#### Supplementary Materials

#### Search strategy

Database	Platform	No. of results
Medline	OVID	4718
Embase	OVID	7850
Emcare	OVID	2946
CINAHL	EBSCO	1007
Cochrane CENTRAL	Wiley	98

All searches undertaken on 13<sup>th</sup> October.

The search strategy was developed in MEDLINE and adapted to all other databases.

Ovid MEDLINE(R) ALL <1946 to October 13, 2021>

1 SARS-CoV-2/ or COVID-19/ 112819

2 (corona\* adj1 (virus\* or viral\*)).ti,ab,kw,kf. 4216

3 (CoV not (Coefficien\* or "co-efficien\*" or covalent\* or Covington\* or covariant\* or covarianc\* or "cut-off value\*" or "cutoff value\*" or "cut-off volume\*" or "cutoff volume\*" or "combined optimi?ation value\*" or "central vessel trunk\*" or CoVR or CoVS)).ti,ab,kw,kf. 64155

4 (coronavirus\* or 2019nCoV\* or 19nCoV\* or "2019 novel\*" or Ncov\* or "n-cov" or "SARS-CoV-2\*" or "SARSCoV-2\*" or "SARSCoV-2\*" or "SARSCoV-2\*" or "SARSCoV-2\*" or "SARS-CoV2\*" or "severe acute respiratory syndrome\*" or COVID\*2).ti,ab,kw,kf. 196562

5 or/1-4 201960

6 limit 5 to dt=20191201-20211013 189003

7 6 not (letter or historical article or comment or editorial or news).pt. not (Animals/ not humans/) 151366

8 (ethnicity or ethnic).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 187026

- 9 Minority Groups/ 15469
- 10 Population Groups/ 5186
- 11 continental population groups/ 23457
- 12 hispanic americans/ 30483
- 13 african continental ancestry group/ 38755
- 14 American Native Continental Ancestry Group/ 480
- 15 Asian Continental Ancestry Group/ 69899
- 16 European Continental Ancestry Group/ 69534
- 17 Oceanic Ancestry Group/ 11183
- 18 African Americans/ 58336
- 19 Arabs/ 4935
- 20 Asian Americans/ 8325

21 (multi?cultural or multi cultural or cross?cultural or cross cultural or trans?cultural or transcultural).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol

supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 42403

22 (BAME or minority or minorities).mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] 88772

- 23 "transients and migrants"/ 12779
- 24 migrant\*.mp. 26157
- expatriate.mp. 699
- 26 asylum.mp. 3960
- 27 foreign-born.mp. 3703
- 28 indigenous.mp. or Indigenous Peoples/ 38564
- 29 Ethnic Groups/ 66074
- 30 refugee\*.mp. or Refugees/ 16000
- 31 aboriginal\*.mp. 9622
- 32 "country of birth".mp. 2137
- 33 or/8-32 541151
- 34 7 and 33 4718

#### Table S1. Inclusion & exclusion criteria.

	Inclusion	Exclusion
Condition	1. Original clinical data on COVID-19 infection (lab confirmed PCR, serological evidence of previous SARS-CoV-2 infection, i.e., antibodies)	<ol> <li>Longer-term COVID-19 outcomes</li> <li>Mental health problems related to COVID-19</li> </ol>
	2. Original clinical data on severe COVID- 19 disease (hospitalisation, ITU admission, mechanical ventilation)	3. COVID-19 vaccines
	3. Original clinical data on COVID-19 mortality (ICD10 cause of death, death from any cause within a time-period of positive PCR test for SARS-CoV-2 infection)	
Context	1. Quantitative studies (cohort studies, cross-sectional studies, case-control studies)	1. Modelling studies (e.g., mathematical modelling, machine learning, computational)
	2. Non-population based (i.e., individuals with COVID-19) AND population-based studies (i.e., individuals with and without	2. Animal data
	COVID-19)	3. Qualitative data
		4. Any type of review
		5. Conference papers
		6. Pre-prints
		7. Retracted papers
		8. Ecological studies
		9. Commentaries or editorials
<b>D</b>		10. Not available in English
Population	1. Includes COVID-19 outcome	1. COVID-19 outcomes that are not
	disaggregated by ethnicity or race (include studies with closely related measures, i.e.,	disaggregated by ethnicity
	Indigenous or Aboriginal groups, race, migrant status, country of birth).	2. Children (under 16)
	2. Adult populations (16+)	3. Religious groups
		4. Sample recruited based on an existing physical or mental health problem, or healthcare utilisation

#### Criteria to minimise inclusion of duplicate data

To minimise the inclusion of duplicate data (i.e., participants from the same population assessing the same outcome), the following criteria were used to decide which dataset to include:

1. The largest sample and most representative sample (particularly for ethnic groups).

2. The most recent version up to the  $3^{rd}$  October 2022.

3. Data that would facilitate inclusion in a meta-analysis (prioritising age and sex adjusted models, versus over or under adjusted models).

4. Studies which provide more detailed categories (ethnic groups are not amalgamated) and relevant measures of ethnicity (prioritising self-defined ethnicity).

5. Longitudinal studies which cover a longer period.

Criteria were given equal weight.

### JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewe	er	-			
Date					
Author_	Year		_ Recor	d Number_	
		Yes (2)	No (0)	Unclear (1)	N/A Remove Item
1.	Were the criteria for inclusion in the sample clearly defined?				
2.	Were the study subjects and the setting described in detail?				
3.	Was the exposure measured in a valid and reliable way?				
4.	Were objective, standard criteria used for measurement of the condition?				
5.	Were confounding factors identified?				
6.	Were strategies to deal with confounding factors stated?				
7.	Were the outcomes measured in a valid and reliable way?				
8.	Was appropriate statistical analysis used?				
Overall a Commen	ppraisal: Include 🗆 Exclude 🗆 Seek fu	urther in	fo 🗌		

# EXPLANATION OF ANALYTICAL CROSS SECTIONAL STUDIES CRITICAL APPRAISAL

*How to cite:* Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, Currie M, Qureshi R, Mattis P, Lisy K, Mu P-F. Chapter 7: Systematic reviews of etiology and risk . In: Aromataris E, Munn Z (Editors). *JBI Manual for Evidence Synthesis.* JBI, 2020. Available from <a href="https://synthesismanual.jbi.global">https://synthesismanual.jbi.global</a>

#### Analytical cross sectional studies Critical Appraisal Tool

Answers: Yes, No, Unclear or Not/Applicable (remove item if N/A)

#### 1. Were the criteria for inclusion in the sample clearly defined?

The authors should provide clear inclusion and exclusion criteria that they developed prior to recruitment of the study participants. The inclusion/exclusion criteria should be specified (e.g., risk, stage of disease progression) with sufficient detail and all the necessary information critical to the study. Score 2 if very clear inclusion criteria for patients e.g., all patients in X hospital or community, all patients with confirmed covid-19. Score 1 is some detail but could be clearer. Score 0 if unclear.

#### 2. Were the study subjects and the setting described in detail?

The study sample should be described in sufficient detail so that other researchers can determine if it is comparable to the population of interest to them. The authors should provide a clear description of the population from which the study participants were selected or recruited, including demographics, location, and time period. Score 2 if country, region (and name of hospital if hospital-based), and exact dates reported. Score 1 if most important details are reported but not all. Score 0 if unclear (especially if exact dates are not reported).

#### 3. Was the exposure measured in a valid and reliable way?

The study should clearly describe the method of measurement of exposure. Assessing validity requires that a 'gold standard' is available to which the measure can be compared. The validity of exposure measurement usually relates to whether a current measure is appropriate or whether a measure of past exposure is needed. Reliability refers to the processes included in an epidemiological study to check repeatability of measurements of the exposures. These usually include intra-observer reliability and inter-observer reliability. Score 2 if ethnicity was measured and reported in a valid/reliable way (self-reported/self-defined) and groups were not aggregated. Score 1 if ethnicity reported in valid/reliable way but groups were aggregated or vice versa. Score 0 if unclear, not self-reported, aggregated groups.

#### 4. Were objective, standard criteria used for measurement of the condition?

It is useful to determine if patients were included in the study based on either a specified diagnosis or definition. This is more likely to decrease the risk of bias. Characteristics are another useful approach to matching groups, and studies that did not use specified diagnostic methods or definitions should provide evidence on matching by key characteristics Score 2 for lab-confirmed PCR test/lab confirmed anti-bodies, clear definition of COVID-19 hospital admission/ICU admission/mortality. Score 0 if unclear.

#### 5. Were confounding factors identified?

Confounding has occurred where the estimated intervention exposure effect is biased by the presence of some difference between the comparison groups (apart from the exposure investigated/of interest). Typical confounders include baseline characteristics, prognostic factors, or

concomitant exposures (e.g. smoking). A confounder is a difference between the comparison groups and it influences the direction of the study results. A high quality study at the level of cohort design will identify the potential confounders and measure them (where possible). This is difficult for studies where behavioral, attitudinal or lifestyle factors may impact on the results. Score 2 if at least age and sex identified as confounding factors. Score 1 if either age or sex identified as confounding. Score 0 if neither identified as confounders.

#### 6. Were strategies to deal with confounding factors stated?

Strategies to deal with effects of confounding factors may be dealt within the study design or in data analysis. By matching or stratifying sampling of participants, effects of confounding factors can be adjusted for. When dealing with adjustment in data analysis, assess the statistics used in the study. Most will be some form of multivariate regression analysis to account for the confounding factors measured. Score 2 if study reports strategy to deal with confounding factors. Score 0 if does not report.

#### 7. Were the outcomes measured in a valid and reliable way?

Read the methods section of the paper. If for e.g. lung cancer is assessed based on existing definitions or diagnostic criteria, then the answer to this question is likely to be yes. If lung cancer is assessed using observer reported, or self-reported scales, the risk of over- or under-reporting is increased, and objectivity is compromised. Importantly, determine if the measurement tools used were validated instruments as this has a significant impact on outcome assessment validity. Having established the objectivity of the outcome measurement (e.g. lung cancer) instrument, it's important to establish how the measurement was conducted. Were those involved in collecting data trained or educated in the use of the instrument/s? (e.g. radiographers). If there was more than one data collector, were they similar in terms of level of education, clinical or research experience, or level of responsibility in the piece of research being appraised? Similar to item 4: Score 2 for lab-confirmed PCR test/lab confirmed anti-bodies, clear definition of COVID-19 hospital admission/ICU admission/mortality. Score 0 if unclear.

#### 8. Was appropriate statistical analysis used?

As with any consideration of statistical analysis, consideration should be given to whether there was a more appropriate alternate statistical method that could have been used. The methods section should be detailed enough for reviewers to identify which analytical techniques were used (in particular, regression or stratification) and how specific confounders were measured.

For studies utilizing regression analysis, it is useful to identify if the study identified which variables were included and how they related to the outcome. If stratification was the analytical approach used, were the strata of analysis defined by the specified variables? Additionally, it is also important to assess the appropriateness of the analytical strategy in terms of the assumptions associated with the approach as differing methods of analysis are based on differing assumptions about the data and how it will respond. Score 2 if age and sex adjusted for. Score 1 if age and sex were adjusted for and maybe one or two others, or if only age OR sex were adjusted for. Score 0 if over adjusted or under adjusted.

#### Data manipulation.

We extracted available crude data, unadjusted and adjusted odds/risk/hazard ratios, for each ethnic group. Where only crude numbers were available, unadjusted risk ratios (RR) were calculated. Crude numbers were used to calculate unadjusted RR for the ethnic majority group *versus* minoritised ethnic groups. Adjusted odds ratios (OR) were extracted and converted to adjusted RR using a validated conversion method (Zhang & Kai, 1998). Adjusted hazard ratios (HR) were extracted and assumed to approximate an adjusted RR. We contacted authors if the required data were not available. We specifically contacted authors of studies which reported effect sizes for aggregated Asian ethnic groups, to determine whether the study population mostly included East or South Asian people.

#### GRADE criteria

We assessed overall certainty in the pooled adjusted estimates using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach. The overall certainty estimates were categorised into one of four levels: high, moderate, low, very low. In keeping with GRADE guidance for prognostic studies, observational studies start as high certainty evidence.

Certainty was rated down based on the following criteria:

- 1. Risk of bias: rated down if most studies were moderate or high risk of bias.
- 2. Imprecision: rated down if confidence intervals were wide, relative to the clinical decision threshold (i.e., would the outcome differ depending on whether the upper or lower boundary of the confidence interval represented the truth).
- Inconsistency: rated down if there was wide variation in point estimates within ethnic groups.
- 4. Indirectness: rated down if most studies did not record ethnicity through self-report.

We were unable to use publication bias as criteria when assessing the certainty of the adjusted analyses, as only the meta-analysis of the risk of seropositivity included a sufficient number of studies to test for publication bias.

