankings and surface under the cumulative ranking curve (SUCRA) values, as well as modified approaches used to present summary findings from meta-analyses.*	***Main-text Methods: Data synthesis***
Planned methods of analysis	14	Describe the methods of handling data and combining results of studies for each network meta-analysis. This should include, but not be limited to: • *Handling of multi-arm trials;* • *Selection of variance structure;* • *Selection of prior distributions in Bayesian analyses; and* • *Assessment of model fit.*	***Supplementary document Protocol 2.4***
Assessment of Inconsistency	**S2**	Describe the statistical methods used to evaluate the agreement of direct and indirect evidence in the treatment network(s) studied. Describe efforts taken to address its presence when found.	***Supplementary document Protocol 2.4***
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	***Supplementary document Protocol 2.4***

Additional analyses	16	Describe methods of additional analyses if done, indicating which were pre-specified. This may include, but not be limited to, the following: • Sensitivity or subgroup analyses; • Meta-regression analyses; • *Alternative formulations of the treatment network; and* • *Use of alternative prior distributions for Bayesian analyses (if applicable).*	***Supplementary document Protocol 2.4***
RESULTS†			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	***Main-text figure 1 (study selection flowchart)***
Presentation of network structure	**S3**	Provide a network graph of the included studies to enable visualization of the geometry of the treatment network.	***Main-text Results, Supplementary document Figure 1A-J***
Summary of network geometry	**S4**	Provide a brief overview of characteristics of the treatment network. This may include commentary on the abundance of trials and randomized patients for the different interventions and pairwise comparisons in the network, gaps of evidence in the treatment network, and potential biases reflected by the network structure.	***Supplementary document Figure 1A-J***
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Supplementary document Table 2
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment.	Results ***Table 4. Risk of bias assessment of observational studies using ROBINS-***

			I Figure 2. Risk of bias assessment of RCTs using Cochrane ROB-II tool
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: 1) simple summary data for each intervention group, and 2) effect estimates and confidence intervals. *Modified approaches may be needed to deal with information from larger networks.*	***GitHub data***
Synthesis of results	21	Present results of each meta-analysis done, including confidence/credible intervals. *In larger networks, authors may focus on comparisons versus a particular comparator (e.g. placebo or standard care), with full findings presented in an appendix. League tables and forest plots may be considered to summarize pairwise comparisons.* If additional summary measures were explored (such as treatment rankings), these should also be presented.	***League tables in supplementary document, main-text Table 1 and 2***
Exploration for inconsistency	**S5**	Describe results from investigations of inconsistency. This may include such information as measures of model fit to compare consistency and inconsistency models, *P* values from statistical tests, or summary of inconsistency estimates from different parts of the treatment network.	Main-text Results: Inconsistency assessment Figure 3A-B. Deviance plot for comparison between inconsistency and consistency model
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies for the evidence base being studied.	GRADE score presented in Appendix Table 3
Results of additional analyses	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression analyses, *alternative network geometries studied, alternative choice of prior distributions for Bayesian analyses,* and so forth).	***Supplementary document Table 8A-C. Results of subgroup analyses***
DISCUSSION			
Summary of evidence	24	Summarize the main findings, including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare	Main-text Discussion

		providers, users, and policy-makers).	
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias). *Comment on the validity of the assumptions, such as transitivity and consistency. Comment on any concerns regarding network geometry (e.g., avoidance of certain comparisons).*	Main-text Discussion
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Main-text Discussion
FUNDING			Main-text Acknowledgement
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. This should also include information regarding whether funding has been received from manufacturers of treatments in the network and/or whether some of the authors are content experts with professional conflicts of interest that could affect use of treatments in the network.	

PICOS = population, intervention, comparators, outcomes, study design.
* Text in italics indicateS wording specific to reporting of network meta-analyses that has been added to guidance from the PRISMA statement.
† Authors may wish to plan for use of appendices to present all relevant information in full detail for items in this section.