First author	Date	Study design	Study setting	Study population	Sample size	Ethnicity	Ethnic groups
	published				(N)	measure	
High-income co	untries		1	I	I		L
Song	13 <sup>th</sup> May 21	Cohort	Population	Veteran Affairs	648,202	Self-reported,	White*, Black or African American,
				Million Veteran		supplemented	AND Hispanic
				Program		with	
						administrative	
						data	
Acosta	21 <sup>st</sup> Oct 21	Cross-sectional	Hospital	COVID-NET	143,342	Medical records	Hispanic, American Indian or Alaska
							Native, Black, Asian or Pacific
							Islander, White*
Adjei	16 <sup>th</sup> Sep 21	Mortality report	Hospital	Premier Healthcare	288,144	Medical records	Hispanic, White*, Black, Asian,
				Database			Other
Lindsay	1 <sup>st</sup> Oct 21	Cohort	Population	Optum COVID-19	771,278	Historic	Non-Hispanic White*, Asian,
				HER dataset	(infection)	Environment	Hispanic, Non-Hispanic Black,
					91,741 (sero)	Records	Unknown.
						(unclear if self-	
						reported)	
Luo	16 <sup>th</sup> Dec 20	Cohort	Population	Veteran Health	10,621,580	Electronic	White*, Black or African American,
				Administration		health records	Asian, Pacific Islander, Asian,
						(unclear if self-	American Indian or Alaska Native
						reported)	
Metra	3 <sup>rd</sup> Jul 21	Cohort	Population	TriNetX	346,953	Self-reported	White*, Black

**Table S2.** Characteristics of included studies (N = 77). Ethnic groups are presented as described in the original studies.

Zerbo	25 <sup>th</sup> Aug 21	Cohort	Population	Kaiser Permanente	4,579,858	Self-reported	White*, Black, Asian,
				Northern California			Hawaiian/Pacific Islander, Native
							American or Alaska Native,
							Multiracial, Hispanic, Unknown
Bennett	13 <sup>th</sup> Jul 21	Cohort	Population	National Cohort	1,926,699	NR	White*, Black, Native Hawaiian or
				Collaborative			Pacific Islander, Asian, Other
Chang	5 <sup>th</sup> Oct 21	Cohort	Population	Centres for Medicare	31,629,094	Administrative	White*, Black, Hispanic, Asian or
				and Medicaid		data	Pacific Islander, American Indian or
							Alaska Native, Other/Unknown
Egede	Nov 20	Cross-sectional	Population	Froedert Medical	31,549	Self-reported	White*, Black, Hispanic
				College			
Feldman	23 <sup>rd</sup> Nov 21	Cross-sectional	Population	US Centres for Disease	219,100,000	US Centres for	American Indian or Alaska Native,
				Control and Prevention		Disease Control	Asian, Black, Hawaiian or Pacific
						and Prevention	Islander, Hispanic, White*
Ioannou	21 <sup>st</sup> Oct 21	Cohort	Population	Veterans Affairs	9,127,673	Self-reported	White*, Black, Asian, American
							Indian or Alaska Native, Pacific
							Islander or Native Hawaiian
Jones	2 <sup>nd</sup> Sep 21	Cross-sectional	Population	Blood donors	1,443,519	Self-reported	American Indian, Asian, Black,
							Hispanic, White*, Multiple Races,
							Other
Young	16 <sup>th</sup> Aug 21	Cohort	Population	Armed Forces Health	694,878	Self-reported	White*, Black, Hispanic, Other,
				Surveillance Division			Unknown
Thomas 1	18 <sup>th</sup> Aug 21	Cohort	Population	Surveillance Data	77,555	Name-based	White British*, White Irish, White
						classification	Other, Bangladeshi, Chinese, Indian,

							Pakistani, Other Asian, Black
							African, Black Caribbean, Other
Gray	24 <sup>th</sup> Nov 21	Cohort	Hospital	Hospital episode	374,244	Self-reported	White*, Bangladeshi, Pakistani,
				statistics			Other Asian, Black African, Black
							Caribbean, Other Black, Mixed,
							Other
Knight	19 <sup>th</sup> Sep 22	Cohort	Population	CVD COVID UK	44,964,486	Medical records	Asian, Black, Mixed, Other, White*
				Impact Consortium			
Thomas 2	10 <sup>th</sup> May 22	Cohort	Community	Online questionnaire	2,820	Self-reported	White British or Irish*, White Other,
							any other background
Martin	26 <sup>th</sup> May 22	Cross-sectional	Hospital	UK REACH	10,772	Self-reported	White*, Asian, Black, Mixed, Other
				(healthcare workers)			
Talaei	22 <sup>nd</sup> Feb 22	Cohort	Population	COVIDENCE UK	11,130	Self-reported	White*, Black, South Asian,
							Mixed/Multiple
Mathur	30 <sup>th</sup> Apr 21	Cohort	Population	OpenSAFELY	17,288,532	Self-reported	White* (White British, White Irish,
						(primary care	other White), South Asian (Indian,
						record)	Pakistani, Bangladeshi, other South
							Asian), Black (African, Caribbean,
							other Black), Other (Chinese, all
							others), and Mixed (White and
							Asian, White and African, White and
							Caribbean, other mixed)
Hippisley Cox	13 <sup>th</sup> Sep 21	Cohort	Population	QResearch Database	6,952,440	NR	White*, Indian, Pakistani,
				(vaccinated)			Bangladeshi, Other Asian,

							Caribbean, Black African, Chinese,
							Other
Ward	10 <sup>th</sup> Feb 21	Cross-sectional	Community	REACT-2 Study	105,651	Self-reported	White*, Asian (includes Asian,
							Asian British), Black (includes
							Black, African, Caribbean, Black
							British)
Farrell	3 <sup>rd</sup> Nov 20	Cohort	Hospital	Hospital Microbiology	382	Unclear if self-	White Irish*, White Other, Black
				Department, Ireland		reported	Asian and Minority Ethnic Groups
							(BAME)
Allen	4 <sup>th</sup> Feb 22	Cross-sectional	Hospital	Healthcare workers	5,085	Self-reported	Irish*, other White, Asian, Black,
							Other
Chu	24 <sup>th</sup> Jun 21	Cohort	Population	Ontario Laboratory	47,192	Surname-based	General*, Chinese, South Asian
				Information System		algorithm to	
				Database		identify	
						ethnicity	
Saeed	1 <sup>st</sup> Feb 21	Cross-sectional	Population	Blood donors from all	74,642	Self-reported	White*, Aboriginal, Asian, Other
				Canadian Blood			
				Services			
Passos-Castilho	13 <sup>th</sup> Apr 22	Cohort	Hospital	4 hospitals in Montreal	1,104	Self-reported	Asian, White*, Black, Latino,
							Middle Eastern/North African,
							Other/Mixed
Islamoska	27 <sup>th</sup> Oct 21	Cohort	Population	National Patient	500,349	Country of birth	Danish*, Immigrant
				Register		(unclear if self-	
						reported)	

Guijarro	27 <sup>th</sup> Feb 21	Cohort	Population	Population-based study	152,018	City Council	Country of birth
						registry	
Ramos-Rincon	31 <sup>st</sup> Mar 22	Cohort	Hospital	SEMI-COVID-19	23,953	Medical records	Latin American, North American,
				Registry			Sub-Saharan African, Asian,
							European*
Rostila	12 <sup>th</sup> Mar 21	Cohort	Population	Register-based study	1,778,670	Country of birth	Sweden*, other Nordic countries,
				of all Stockholm		obtained from	Europe, Middle East, Africa, rest of
				residents aged 21 and		registers	the world
				over		(unclear if self-	
						reported)	
Nwaru	7 <sup>th</sup> Jan 22	Cohort	Population	SCIFI-PEARL	326,052	LISA register	Swedish born*, foreign born
Stralin	26 <sup>th</sup> Feb 21	Cohort	Population	Swedish national board	17,140	Personal	Country of birth (Sweden*, other)
				of Health and Welfare		identity number	
Gustafsson	6 <sup>th</sup> Sep 21	Cohort	Population	All Swedish residents	72,728	Statistics	Country of birth (Sweden*, high-
				who tested positive		Sweden	income country, middle-income
							country, low-income country)
Consolazio	2 <sup>nd</sup> Mar 21	Cohort	Population	All COVID-19 cases	3,325,675	Country of birth	Italy*, European Union, Eastern
						obtained	Europe, Other Europe, Centre-
						through Census	Southern Africa, West Africa, East
						(unclear if self-	Africa, North Africa, Centre-
						reported)	Southern Asia, Western Asia, East
							Asia, Centre-South America, North
							America, Oceania, Other

Lombardi	4 <sup>th</sup> Feb 21	Cross-sectional	Hospital	Healthcare workers,	4,055	Country of birth	Italy*, Other
				Italian third-level		(unclear if self-	
				University Hospital		reported)	
Fabiani	8 <sup>th</sup> Jan 21	Cohort	Population	Italian National case-	213,180	Self-reported	Italian nationals*, Non-Italian
				base COVID-19		Nationality	Nationals
				surveillance system			
Cacciani	Jul-Aug 22	Cohort	Hospital	Hospital discharges	275,525	Unclear	Italian born*, foreign born
DiGirolamo	Jul-Aug 22	Cohort	Population	Health services	38,376,849	Unclear	Italian born*, immigrant
Pagani	11 <sup>th</sup> Oct 21	Cross-sectional	Community	San Siro Social	2,044	Citizenship of	Italian*, non-Italian
				Housing		parents	
Coyer 1	22 <sup>nd</sup> Sep 21	Case series	Population	Surveillance data, all	2,326	Country of birth	Migration: Non-Ethnic Dutch*,
				COVID-19		of individuals	Western (North American, European,
				hospitalisations		and their	Oceania, Indonesia, Japan), Non-
						parents	Western (African, Latin-American,
							Asian, Turkey)
Collard	17 <sup>th</sup> May 22	Cohort	Hospital	COVID Predict	1,178	Estimated using	Dutch*, South Asian, African,
						country of birth	Ghanian, Turkish, Moroccan, Other
Coyer 2	8 <sup>th</sup> Dec 21	Cross-sectional	Population	Health Life	2,497	Country of birth	Dutch*, South Asian, African,
						of individuals	Ghanian, Turkish, Moroccan, Other
						and their	
						parents	
Vos	10 <sup>th</sup> Nov 20	Cross-sectional	Population	PICO study	3,207	NR	Dutch*, non-dutch Western, Non-
							Western
Indseth	12 <sup>th</sup> Aug 21	Cohort	Population	Norwegian	1,329,243	Country of	Immigrants, Non-Immigrants*, AND
				Surveillance System		birth, residence	Region AfAsSA, Region ENAO

Labberton	14 <sup>th</sup> Feb 22	Cohort	Population	Beredt C19	5,490,000	Personal	Country of birth
						identifier	
Jefferies	14 <sup>th</sup> Oct 20	Cohort	Population	All confirmed COVID-	1,503	Self-reported	Māori, Pacific peoples, Asian,
				19 cases			European*, Other, Unknown
Ishii	4 <sup>th</sup> Feb 21	Cross-sectional	Community	Drive through PCR	3,540	NR	Japanese*, Non-Native
				test			
Saidel Odes	30 <sup>th</sup> Apr 21	Cohort	Hospital	Soroka University	8,518	NR	Jewish*, Bedouin Arab
				Medical Centre			
Al Awaidy	4 <sup>th</sup> Aug 21	Cohort	Hospital	All confirmed COVID-	69,382	NR	Omani nationals*, foreign-born
				19 cases			individuals
Abu Ruz	2 <sup>nd</sup> Mar 22	Cohort	Hospital	Hospital in UAE	3,296	Medical records	Middle Eastern*, other
Al Zahmi	16 <sup>th</sup> Mar 22	Cohort	Hospital	Mediclinic Parkview	560	Medical records	Arab*, African
				Hospital			
Hamadah	10 <sup>th</sup> Sep 20	Cohort	Hospital	All confirmed COVID-	1,123	Passports and	Kuwaitis*, Non-Kuwaiti
				19 cases		National Civil	
						ID cards	
Al Kuwari	8 <sup>th</sup> Sep 20	Cohort	Population	All confirmed COVID-	5,685	State	Indian, Bangladeshi, Nepalese,
				19 cases		Identification	Qatari*, Pakistani, Filipino,
						Card	Egyptian, Sri Lankan, Sudanese,
							Other
Shaikh	12 <sup>th</sup> Aug 21	Cohort	Hospital	Prince Mohammed Bin	565	NR	Saudi Nationals*, Non-Saudi
				Abdulaziz Hospital			Nationals
Nasif	26 <sup>th</sup> Dec 21	Cohort	Hospital	Several hospitals in	2,617	NR	Saudi*, Arabic, South Asia, South
				Makkah			East Asia, Africa
Low- and middle	-income countries	1	•	1	1		

Horta	29 <sup>th</sup> Oct 20	Cross-sectional	Population	Three household	89,362	Self-reported	White*, Brown (Pardo), Black,
				surveys			Yellow (Asian), Indigenous
Da Silva	30 <sup>th</sup> Dec 21	Cross-sectional	Population	Brazilian University	5,984	NR	Brown, White*, Yellow, Black,
				Students			Indigenous, Unknown
Rodrigues	31 <sup>st</sup> Mar 22	Cohort	Population	SIVEP-Gripe	840,201	Medical records	White*, Mixed, Black, Asian,
							Indigenous
Sansone	25 <sup>th</sup> Jul 22	Cohort	Population	OpenDataSUS	585,655	Medical records	White*, Black, Asian, Pardos,
							Indigenous
Silva	28 <sup>th</sup> Apr 21	Cohort	Population	SIVEP-Gripe	159,704	SIVEP-Gripe	Black, Mixed ethnicity, East Asian,
						(unclear if self-	Indigenous, White*
						reported)	
Ibarra-Nava	10 <sup>th</sup> Mar 21	Cross-sectional	Population	Epidemiological	416,546	Participants	Indigenous, Non-Indigenous*
				Surveillance System		asked if they	
				for Viral Respiratory		speak an	
				Diseases (SISVER)		Indigenous	
						language	
Servan-Mori	15 <sup>th</sup> Jul 21	Cross-sectional	Population	General Directorate of	795,878	Participants	Indigenous, Non-Indigenous*
				Epidemiology of the		asked if they	
				Ministry of Health		speak an	
						Indigenous	
						language	
Bojorquez-Chapela	10 <sup>th</sup> Feb 22	Cross-sectional	Community	Migrants living in	481	Self-reported	Country of birth (Mexico*, other)
				shelters			
Dahal	7 <sup>th</sup> Aug 22	Cohort	Population	Ministry of Health	2,173,036	Self-reported	Indigenous, non-Indigenous*
Ramli	24 <sup>th</sup> Mar 22	Cross-sectional	Community	Healthcare facilities	690	NR	Malay, Non-Malay

Utulu	10 <sup>th</sup> Apr 22	Cohort	Population	Nigeria Centre for Disease Control	1,494	NR	Igbo, Yoruba, Hausa, Others
Cifuentes	20 <sup>th</sup> Feb 21	Cohort	Population	SIVIGILA	1,033,218	NR	White/Mestizo/Other*, African- Colombian descent, Indigenous, Gipsy/Roman, Raizal (refers to descendants of the original enslaved Africans and Gipsy-Romany)
Concha	1 <sup>st</sup> Oct 21	Cross-sectional	Community	North Eastern Colombian territories	452	Unclear if self- reported	Colombian*, Indigenous
Sultanoglu	24 <sup>th</sup> Jun 20	Cohort	Population	All confirmed COVID- 19 cases	15,428	NR	Nationality: Northern Cyprus*, German, Turkmenistan
Sacoto	6 <sup>th</sup> Sep 22	Cohort	Population	Ministry of Health	251,765	Unclear if self- reported	Black, White, Indigenous, Mestizo*, Montubio, Unknown
Kadyrova	27 <sup>th</sup> Jul 22	Cross-sectional	Community	Public University employees	100	NR	Kazakh*, non-Kazakh
Ikram	29 <sup>th</sup> Apr 22	Cohort	Hospital	King Edward VII Hospital	236	Medical records	Black, White*, Coloured, Asian
Jugwanth	4 <sup>th</sup> Feb 22	Cross-sectional	Community	Unclear	530	NR	African, White*, Indian, Mixed Race
Stead	24 <sup>th</sup> Feb 22	Cross-sectional	Hospital	Healthcare workers in Eastern Cape	1,295	Self-reported	Black, White*, Coloured, Others

Ethnic majority groups are highlighted with an asterisk \*

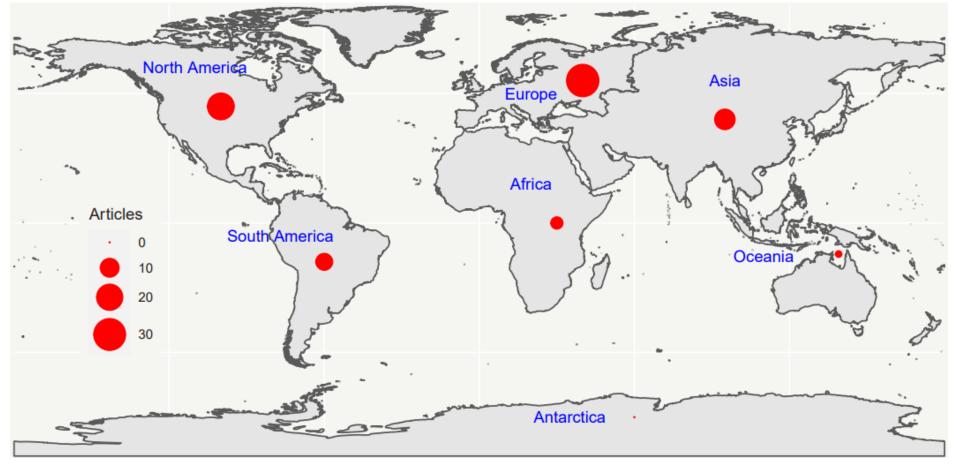
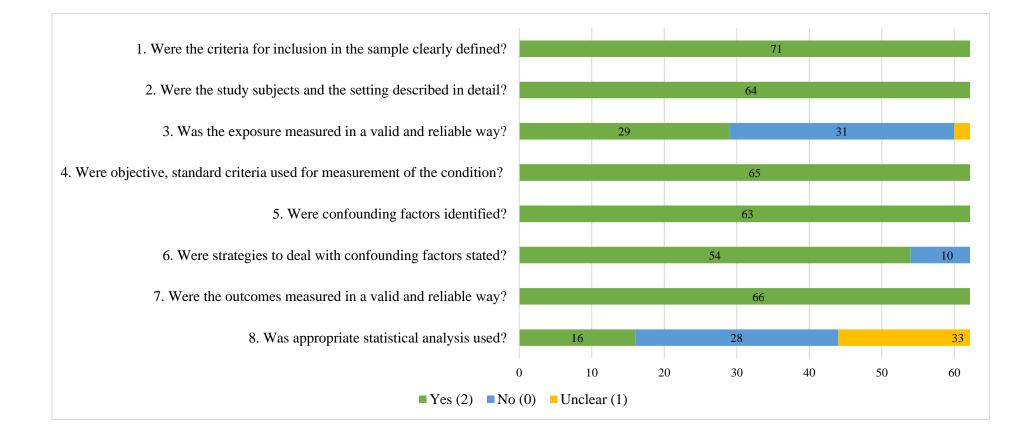


Figure S1. Map displaying geographical distribution of included studies

#### Figure S2. Summary of JBI critical appraisal scores.



## Unadjusted meta-analyses of outcomes by ethnic majority group versus minoritised ethnic groups.

Fourteen studies (with approximately 52,500,000 participants) reported crude numbers to compare the risk of infection among minoritised ethnic groups to the ethnic majority group (Figure S3). Minoritised ethnic groups had 1.4 times the risk of infection (RR = 1.40, 95% CI: 1.04 to 1.89,  $I^2 = 100.0$ ). Egger's test suggested no evidence of publication bias for the studies reporting infection (p=0.984, Figure S13).

			Unadjusted	Risk of
Author	Minority n/N	Majority n/N	RR (95% CI)	Bias
Labberton	28642/912043	53890/4582626	2.67 (2.63, 2.71)	Low
Concha	14/72	47/380	1.57 (0.92, 2.70)	Low
Stead	571/1140	30/114	1.90 (1.39, 2.60)	Low
Martin	785/3189	1711/4258	• 0.61 (0.57, 0.66)	Low
Al-Kuwari	11447/70286	47728/130720	• 0.45 (0.44, 0.45)	Low
Guijarro	179/20301	856/131599	1.36 (1.15, 1.59)	Low
Chang	357922/6834687	976213/2.38e+07	▲ 1.28 (1.27, 1.28)	Low
Mathur	14018/1857503	41180/1.09e+07	● 1.99 (1.96, 2.03)	Low
Consolazio	4651/475980	27934/2856202	1.00 (0.97, 1.03)	Low
Saidel Odes	132/2137	156/6381	2.53 (2.01, 3.17)	Low
Thomas	7/88	192/2739	1.13 (0.55, 2.34)	Low
Ishii	55/298	109/3242	5.49 (4.06, 7.42)	Medium
Jugwanth	223/255	168/275	1.43 (1.29, 1.59)	High
Utulu	350/1138	147/356	0.74 (0.64, 0.87)	High
Overall, DL	418996/1.02e+07	1150361/4.24e+07	1.40 (1.04, 1.89)	
(l <sup>2</sup> = 100.0%, p	= 0.000)		<b>~</b>	
		<b>I</b> .12	1 8	
VOTE: Weights are	rom random-effects model			

Figure S3. Forest plot showing the pooled effect size for the risk of infection in minoritised ethnic groups

compared to the ethnic majority group.

Ten studies reported seropositivity (due to infection rather than vaccination), including 1,643,454 participants (Figure S4). Minoritised ethnic groups were more likely to be seropositive compared to the ethnic majority group (RR = 1.61, 95% CI: 1.22 to 2.13,  $I^2 = 99.1$ ). Egger's test indicated no evidence of publication bias for studies reporting seropositivity (p=0.239, Figure S14).

Study Lombardi Talaei Vos Pagani	n/N 27/186 98/577 9/331	Majority n/N 282/3869 1589/12240					RR (95% CI)	Bias
Talaei Vos	98/577				<u> </u>	•	1 99 (1 38 2 87)	Lov
Vos		1589/12240					1.55 (1.50, 2.57)	LUV
	9/331						1.31 (1.09, 1.58)	Lov
Jogoni		65/2306		•	1		0.96 (0.49, 1.92)	Low
ayanı	110/472	143/1572				•	2.56 (2.04, 3.21)	Low
Allen	303/1287	595/3798					1.50 (1.33, 1.70)	Low
Coyer	201/2178	24/522				•	2.01 (1.33, 3.03)	Low
Saeed	370/52852	119/10695	-	•			0.63 (0.51, 0.77)	Low
Horta	1637/55057	372/32383			1		2.59 (2.31, 2.89)	Low
Jones 3	39803/167251	226948/1226745					1.29 (1.27, 1.30)	Medium
_indsay	1974/9164	5227/59969				•	2.47 (2.36, 2.59)	Medium
Overall, DL 4	44532/289355	235364/1354099				>	1.61 (1.22, 2.13)	
(l <sup>2</sup> = 99.1%, p = 0.0	000)							

NOTE: Weights are from random-effects model

Figure S4. Forest plot showing the pooled effect size for the risk of seropositivity in minoritised ethnic groups

compared to the ethnic majority group.

A total of 14 studies, including approximately 47,600,000 participants, reported crude numbers to determine the risk of hospital admission. Six studies reported the unadjusted risk of hospitalisation in the general population, showing an increased risk of hospitalisation for minoritised ethnic groups compared to the ethnic majority group (RR = 1.41, 95% CI: 1.01 to 1.98,  $I^2 = 99.9$ ) (Figure S5). Eight studies investigated prognosis (hospital admission) among people infected with COVID-19. There was no difference in risk for minoritised ethnic groups compared to the ethnic majority group (RR = 1.19, 95% CI: 0.73 to 1.94,  $I^2 = 99.9$ ) (Figure S5). Egger's test suggested no evidence of publication bias (p=0.350, Figure S18).

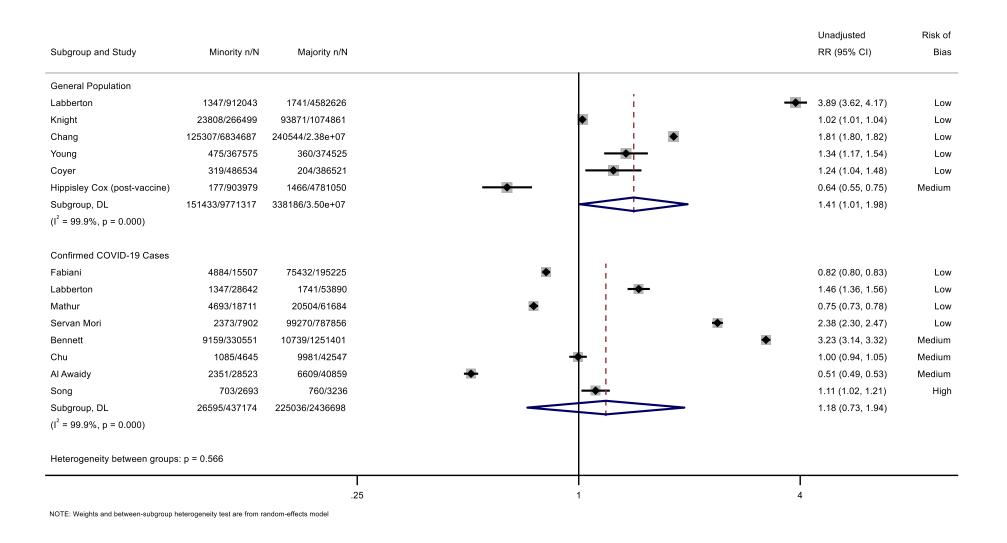


Figure S5. Forest plot showing the pooled effect size for the risk of hospital admission in minoritised ethnic groups compared to the ethnic majority group.

There were 21 studies (with approximately 15,000,000 participants) that included crude numbers to identify the risk of ICU admission. Three studies reported crude numbers to investigate the unadjusted risk of ICU admission among the general population. Minoritised ethnic groups were three times as likely to be admitted to ICU for COVID-19 compared to the ethnic majority group (RR = 3.03, 95% CI = 2.08 to 4.41,  $I^2 = 93.9$ ) (Figure S6). Among eight studies which assessed prognosis following infection, there was no increased risk of ICU admission for minoritised ethnic groups (RR = 1.30, 95% CI = 0.97 to 1.74,  $I^2 = 99.2$ ). However, there was an increased risk among 10 studies which assessed prognosis following hospitalisation for COVID-19 (RR = 1.58, 95% CI = 1.19 to 2.11,  $I^2 = 97.6$ ) (Figure S6). Egger's test indicated possible publication bias for studies reporting ICU admission (p=0.007, Figure S19).

Subgroup and Study	Minority n/N	Majority n/N	Unadjusted RR (95% CI)	Risk o Bias
General Populati	on			
Egede	139/7761	83/23788	5.13 (3.92, 6.73)	Lov
Mathur	652/1857406	1700/1.09e+07	2.25 (2.05, 2.46)	Lo
Song	291/182637	288/465565	2.58 (2.19, 3.03)	Hig
Subgroup, DL	1082/2047804	2071/1.14e+07	3.03 (2.08, 4.41)	
(l <sup>2</sup> = 93.9%, p = 0	0.000)			
Confirmed COVII	D-19 Cases			
Fabiani	549/15507	9066/195225	0.76 (0.70, 0.83)	Lo
Hamadah	40/829	11/294	1.29 (0.67, 2.48)	Lo
Ibarra Nava	155/4178	8715/412368	1.76 (1.50, 2.05)	Lo
Mathur	652/13921	1700/41180	1.13 (1.04, 1.24)	Lo
Al Awaidy	426/2351	763/6609	1.57 (1.41, 1.75)	Mediur
Metra	1971/50376	2815/157049	◆ 2.18 (2.06, 2.31)	Hig
Silva	22660/73639	21001/66669	0.98 (0.96, 0.99)	Hig
Song	291/2693	288/3236	1.21 (1.04, 1.42)	Hig
Subgroup, DL	26744/163494	44359/882630	1.30 (0.97, 1.74)	
(l <sup>2</sup> = 99.2%, p = 0	0.000)			
Hospitalised CO	VID-19			
Passos Castilho	159/465	171/589	1.18 (0.99, 1.41)	Lo
Ibarra Nava	155/1602	8715/412368	4.58 (3.94, 5.32)	Lo
Thomas	23/697	282/13092	1.53 (1.01, 2.33)	Lo
Fabiani	549/4884	9066/75432	0.94 (0.86, 1.01)	Lo
Mathur	652/4596	1700/20504	1.71 (1.57, 1.86)	Lo
Ramos-Rincon	315/2354	1871/20599	1.47 (1.32, 1.65)	Lo
Stralin	975/6244	1245/9972	1.25 (1.16, 1.35)	Lo
Shaikh	81/434	20/131	1.22 (0.78, 1.91)	Mediu
Al Zahmi	60/412	12/148	1.80 (0.99, 3.24)	Mediu
Farrell	10/49	21/208	2.02 (1.02, 4.01)	Mediu
Subgroup, DL	2979/21737	23103/553043	1.58 (1.19, 2.11)	
(l <sup>2</sup> = 97.6%, p = 0	0.000)			
Heterogeneity be	etween groups: p =	= 0.002		
		<b> </b> .125	1 I 8	
		.125	I ð	

*Figure S6.* Forest plot showing the pooled effect size for the risk of ICU admission in minoritised ethnic groups compared to the ethnic majority group (studies are separated by denominator).

A total of 35 studies reported the risk of mortality, including approximately 283,000,000 participants. Seven studies reported the risk of mortality in the general population (Figure S7). The unadjusted analyses showed a reduced risk of mortality for minoritised ethnic groups compared to the ethnic majority group (RR = 0.63, 95% CI = 0.41 to 0.98,  $I^2 = 99.7$ ). Of the ten studies which assessed prognosis (mortality) following COVID-19 infection, there was no difference in risk of mortality for minoritised ethnic groups (RR = 0.78, 95% CI = 0.51 to 1.20,  $I^2 = 99.7$ ), and the risk was reduced in the 18 studies which reported prognosis following hospitalisation (RR = 0.67, 95% CI = 0.61 to 0.73,  $I^2 = 99.6$ ) (Figure S7). Egger's test suggested evidence of publication bias for the studies reporting mortality (p=0.010, Figure S20).

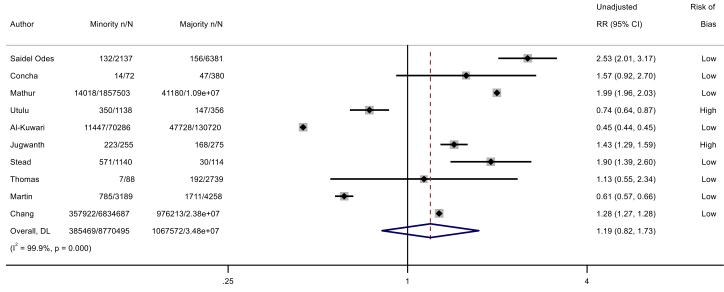
General Population Mathur 1174/1597503 7514/100e-07 Rotlikin 4308/45193 1016/1222511 Unificatelin 31/086442 222/45080 Feldman 14666/47/52e-07 225521/4616 Highlam 1126/9303970 15124/711003 Savgroup, DL 1506339.07+07 259766138+08 01 = 39.7%, p = 0.000) Confirmed COVID-19 Cases Darra Nava 601/4178 45817/382388 Mathur 1774/14018 751441180 Tablen1 350015064 27380173402 Data 31072761 2222 1140 Tablen1 350015064 27380173402 Data 311/222 1278 Data 311/222 12	ubgroup and Study	Minority n/N	Majority n/N	Unadjusted RR (95% CI)	Ris
Beatla 4396/46/159 1016/1232511 DiGrobano 991/8955416 2007b2.96+07 Feldman 1466047.52x477 2275321.44+08 Bernett 1228030379 1512/47050 Skilgroup, DL 109538.3.7x+07 22752401 Hypiskey Cox (post-vaccime) 12290379 1512/471050 Skilgroup, DL 3001/5504 273251138-08 12 971X, p = 0.000 Confirmed COVID-19 Cases bera Nixa 3001/5504 2732511345 Data 3301/5504 2732511345 Data 3301/5504 2732511345 Data 3301/5504 2733511395 Data 3301/5502 10952112251 Data 3301/5502 10952112251 Data 33001/5504 273357222 Data 3300/5502 10492243733 Data 3300/5502 10492243733 Data 3300/5502 1049224373 Data 3300/5502 1049224373 Data 3300/5502 1049224373 Data 3300/5502 1049224373 Data 3300/5502 1049224373 Data 3400/5502 10492437750 Data 4400/5507 1634100/557 1634100/5514 Data 44044 17731 Data 44044 17731 D	Seneral Population				
ndsehn 31/069442 222/6000 Geriahman 146604/7.52e+07 22753/1.44e+08 Barnett 1269/30851 122/0782.98e+07 (128/30851 122/0782.98e+07 (128/30857 1512/1216101 129/05376 37 1512/1216101 138 (128, 148) 046 (04, 048) 058 (144, 0.88) 138 (128, 148) 046 (04, 048) 048 (140, 047, 058) 048 (128, 148) 048 (140, 047, 058) 048 (140, 048) 048 (048), 039) 048 (048), 03	lathur	1174/1857503	7514/1.09e+07	0.91 (0.86, 0.97)	
Useri         10009H1         2207122109         0.07 (0.03, 0.1)           Windmin         1800047.52e77 2275271.44e100         0.27 (0.23, 0.24)           Windproup, DL         150033051         1912/22101         1.23 (123, 1.24)           Windproup, DL         15003305.11 (127, 128)         0.24 (0.27, 0.23)           Windproup, DL         15003305.11 (127, 128)         0.24 (0.27, 0.23)           Windproup, DL         15003308.37e+07 2875611.39e+08         0.24 (0.27, 0.23)           Windproup, DL         150013308.37e+07 2875611.39e+08         0.38 (0.41, 0.80)           Windproup, DL         150013308.37e+07 2875611.39e+08         0.38 (0.41, 0.80)           Windproup, DL         150013308.37e+07 2875611.39e+08         0.38 (0.41, 0.80)           Windproup, DL         30017504         227330(194966         0.36 (0.41, 0.80)           Windproup, DL         30017504         227380(194966         0.36 (0.41, 0.80)           Windproup, DL         984/161657         326490398222         0.76 (0.61, 0.77)           Windproup, DL         984/161657         326490398222         0.76 (0.61, 0.77)           Windproup, DL         984/161657         326490398222         0.76 (0.61, 0.61)           Windproup, DL         984/160         0.06699         0.36 (0.61, 0.61)         0.36 (0.61, 0.61	tostila	438/546159	1016/1232511	0.97 (0.87, 1.09)	
adaman       1460047.52×07.2275.207.144×08       123 (123, 124)         emneti       128 (033051       1912/1251401       251 (234, 2.70)         hybropin, D.L       1050336.37×67       25972861 93×68       0.83 (6.41, 0.88)         samiran Ava       691/4178       458177382388       0.44 (0.37, 0.53)         samiran Ava       691/4178       458177382388       0.46 (0.43, 0.49)         samiran       30017504       2738179456       0.46 (0.43, 0.49)         samiran       303172169       2249722151140       0.46 (0.43, 0.49)         samiran       219982140       28366971078       0.32 (0.22, 0.47)         sacob       47977876       6372/208718       0.75 (0.61, 0.92)         sacob       47977876       6372/208718       0.76 (0.68, 0.82)         sacob       4488/2746       26569/11087       3246972250718       0.76 (0.68, 0.82)         sacob       47977876       6372/208718       0.76 (0.68, 0.82)       0.76 (0.68, 0.82)         sacob       47897786       5372/208718       0.85 (0.60, 0.69)       0.36 (0.07, 0.82)       0.76 (0.68, 0.28)       0.76 (0.68, 0.28)         sacob       47897786       5372/208718       0.85 (0.68, 0.71)       0.86 (0.68, 0.71)       0.86 (0.68, 0.71)       0.76 (0.68, 0.68)       0.8	ndseth	31/869442	222/450804	0.07 (0.05, 0.11)	
ennett 128933055 1912/1251401 ippslagv Cox (post-vacine) 128983979 1512/4781050 uodyroup, DL 150838.3.7+07 25978b1.3.8+08 = 99.7%, p = 0.00) andfmed COVID-19 Cases arra Nava 901/4778 45917382388 lathur 1174/14018 7514/41180 ablah 39015504 27850/14980 ablah 39015504 27850/14980 ablah 39015504 22820716 Jakets 219082140 2385087108 LAwaigy 152/4067 20624201 utanoglu 27/22 27/76 0.0 714/7015 989/7244 acoto 4778/7876 55722020718 utanoglu 27/877876 5572202778 utanoglu 27/877876 5572202778 amo-Rhoxo 1778/2354 4459120599 ray 4868/25746 22659711372 amo-Rhoxo 1778/2354 4459120599 ray 4868/25746 236971672 amo-Rhoxo 1778/2354 4459120599 ray 4868/25746 236971672 amo-Rhoxo 1778/2354 4459120599 ray 046883 27789175252 train 390/4883 27839175252 train 390/4883 27839175252 train 3902/2624 010956973 amo-Rhoxo 1778/2354 4459120599 ray 04683 27839175252 train 3902/2624 228090972 aso-Caslibo 50149/246793 amadah 301829 101294 tray (bask 12 1290700080 254787182348 defind 441415 1277786 amadah 301829 101294 tray (bask 12 1290700080 254787182348 defind 441415 1277786 amadah 40434 171731 deji 12809700805 124787182348 defind 441415 1277786 amadah 40434 171731 deji 12809700857 13410435144 defind 441415 1277786 amad	iGirolamo	991/3955419	20078/2.98e+07	• 0.37 (0.35, 0.40)	
tipplelay Cox (post-vaccine)       125903973       1512/478100       0.44 (0.37, 0.53)         ubgroup, DL       1306338.37e+07       2597861.93a+08       0.63 (0.41, 0.89)         confirmed COVID-19 Cases       1.38 (128, 148)       0.46 (0.43, 0.49)         baini       39015504       27838114985       0.48 (0.43, 0.49)         baini       390115504       27838114985       0.48 (0.41, 0.89)         Jikantes       21990621400       28366071078       1.22 (1.47, 1.20)         Junoglu       2.32       2.37       0.52 (0.61, 0.29)         Junoglu       2.32       2.76       0.75 (0.68, 0.82)         ua       714/7175       9897244       0.57 (0.68, 0.82)         biogroup, DL       9664/161657       352496/3989262       0.76 (0.61, 0.29)         biogroup, DL       9664/161657       352496/3989262       0.58 (0.41, 0.89)         rise park Awa       595/1602       40052/112251       0.58 (0.48, 0.80)         tamos-Rincon       1178/2354       4465/20599       0.58 (0.48, 0.80)<	eldman	146604/7.52e+07	227532/1.44e+08	♦ 1.23 (1.23, 1.24)	Me
blagroup, DL 15063318.37e-07 259786/1938-08 if =97%, p = 0.000) Damimed COVID-19 Cases bara Nuva 0501500 272830194955 dathur 1174/14018 751441180 ablani 33011500 272832151140 ndsehn 3144931 2222/151410 ndsehn 3144931 2222/151410 ndsehn 21962140 223626971078 NAwaidy 153/24067 2026/24201 billanoglu 2/32 2/76 bara Nuva 505/1602 40692/112251 datou 714/7015 9897244 3acolo 4797876 6572205718 3blgroup, DL 9964/161657 352496/398262 =97%, p = 0.000) Hospitalised COVID-19 bara Nuva 505/1602 40692/112251 tamos-Rincon 178/2354 4458/20599 3ry 4888/2574 20569111387 rablani 390/483 278507/5252 bara Nuva 505/1602 40692/112251 tamos-Rincon 178/2354 2458/20599 3ry 4088/2574 20569111387 rablani 390/483 278507/5252 bara Nuva 505/1602 40692/112251 tamos-Rincon 178/2354 2458/20599 3ry 4088/2574 20569111387 rablani 390/483 278507/5252 bara Nuva 505/1602 40692/112251 bara Nuva 505/1602 40692/11251 bara Nuva 505/1602 40692/11251 bara Nuva 506/1605/1014/1010, 111, 111, 111, 111, 111, 111, 111	ennett	1269/330551	1912/1251401	♦ 2.51 (2.34, 2.70)	Me
f <sup>2</sup> = 98.7%, p = 0.000)         Confirmed COVID-19 Cases         harra Niva       6914178       45817/382368         harra Niva       6914178       45817/382368         harra Niva       138 (129, 148)       0.18 (0.16, 0.18)         Dahal       3331/21896       22497/21151140       0.18 (0.16, 0.18)         Dahal       3331/21896       22497/22151140       0.32 (0.22, 0.47)         Jithenes       2199/02140       2380/071078       1.06 (1.56, 1.65)         Jixanoglu       223       2.76       0.75 (0.68, 0.82)         Juo       714/7015       9807/244       0.75 (0.68, 0.82)         Jiborou       7497876       657/2050718       1.90 (1.74, 2.08)         Jibarosup, DL       964/161657       352496/3989262       0.75 (0.68, 0.82)         Jibara Nava       595/1602       40692/11251       1.90 (1.74, 2.08)         Jamos-Rincon       178/2554       4458/20599       0.35 (0.30, 0.40)         Jarra Nava       595/1602       40692/11251       0.58 (0.23, 0.48)         Jamos-Rincon       178/2554       4458/20599       0.65 (0.60, 0.68)         Jarra Nava       595/1602       109/689       0.65 (0.60, 0.68)       0.65 (0.60, 0.68)         Jarano Nava       595/160	lippisley Cox (post-vaccine)	) 126/903979	1512/4781050	0.44 (0.37, 0.53)	Me
Confirmed COVID-19 Cases         691/4178         45817/382368           Jahun         1174/14018         751/441180         0.46 (0.43, 0.49)           Salani         33031/21996         234972/2151140         0.48 (0.16, 0.19)           Indexth         314931         22211301         0.88 (0.15, 0.18)           Diamal         3331/21996         234972/2151140         0.38 (0.15, 0.18)           Indexth         314931         22211301         0.58 (0.15, 0.18)           Nawaity         153/24067         20624201         0.27 (0.68, 0.82)           Nawaity         153/24067         20624201         0.27 (0.68, 0.82)           Juid column         74/47/015         9807/244         2380(0.35, 16, 13)           Juid column         75 (56, 10, 20)         0.75 (0.68, 0.82)         0.76 (0.61, 120)           Juig column         595/1602         40692/112251         1.90 (1.74, 2.08)         0.78 (0.51, 120)           Stription         179/25254         4260/957         258/61/2096         1.90 (0.82, 0.71)           Stription         109/248/276069         1109/248/27869         0.85 (0.68)         0.85 (0.60, 0.68)           Stription         1108/252644         2260/972         0.85 (0.60, 0.68)         0.85 (0.63, 0.63)         0.85 (0.63, 0.63)	ubgroup, DL	150633/8.37e+07	259786/1.93e+08	0.63 (0.41, 0.98)	
barra Nava 6914178 45817/382368 Athur 1174/14018 751441180 Tablahi 3001564 273681/1496 Tablahi 3010564 273681/1496 Tablahi 30312(1488 2349722(151140) Tablahi 2019/62140 23669/71078 Tablahi 2019/62140 23669/71078 Tablahi 2020/22012 Siltendes 2199/62140 23669/71078 UAwatdy 15324067 206/2201 Subaroup U 2/32 2/76 Sacobo 4747/7875 6572/205718 Subgroup DL 9664/16157 352496720578 Subgroup DL 9664/16157 352496720578 Subgroup DL 9664/16157 35249675252 Tablahi 390/4883 2786/15252 Tablahi 390/4883 2786/1525 Tablahi 390/4883 2786/15252 Tablahi 390/4883 2786/1525 Tablahi 390/4883 2786/15252 Tablahi 390/4883 2786/1525 Tablahi 390/4835 22/964 Tablahi 31/635 22/964 Tablahi 31/	<sup>2</sup> = 99.7%, p = 0.000)			-	
Hathur       1174/14018       7514/41180       0.46 (0.43, 0.49)         Bahal       39011550       227380134956       0.18 (0.16, 0.19)         Jahal       39172189       23472189       0.18 (0.16, 0.19)         Indseth       314931       222(11301       0.22 (0.22, 0.47)         Jifkentes       2199/62140       22860/971078       0.32 (0.22, 0.47)         Jikawaidy       1532/4067       208/24201       0.75 (0.61, 0.92)         Juco       714/7015       989/7224       0.75 (0.68, 0.82)         Jacolo       479/7876       657/202/71251       1.9 (0.17, 4.20)         Sacolo       479/7876       657/202/11251       1.9 (0.17, 4.20)         Amana Mas       595/1602       40692/11251       1.9 (0.77, 0.82)         Jamal       392/6244       206099772       0.8 (0.67, 0.82)         Jamal       392/6244       206099772       0.8 (0.6, 0.69)         Jamal       392/6244       206099772       0.5 (0.40, 0.88)         Jamal       392/6244       206099772       0.5 (0.40, 0.88)         Jamal       392/6244       206099772       0.6 (0.6, 0.89)         Jamal       392/6244       206099772       0.8 (0.4, 0.63)         Jamal       392/6244	confirmed COVID-19 Cases	3			
abiani       390/15504       27836/194956         abiani       3331/2186       224/1301         indesh       314931       222/1301         indesh       314931       22011301         uo       714/7015       989/7244         isoolo       4797876       6572/205718         ubigroup, DL       9664/161657       352496/3980262         isoolo       4797876       6572/205718         ubigroup, DL       9664/161657       352496/3980262         isacolo       176/2354       458/20599         jar       932/6224       2060/972         isaso-Castiho       65465       199/599         jarsanoe       10843/27609       1049/249793         jarsanoe       10843/27609       1049/249793         jarsanoe       10843/27609       0.68 (0.68, 0.81)         jarlani       31/055       22/964         kram       50/228       36         jarlani       31/055       22/964         kram       <	oarra Nava	691/4178	45817/382368	♦ 1.38 (1.29, 1.48)	
bahal 3831/21896 234972/2151140 deseth 314/931 22211301 jtientes 2199/62140 23866971078 Ukandy 153/24067 206/24201 uu 71417015 9907244 bacoto 4797876 6572/205718 subgroup, DL 9664/161657 352496/3989262 acoto 4797876 6572/205718 bubgroup, DL 9664/161657 352496/3989262 desetated COVID-19 bara Nava 595/1602 40692/112251 tamos-Rincon 178/354 44581/20599 tamadah 390/4883 27386/75252 tamin 8320/244 5 109/569 tamadah 30/829 10/294 tarandah 30/820 10/294 tarandah 30/820 10/	lathur	1174/14018	7514/41180	• 0.46 (0.43, 0.49)	
vidseth       31/4931       222/11301       0.32 (0 22, 0.47)         i/Uentes       2199/62140       28366/971078       1.21 (1 16, 126)         i/Waidy       153/24067       206/24001       0.75 (0 66, 0.62)         i/Waidy       153/24067       206/24001       0.75 (0 66, 0.62)         uo       7147/015       989/7244       0.75 (0 66, 0.62)         i/Waidy       153/24067       352496/3989262       0.76 (0 66, 0.62)         i/waidy       488/25746       26569/112251       1.90 (17, 4, 2.08)         i/amos-Rincon       178/2354       4458/20599       0.56 (0, 0, 69)         i/amos-Rincon       178/2354       2466/929927       0.83 (0, 0, 70, 0.82)         i/amos-Rincon       178/2354       26569/11367       0.22 (0 2.0, 0.24)         i/asso-Castilho       56/465       109/589       0.65 (0, 60, 69)         i/asso-Castilho       56/465       109/589       0.65 (0, 60, 69)         i/asso-Castilho       56/465       109/589       0.65 (0, 64, 0.73)         i/asso-Castilho       56/466       109/589       0.65 (0, 64, 0.68)         i/asso-Castilho       56/466       109/589       0.65 (0, 64, 0.71)         i/asso-Castilho       56/466       109/589       0.65 (0, 64, 0.73) </td <td>abiani</td> <td>390/15504</td> <td>27836/194956</td> <td>• 0.18 (0.16, 0.19)</td> <td></td>	abiani	390/15504	27836/194956	• 0.18 (0.16, 0.19)	
2/itentes       2199/62140       28366/971078       1.21 (1.16, 1.26)         M Awaidy       153/24067       206/24201       0.75 (0.61, 0.92)         Sultanoglu       2/32       2/76       0.75 (0.61, 0.92)         Juo       714/7015       999/7244       0.75 (0.66, 0.82)         Jacobo       479/7876       657/2/057/18       0.76 (0.66, 0.82)         Subgroup, DL       9664/161657       352496/3989262       0.78 (0.51, 1.20)         /* = 99.7%, p = 0.000)       Hospitalised COVID-19       0.35 (0.30, 0.40)         barra Nava       595/1602       40692/112251         tamos-Rincon       178/2354       4458/20599         Jarajin       390/488       278/36/75252         Stralin       832/6244       2060/9972         Passoc-Castliho       56/465       109/589         Jaray (post-vaccine)       7630/54502       50149/248793         Jaray (post-vaccine)       7630/54502       22/2/20         Jaray (p	ahal	3831/21896	234972/2151140	1.60 (1.56, 1.65)	
N Awaidy 153/24067 206/24201 Jultanoglu 2/32 2/76 July 714/7015 989/7244 Jacobo 479/7876 6572/205718 July 9664/161657 352496/3969262 1 <sup>2</sup> = 99.7%, p = 0.000) Hospitalised COVID-19 Dara Nava 595/1602 40692/112251 Ramos-Rincon 178/2354 4458/20599 Jaray 04883 27836/75252 Jabiani 390/4883 27836/75252 Jabiani 882/62746 26569/111367 Jabiani 882/62746 26569/111367 Jabiani 882/62746 26569/11367 Jabiani 882/62746 2659/11467 Jabiani 98/208 Jabiani 98	ndseth	31/4931	222/11301	••••••••••••••••••••••••••••••••••••••	
Sultanoglu 2/32 2/76 .uo 714/7015 989/7244 Sacoto 479/7876 6572/205718 Subgroup, DL 9664/161657 352496/3989262 i <sup>2</sup> = 99.7%, p = 0.000 Hospitalised COVID-19 barra Nava 595/1602 40692/112251 tamos.Rincon 178/3254 4458/20599 Paray 4886/25746 265691/11367 Fabiani 3390/4883 27836/75252 Stralin 822/6244 2060/9972 Passos.Castilho 56/465 109/589 tamadah 30/829 10/294 Sray (post-vaccine) 7630/64502 50149/248793 Sray (post-vaccine) 7630/64502 50160/640, 073 Sray (post-vaccine) 7630/640, 073 Sray (po	ifuentes	2199/62140	28366/971078	I ◆ 1.21 (1.16, 1.26)	
uo       714/7015       989/7244       0.75 (0.68, 0.82)         Jacobo       479/7876       6572/205718       1.90 (17.4, 2.08)         Subgroup, DL       9664/161657       352496/3989262       0.78 (0.51, 1.20)         Hospitalised COVID-19       Jamos-Rincon       179/2354       4458/20599         Jamos-Rincon       179/2354       4458/20599       0.53 (0.30, 0.40)         Yangy       4888/25746       26569/111367       0.22 (0.20, 0.24)         Jarano - Rincon       179/2354       4458/20599       0.22 (0.20, 0.24)         Yanin       390/4883       27836/7552       0.22 (0.20, 0.24)         Jarandah       30/0/829       10/294       0.65 (0.66, 0.69)         Passos-Castilho       56/465       109/589       0.66 (0.67)         Yang (post-vaccine)       763/054502       50149/248793       0.66 (0.67)         Jansone       108643/276000       110495/308646       0.52 (0.81, 0.36)         Kram       50/228       3/8       0.56 (0.23, 1.48)         Olard       4/4/15       1277736       0.35 (0.11, 1.10)         Shahh       4/6/344       17/111       0.62 (0.44, 1.08)         Sodrigues       168025/405057       163410/435144       0.68 (0.44, 1.08)	l Awaidy	153/24067	206/24201	0.75 (0.61, 0.92)	Me
bacob       479/7876       6572/205718       1.90 (1.74, 2.08)         bubgroup, DL       9664/161657       352496/3989262       0.78 (0.51, 1.20)         dospitalised COVID-19       10.02 (0.96, 1.09)       0.78 (0.51, 1.20)         damoa-Rincon       178/2354       4458/20599       1.02 (0.96, 1.09)         dramoa-Rincon       178/2354       4458/20599       0.83 (0.30, 0.40)         dramoa-Rincon       178/2354       2060/9972       0.83 (0.20, 0.24)         dramadah       309/483       27836/75252       0.22 (0.20, 0.24)         dramadah       30/829       10/294       0.65 (0.46, 0.89)         dramadah       30/829       10/294       0.69 (0.66, 0.71)         dramadah       30/829       10/294       0.69 (0.68, 0.71)         dramadah       30/829       10/294       0.69 (0.68, 0.71)         dramadah       30/829       10/294       0.69 (0.68, 0.71)         dramadah       30/6120       5478/182348       0.58 (0.23, 1.48)         ndseth       31/535       222/064       0.58 (0.23, 1.48)         oblard       44/415       1277736       0.58 (0.23, 1.48)         oblard       34/49       36/208       0.58 (0.24, 0.39)         orrel       1.69(0.56,	ultanoglu	2/32	2/76	2.38 (0.35, 16.13)	
Aubgroup, DL       9664/161657       352496/3989262       0.78 (0.51, 1.20)         Hospitalised COVID-19       10.2 (0.96, 1.09)       1.02 (0.96, 1.09)         Baray       488/25746       26569/111367       0.35 (0.30, 0.40)         Strain       390/483       27836/75252       0.66 (0.60, 0.69)         Baray       488/25746       26569/111367       0.22 (0.20, 0.24)         Strain       832/6244       2060/9972       0.65 (0.60, 0.69)         Baray       654/65       109/689       0.65 (0.60, 0.69)         Parsoso-Castilho       561/4502       501/49/248793       0.65 (0.66, 0.71)         Strainon       108643/276009       110495/309646       0.10 (1.10, 1.11)         Adapti       30/629       10/294       0.65 (0.62, 0.71)         Strainon       50/228       3/8       0.22 (0.20, 0.24)         Ansone       108643/276009       110495/309646       0.25 (0.18, 0.36)         Aralin       30/208       3/6       0.65 (0.62, 0.72)         Scalard       4/4/415       127/736       0.65 (0.62, 0.22)         Aralin       3/9       3/6/208       0.58 (0.23, 1.48)         Scalard       4/4/415       127/736       0.65 (0.65, 0.82)         Aralin       4/4/41	uo	714/7015	989/7244	0.75 (0.68, 0.82)	
t <sup>2</sup> = 99.7%, p = 0.000) tospitalised COVID-19 barra Nava 595/1602 40692/112251 tamos-Rincon 178/2354 4458/20599 tamos-Rincon 178/2354 4458/20599 tamos-Rincon 178/2354 4258/2059 tamos-Rincon 178/2354 4258/2059 tamos-Rincon 178/2354 4258/2059 tamos-Rincon 178/2354 4258/2059 tamos-Rincon 178/2354 4258/2059 tamos-Rincon 188/2/624 2060/972 tassos-Castilho 56/465 109/589 tamadah 30/829 10/294 tamadah 44/415 127/736 tamadah 30/49/882353 451948/1509827 tamadah 30/68 0.44, 1.06 tamadah	acoto	479/7876	6572/205718		
Hospitalised COVID-19         barra Nava       595/1602       40692/112251         akmos-Rincon       178/2354       4458/20599         3ray       4888/25746       26569/111367         abiani       390/4883       27836/75252         abiani       390/4883       27836/75252         bitralin       6332/6244       2060/9972         abasos-Castilho       556/465       109/589         damadah       30/829       10/224         Bray (post-vaccine)       7630/54502       50149/248793         Sray (post-vaccine)       7630/54502       50149/248793         Adseth       31/255       222/964         kram       50/228       3/8         bolard       44/415       127/736         kram       50/228       3/8         bolard       44/415       127/736         brarell       3/49       36/208         brarell       3/610/435144       0.68 (0.44, 1.06)         braif       43/1418       34/765	ubgroup, DL	9664/161657	352496/3989262	0.78 (0.51, 1.20)	
bara Nava 595/1602 40692/112251 Ramos-Rincon 178/2354 4458/20599 ray 4888/25746 26569/111367 ray 4888/25746 26569/111367 ray 4888/25746 26569/111367 ray 4888/25746 26569/111367 ray 4888/25746 26569/111367 ray 4888/25746 26569/11367 ray 4888/25746 2060/9972 ray 4888/25746 2060/9972 ray 4888/25746 26569/11367 ray 4889/212262 ray 4889/21226 ray 4889/212262 ray 4889/212262 ray 4889/212262 ray 4889/212262 ray 4889/21226 ray 4889/212262 ray 4889/212262 ray 4887 ray 50/228 3/8 ray 50/289 ray 50/289	<sup>2</sup> = 99.7%, p = 0.000)				
Ramos-Rincon       178/2354       4458/20599 <ul> <li>Gray</li> <li>488/25746</li> <li>26669/111367</li> <li>390/4883</li> <li>27836/75252</li> <li>309/589</li> <li>3065 (0.60, 0.69)</li> <li>0.65 (0.64, 0.88)</li> <li>106 (0.53, 2.15)</li> <li>30800</li> <li>56/465</li> <li>109/589</li> <li>36829</li> <li>10/294</li> <li>368029</li> <li>10495/309646</li> <li>1.10 (1.10, 1.11)</li> <li>304619/3027</li> <li>308</li> <li>222/964</li> <li>31/535</li> <li>222/964</li> <li>31/535</li> <li>222/964</li> <li>36/208</li> <li>31/535</li> <li>222/964</li> <li>36/208</li>             &lt;</ul>					
Gray       4888/25746       26569/111367       0.80 (0.77, 0.82)         Fabiani       390/4883       27836/75252       0.22 (0.20, 0.24)         Stralin       832/6244       2060/9972       0.65 (0.60, 0.69)         Passos-Castilho       56/465       109/589       0.65 (0.48, 0.88)         Atamadah       30/829       10/294       1.06 (0.53, 2.15)         Sansone       108643/276009       110495/309646       1.10 (1.10, 1.11)         Adeji       12980/100880       25478/182348       0.25 (0.18, 0.36)         Andseth       31/535       222/964       0.25 (0.18, 0.36)         kram       50/228       3/8       0.58 (0.23, 1.48)         Collard       44/415       127/736       0.69 (0.58, 0.62)         Farell       3/49       36/208       0.35 (0.11, 1.10)         Shaikh       46/434       17/131       0.69 (0.58, 0.62)         Shaikh       43/1418       34/765       0.68 (0.44, 1.06)         Sudgrups       168025/405057       163410/435144       0.67 (0.61, 0.73)         I <sup>2</sup> = 99.6%, p = 0.000)       10.0061       0.67 (0.61, 0.73)       0.67 (0.61, 0.73)					
Fabiani       390/4883       27836/75252 <ul> <li>Østralin</li> <li>832/6244</li> <li>2060/9972</li> <li>Østralin</li> <li>932/6244</li> <li>2060/9972</li> <li>Østralin</li> <li>90/8829</li> <li>10/294</li> <li>0.65 (0.48, 0.88)</li> <li>0.66 (0.65, 0.24)</li> <li>1.06 (0.53, 2.15)</li> <li>0.69 (0.68, 0.71)</li> <li>0.69 (0.69, 0.94)</li> <li>0.69 (0.68, 0.71)</li> <li>0.69 (0.68, 0.71)</li> <li>0.92 (0.90, 0.94)</li> <li>0.92 (0.90, 0.94)</li></ul>				• • • • • • • • • • • • • • • • • • •	
Stralin $832/6244$ $2060/9972$ 0.65 (0.60, 0.69)         Passos-Castilho $56/465$ $109/589$ 0.65 (0.48, 0.88)         Hamadah $30/829$ $10/294$ 1.06 (0.53, 2.15)         Gray (post-vaccine) $7630/54502$ $50149/248793$ 0.69 (0.68, 0.71)         Sansone $108643/276009$ $110495/309646$ 1.10 (1.10, 1.11)         Adeji $12980/100880$ $25478/182348$ 0.92 (0.90, 0.94)         Adsth $31/535$ $222/964$ 0.25 (0.18, 0.36)         Kram $50/228$ $3/8$ 0.58 (0.23, 1.48)         Collard $44/415$ $127/736$ 0.61 (0.45, 0.85)         Farrell $3/49$ $36/208$ 0.35 (0.11, 1.10)         Shaikh $46/434$ $17/131$ 0.82 (0.49, 1.37)         Song $155/703$ $243/760$ 0.68 (0.58, 0.82)         Asif $43/1418$ $34/765$ 0.68 (0.64, 4.1, 0.65)         Rodrigues $168025/405057$ $163410/435144$ $40.67$ (0.61, 0.73) $t^2$ $9.6\%$ , $p = 0.000$ ) $t^2$ $t^2$ $t^2$					
Passos-Castilho $56/465$ $109/589$ $0.65$ ( $0.48$ , $0.85$ )Hamadah $30/829$ $10/294$ $1.06$ ( $0.53$ , $2.15$ )Gray (post-vaccine) $7630/54502$ $50149/248793$ $0.69$ ( $0.68$ , $0.71$ )Sansone $108643/276009$ $110495/309646$ $1.10$ ( $1.10$ , $1.11$ )Adeji $12980/100880$ $25478/182348$ $0.92$ ( $0.90$ , $0.94$ )Indesth $31/535$ $222/964$ $0.25$ ( $0.18$ , $0.36$ )Kram $50/228$ $3/8$ $0.58$ ( $0.23$ , $1.48$ )Collard $44/415$ $127/736$ $0.61$ ( $0.45$ , $0.85$ )Shaikh $46/434$ $17/131$ $0.82$ ( $0.49$ , $1.37$ )Song $155/703$ $243/760$ $0.68$ ( $0.54, 0.73$ )Asif $43/1418$ $34/765$ $0.68$ ( $0.44, 1.06$ )Rodrigues $168025/405057$ $163410/435144$ $\bullet$ Subgroup, DL $304619/882353$ $451948/1509827$ $\bullet$ $i^2 = 99.6\%, p = 0.000$					
Hamadah $30/829$ $10/294$ $1.06 (0.53, 2.15)$ Gray (post-vaccine) $7630/54502$ $50149/248793$ $0.69 (0.68, 0.71)$ Sansone $108643/276009$ $110495/309646$ $1.10 (1.10, 1.11)$ Adeji $12980/100880$ $25478/182348$ $0.92 (0.90, 0.94)$ Indseth $31/535$ $222/964$ $0.25 (0.18, 0.36)$ Kram $50/228$ $3/8$ $0.58 (0.23, 1.48)$ Collard $44/415$ $127/736$ $0.61 (0.45, 0.85)$ Shaikh $46/434$ $17/131$ $0.82 (0.49, 1.37)$ Song $155/703$ $243/760$ $0.69 (0.58, 0.82)$ Nasif $43/1418$ $34/765$ $0.68 (0.44, 1.06)$ Rodrigues $168025/405057$ $163410/35144$ $0.67 (0.61, 0.73)$ Nggroup, DL $304619/882353$ $451948/1509827$ $0.67 (0.61, 0.73)$					
Sray (post-vaccine)       7630/54502       50149/248793       0.69 (0.68, 0.71)         Sansone       108643/276009       110495/309646       1.10 (1.10, 1.11)         kdeji       12980/100880       25478/182348       0.92 (0.90, 0.94)         ndseth       31/535       222/964       0.25 (0.18, 0.36)         kram       50/228       3/8       0.58 (0.23, 1.48)         Jollard       44/415       127/736       0.61 (0.45, 0.85)         Shaikh       3/49       36/208       0.35 (0.11, 1.10)         Shaikh       46/434       17/131       0.82 (0.49, 1.37)         Song       155/703       243/760       0.68 (0.44, 1.06)         Nadrigues       168025/405057       163410/435144       0.68 (0.44, 1.06)         Subgroup, DL       304619/882353       451948/1509827       0.67 (0.61, 0.73)         i <sup>2</sup> = 99.6%, p = 0.000)					
Sansone 108643/276009 110495/309646 1104 1104, 1.11 12980/100880 25478/182348 0.92 (0.90, 0.94) 0.25 (0.18, 0.36) 0.25 (0.18, 0.36) 0.58 (0.23, 1.48) 0.61 (0.45, 0.85) 0.35 (0.11, 1.10) 0.61 (0.45, 0.85) 0.35 (0.11, 1.10) 0.69 (0.58, 0.82) 0.68 (0.44, 1.06) 0.68 (0.44, 1.06) 0.68 (0.44, 1.06) 0.68 (0.44, 1.06) 0.67 (0.61, 0.73) 1^2 = 99.6%, p = 0.000)	lamadah				
Adeji       12980/100880       25478/182348       0.92 (0.90, 0.94)         Indseth       31/535       222/964       0.25 (0.18, 0.36)         kram       50/228       3/8       0.58 (0.23, 1.48)         Collard       44/415       127/736       0.61 (0.45, 0.85)         arrell       3/49       36/208       0.35 (0.11, 1.10)         Shaikh       46/434       17/131       0.82 (0.49, 1.37)         Song       155/703       243/760       0.68 (0.44, 1.06)         Nasif       43/1418       34/765       0.68 (0.44, 1.06)         Subgroup, DL       304619/882353       451948/1509827       0.67 (0.61, 0.73)         I <sup>2</sup> = 99.6%, p = 0.000)       I <sup>2</sup> = 99.6%, p = 0.000       I <sup>2</sup> I <sup>2</sup>					
Adseth       31/535       222/964       0.25 (0.18, 0.36)         kram       50/228       3/8       0.58 (0.23, 1.48)         Collard       44/415       127/736       0.61 (0.45, 0.85)         arrell       3/49       36/208       0.35 (0.11, 1.10)         Shaikh       46/434       17/131       0.82 (0.49, 1.37)         Song       155/703       243/760       0.69 (0.58, 0.82)         Vasif       43/1418       34/765       0.68 (0.44, 1.06)         Sodrigues       168025/405057       163410/435144       1.10 (1.10, 1.11)         Subgroup, DL       304619/882353       451948/1509827       •         I <sup>2</sup> = 99.6%, p = 0.000)       -       -       •					
kram         50/228         3/8         0.58 (0.23, 1.48)           Collard         44/415         127/736         0.61 (0.45, 0.85)           Farrell         3/49         36/208         0.35 (0.11, 1.10)           Shaikh         46/434         17/131         0.82 (0.49, 1.37)           Song         155/703         243/760         0.69 (0.58, 0.82)           Vasif         43/1418         34/765         0.68 (0.44, 1.06)           Sodrigues         168025/405057         163410/435144         1.10 (1.10, 1.11)           Subgroup, DL         304619/882353         451948/1509827         0.67 (0.61, 0.73)           I <sup>2</sup> = 99.6%, p = 0.000)	•				
Collard $44/415$ $127/736$ 0.61 (0.45, 0.85)         Farrell $3/49$ $36/208$ 0.35 (0.11, 1.0)         Shaikh $46/434$ $17/131$ 0.82 (0.49, 1.37)         Song $155/703$ $243/760$ 0.69 (0.58, 0.82)         Nasif $43/1418$ $34/765$ 0.68 (0.44, 1.06)         Rodrigues       168025/405057       163410/435144       0.67 (0.61, 0.73)         Subgroup, DL $304619/882353$ $451948/1509827$ $\checkmark$ $l^2$ = 99.6%, p = 0.000) $= 90.000$ $= 90.000$ $= 90.000$	ndseth				
Farrell 3/49 36/208 Shaikh 46/434 17/131 Song 155/703 243/760 Nasif 43/1418 34/765 Rodrigues 168025/405057 163410/435144 Subgroup, DL 304619/882353 451948/1509827 $l^2 = 99.6\%, p = 0.000$	kram				Me
Shaikh       46/434       17/131       0.82 (0.49, 1.37)         Song       155/703       243/760       0.69 (0.58, 0.82)         Nasif       43/1418       34/765       0.68 (0.44, 1.06)         Rodrigues       168025/405057       163410/435144       1.10 (1.10, 1.11)         Subgroup, DL       304619/882353       451948/1509827       0.67 (0.61, 0.73)         1 <sup>2</sup> = 99.6%, p = 0.000)	ollard	44/415	127/736	<b></b>	Me
Song       155/703       243/760       0.69 (0.58, 0.82)         Nasif       43/1418       34/765       0.68 (0.44, 1.06)         Rodrigues       168025/405057       163410/435144       1.10 (1.10, 1.11)         Subgroup, DL       304619/882353       451948/1509827       0.67 (0.61, 0.73)         1 <sup>2</sup> = 99.6%, p = 0.000)       1       1       1	arrell	3/49	36/208	0.35 (0.11, 1.10)	Me
Nasif     43/1418     34/765     0.68 (0.44, 1.06)       Rodrigues     168025/405057     163410/435144     1.10 (1.10, 1.11)       Subgroup, DL     304619/882353     451948/1509827     \$	haikh	46/434	17/131	0.82 (0.49, 1.37)	Me
Rodrigues       168025/405057       163410/435144       I 1.00 (1.10, 1.11)         Subgroup, DL       304619/882353       451948/1509827       0.67 (0.61, 0.73)         I <sup>2</sup> = 99.6%, p = 0.000)       I 1.00 (1.10, 1.11)       I 1.10 (1.10, 1.11)	ong	155/703	243/760	0.69 (0.58, 0.82)	
Subgroup, DL         304619/882353         451948/1509827         0.67 (0.61, 0.73)           2 <sup>2</sup> = 99.6%, p = 0.000)         0.000         0.000         0.000	lasif	43/1418	34/765	0.68 (0.44, 1.06)	
<sup>2</sup> = 99.6%, p = 0.000)	todrigues	168025/405057	163410/435144	1.10 (1.10, 1.11)	
	ubgroup, DL	304619/882353	451948/1509827	0.67 (0.61, 0.73)	
-leterogeneity between groups: p = 0.735	<sup>2</sup> = 99.6%, p = 0.000)				
	leterogeneity between grou	ps: p = 0.735			
.0625 1 16				l r	

Figure S7. Forest plot showing the pooled effect size for the risk of mortality in minoritised ethnic groups

compared to the ethnic majority group (studies are separated by denominator).

Sensitivity analyses: meta-analyses of outcomes by ethnic majority group versus minoritised ethnic groups (combined), excluding studies which reported country of birth or nationality.

After excluding six studies which reported country of birth or nationality, the meta-analysis of approximately 43,600,000 participants identified that minoritised ethnic groups were not more likely to become infected compared to the ethnic majority group (K = 10; RR = 1.19, 95% CI: 1.82 to 1.73,  $I^2 = 96.4$ ) (Figure S8).



NOTE: Weights are from random-effects model

*Figure S8.* Forest plot showing the pooled risk of infection for minoritised ethnic groups compared to the ethnic majority group, excluding studies reporting country of birth or nationality.

After excluding three studies, seven studies reported the association between ethnicity and seropositivity, including 1,634,655 participants. Minoritised ethnic groups were 1.4 times more likely to be seropositive compared to the ethnic majority group (RR = 1.42, 95% CI: 1.02 to 1.99,  $I^2 = 99.3$ ) (Figure S9).

n/N	Majority n/N						RR (95% CI)
					1		
9/331	65/2306			•			0.96 (0.49, 1.92)
37/55057	372/32383				1		2.59 (2.31, 2.89)
303/1287	595/3798			-	1		1.50 (1.33, 1.70)
98/577	1589/12240				1		1.31 (1.09, 1.58)
370/52852	119/10695		•				0.63 (0.51, 0.77)
1974/9164	5227/59969					-	2.47 (2.36, 2.59)
3/167251 2269	48/1226745			۲			1.29 (1.27, 1.30)
4/286519 2349	15/1348136			$\sim$			1.42 (1.02, 1.99)
					-		
	337/55057 303/1287 98/577 370/52852 1974/9164 3/167251 2269	337/55057       372/32383         303/1287       595/3798         98/577       1589/12240         370/52852       119/10695         1974/9164       5227/59969         3/167251       226948/1226745	337/550573372/32383303/1287595/379898/5771589/12240370/52852119/106951974/91645227/599693/167251226948/1226745	337/55057       372/32383         303/1287       595/3798         98/577       1589/12240         370/52852       119/10695         1974/9164       5227/59969         3/167251       226948/1226745	337/55057 372/32383 303/1287 595/3798 98/577 1589/12240 370/52852 119/10695 1974/9164 5227/59969 3/167251 226948/1226745	337/55057     372/32383       303/1287     595/3798       98/577     1589/12240       370/52852     119/10695       1974/9164     5227/59969       3/167251     226948/1226745	337/55057     372/32383       303/1287     595/3798       98/577     1589/12240       370/52852     119/10695       1974/9164     5227/59969       3/167251     226948/1226745

NOTE: Weights are from random-effects model

up heterogeneity test are from random-effects model

NOTE: Weights and bet

*Figure S9.* Forest plot showing the pooled risk of seropositivity for minoritised ethnic groups compared to the ethnic majority group, excluding studies reporting country of birth or nationality.

After excluding studies which reported country of birth or nationality, there was no difference in risk of hospital admission in general population studies (K = 4, RR = 1.13, 95% CI: 0.76 to 1.68, I<sup>2</sup> = 99.9), or for studies which assessed prognosis among confirmed COVID-19 cases (K = 5, RR = 1.45, 95% CI: 0.75 to 2.81, I<sup>2</sup> = 99.9) (Figure S10).

			Unadjusted	Risk of
Subgroup and Study	Minority n/N	Majority n/N	RR (95% CI)	Bias
General Population				
Knight	23808/266499	93871/1074861	1.02 (1.01, 1.04)	Low
Chang	125307/6834687	240544/2.38e+07	1.81 (1.80, 1.82)	Low
Young	475/367575	360/374525	1.34 (1.17, 1.54)	Low
Hippisley Cox (post-vaccine)	177/903979	1466/4781050	0.64 (0.55, 0.75)	Medium
Subgroup, DL	149767/8372740	336241/3.00e+07	1.13 (0.76, 1.68)	
(I <sup>2</sup> = 99.9%, p = 0.000)			-	
Confirmed COVID-19 Cases				
Servan Mori	2373/7902	99270/787856	2.38 (2.30, 2.47)	Low
Mathur	4693/18711	20504/61684	0.75 (0.73, 0.78)	Low
Bennett	9159/330551	10739/1251401	♦ 3.23 (3.14, 3.32)	Medium
Chu	1085/4645	9981/42547	1.00 (0.94, 1.05)	Medium
Song	703/2693	760/3236	1.11 (1.02, 1.21)	High
Subgroup, DL	18013/364502	141254/2146724	1.45 (0.75, 2.81)	
(l <sup>2</sup> = 99.9%, p = 0.000)				
Heterogeneity between groups	: p = 0.523			
		.25	h 1 4	

Figure S10. Forest plot showing the pooled risk of hospital admission for minoritised ethnic groups compared to

the ethnic majority group (by denominator), excluding studies reporting country of birth or nationality.

After excluding studies which reported country of birth or nationality (Figure S11), populationbased studies showed an increased risk of ICU admission (K = 3, RR = 3.03, 95% CI: 2.08 to 4.41,  $I^2 = 93.9$ )., as did studies which assessed prognosis among hospitalised COVID-19 cases (K = 7, RR = 1.86, 95% CI: 1.28 to 2.69,  $I^2 = 96.7$ ). Studies which assessed prognosis in confirmed COVID-19 cases showed no difference in the risk of ICU admission (K = 5, RR = 1.39, 95% CI: 0.93 to 2.07,  $I^2 = 99.5$ ).

Subgroup	Minority		Unadjusted	Risk
and Study	n/N	Majority n/N	RR (95% CI)	Bi
General Population	on			
Egede	139/7761	83/23788	5.13 (3.92, 6.73)	L
Mathur	652/1857406	1700/1.09e+07	2.25 (2.05, 2.46)	L
Song	291/182637	288/465565	2.58 (2.19, 3.03)	н
Subgroup, DL	1082/2047804	2071/1.14e+07	3.03 (2.08, 4.41)	
$I^2 = 93.9\%, p = 0$	0.000)			
Confirmed COVI	D-19 Cases			
lbarra Nava	155/4178	8715/412368	1.76 (1.50, 2.05)	L
Mathur	652/13921	1700/41180	1.13 (1.04, 1.24)	L
Silva	22660/73639	21001/66669	• 0.98 (0.96, 0.99)	н
Song	291/2693	288/3236	1.21 (1.04, 1.42)	н
Metra	1971/50376	2815/157049	◆ 2.18 (2.06, 2.31)	н
Subgroup, DL	25729/144807	34519/680502	1.39 (0.93, 2.07)	
(l <sup>2</sup> = 99.5%, p = 0	0.000)			
Hospitalised CO	/ID-19			
lbarra Nava	155/1602	8715/412368	4.58 (3.94, 5.32)	L
Mathur	652/4596	1700/20504	1.71 (1.57, 1.86)	L
Passos Castilho	159/465	171/589	1.18 (0.99, 1.41)	L
Ramos-Rincon	315/2354	1871/20599	1.47 (1.32, 1.65)	L
Thomas	23/697	282/13092	1.53 (1.01, 2.33)	L
Al Zahmi	60/412	12/148	1.80 (0.99, 3.24)	Medi
arrell	10/49	21/208	2.02 (1.02, 4.01)	Medi
Subgroup, DL	1374/10175	12772/467508	1.86 (1.28, 2.69)	
$ 1^2 = 96.7\%, p = 0$	0.000)		<b>—</b>	
<i>.</i>	,			
Heterogeneity be	tween groups: p =	0.018		
		l .125	1 I 8	
NOTE WALL		geneity test are from randor		

*Figure S11.* Forest plot showing the pooled risk of ICU admission for minoritised ethnic groups compared to the ethnic majority group (by denominator), excluding studies reporting country of birth or nationality.

After excluding studies which used closely related indicators of ethnicity (Figure S12), population-based studies showed no difference in risk of mortality (K = 4, RR = 1.07, 95% CI:

0.72 to 1.59,  $I^2 = 99.5$ ). There was no difference in risk of mortality for studies assessing prognosis among confirmed COVID-19 cases (K = 6, RR = 1.10, 95% CI: 0.74 to 1.63,  $I^2 = 99.7$ ), and a reduced risk among those hospitalised with COVID-19 (K = 10, RR = 0.87, 95% CI = 0.79 to 0.96,  $I^2 = 99.6$ ).

Subgroup and Study	Minority n/N	Majority n/N	Unadjusted RR (95% CI)	
General Population				_
Mathur	1174/1857503	7514/1.09e+07	<b>↓</b> 0.91 (0.86, 0.97)	
DiGirolamo	991/3955419	20078/2.98e+07	• 0.37 (0.35, 0.40)	
Bennett	1269/330551	1912/1251401	◆ 2.51 (2.34, 2.70)	
Hippisley Cox (post-vaccin	e) 126/903979	1512/4781050	0.44 (0.37, 0.53)	
eldman	146604/7.52e+07	227532/1.44e+08	↓ ↓ 1.23 (1.23, 1.24)	
Subgroup, DL		258548/1.91e+08	0.86 (0.51, 1.45)	
l <sup>2</sup> = 99.8%, p = 0.000)				
Confirmed COVID-19 Case	es			
Dahal	3831/21896	234972/2151140	♦ 1.60 (1.56, 1.65)	
Cifuentes	2199/62140	28366/971078	! ◆ 1.21 (1.16, 1.26)	
/lathur	1174/14018	7514/41180	◆ 0.46 (0.43, 0.49)	
barra Nava	691/4178	45817/382368	1.38 (1.29, 1.48)	
Sacoto	479/7876	6572/205718	▲ 1.90 (1.74, 2.08)	
.uo	714/7015	989/7244	<b>→</b> 0.75 (0.68, 0.82)	
Subgroup, DL	9088/117123	324230/3758728	1.10 (0.74, 1.63)	
l <sup>2</sup> = 99.7%, p = 0.000)				
Hospitalised COVID-19				
barra Nava	595/1602	40692/112251	1.02 (0.96, 1.09)	
Sansone	108643/276009	110495/309646	◆ 1.10 (1.10, 1.11)	
assos-Castilho	56/465	109/589	0.65 (0.48, 0.88)	
Gray (post-vaccine)	7630/54502	50149/248793	♦ 0.69 (0.68, 0.71)	
Gray	4888/25746	26569/111367	◆! 0.80 (0.77, 0.82)	
Adeji	12980/100880	25478/182348	♦ 0.92 (0.90, 0.94)	
Stralin	832/6244	2060/9972		
kram	50/228	3/8	0.58 (0.23, 1.48)	
arrell	3/49	36/208	0.35 (0.11, 1.10)	
Song	155/703	243/760	0.69 (0.58, 0.82)	
Rodrigues	168025/405057	163410/435144	◆ 1.10 (1.10, 1.11)	
Subgroup, DL	303857/871485	419244/1411086	0.84 (0.77, 0.92)	
$l^2 = 99.6\%$ , p = 0.000)			▼	
,				
Heterogeneity between gro	oups: p = 0.442	I		
		l .125	I I 1 8	

Figure S12. Forest plot showing the pooled risk of mortality for minoritised ethnic groups compared to the ethnic

majority group (by denominator), excluding studies reporting country of birth or nationality.

#### **Funnel Plots**

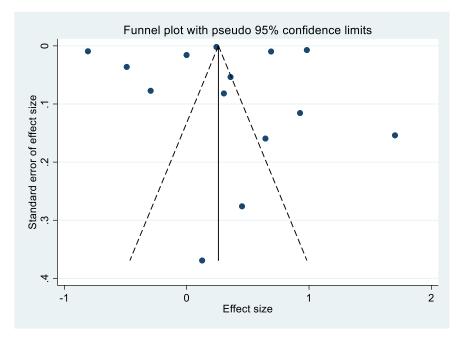


Figure S13. Funnel plot to assess publication bias for the unadjusted pooled risk of infection.

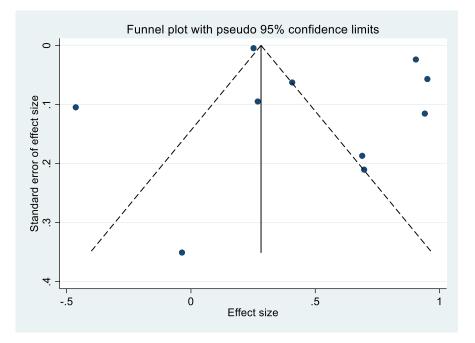


Figure S14. Funnel plot to assess publication bias for the unadjusted pooled risk of seropositivity.

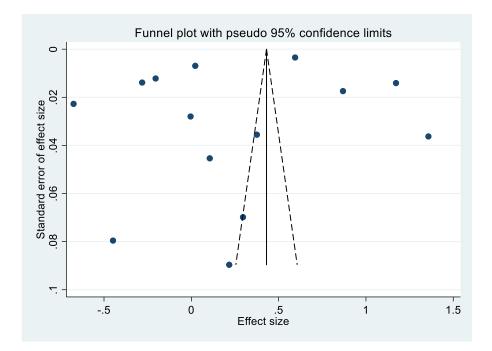


Figure S15. Funnel plot to assess publication bias for the unadjusted pooled risk of hospital admission.

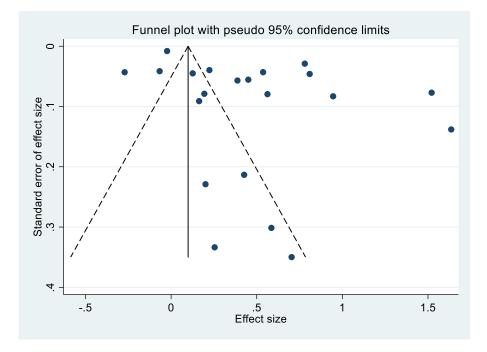


Figure S16. Funnel plot to assess publication bias for the unadjusted pooled risk of ICU admission.

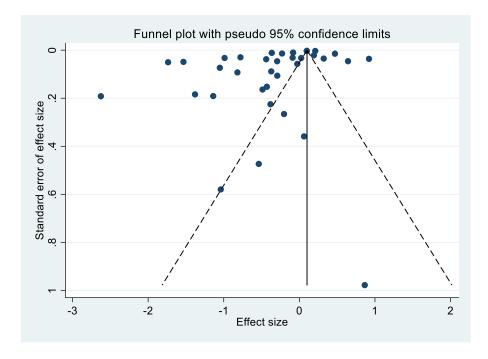


Figure S17. Funnel plot to assess publication bias for the unadjusted pooled risk of mortality.

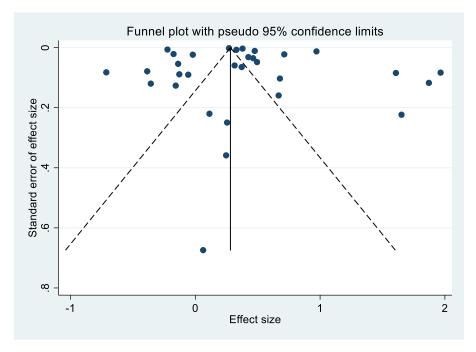


Figure S18. Funnel plot to assess publication bias for the adjusted pooled risk of infection.

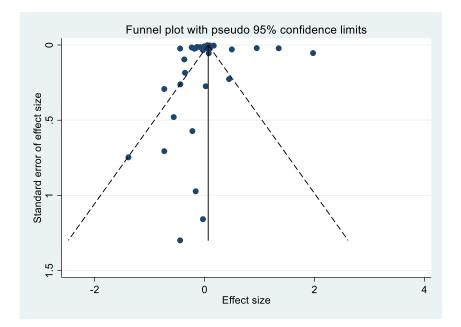
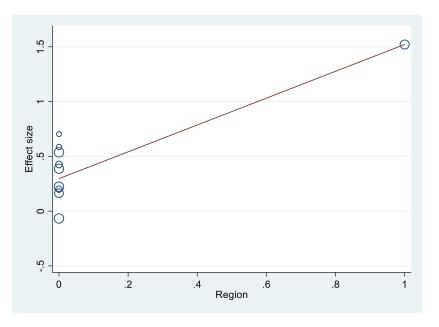
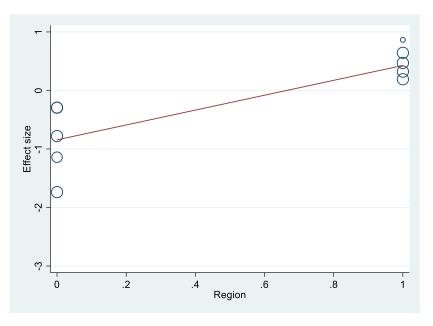


Figure S19. Funnel plot to assess publication bias for the adjusted pooled risk of mortality, among hospitalised cases.

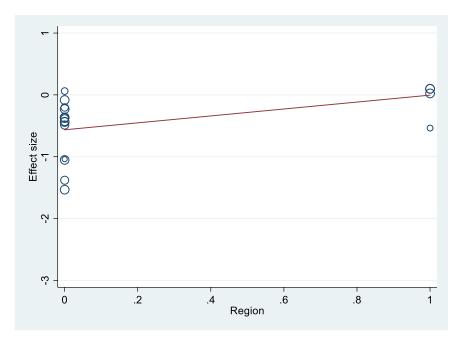
## **Bubble Plot**



*Figure S20.* Bubble plot with fitted meta-regression to show the impact of region (HIC [0] versus LMIC [1]) on heterogeneity in the risk of ICU admission among hospitalised COVID-19 cases.



*Figure S21.* Bubble plot with fitted meta-regression to show the impact of region (HIC [0] versus LMIC [1]) on heterogeneity in the risk of mortality among confirmed COVID-19 cases.



*Figure S22.* Bubble plot with fitted meta-regression to show the impact of region (HIC [0] versus LMIC [1]) on heterogeneity in the risk of mortality among hospitalised COVID-19 cases.

# Sensitivity analyses: stratified meta-analyses by region for adjusted analyses with sufficient data.

To further explore the impact of region on the adjusted risk of outcomes, stratified metaanalyses were conducted, by region (LMIC *versus* HIC). In a synthesis of two studies from LMIC, the risk of infection was increased for Black, South Asian, and Mixed people (similar to the main analyses), but not those from Other ethnic groups (Figure S23). Among HIC, Black and South Asian ethnic groups had an increased risk of infection, compared to White people, and studies presenting an aggregated Asian group showed a reduced risk of infection (Figure S24). These findings are similar to the main analyses, except the risk of infection is no longer increased for Mixed or Other ethnic groups.

Subgroup and Author N	_InfectedN_Non	_Infected				Adjusted RR (95% CI)	Risk of bias
South_Asian							
Jugwanth*	55	7			│	1.45 (1.28, 1.65)	High
Subgroup, DL ( $I^2 = 0.0\%$ , p = .)					$\diamond$	1.45 (1.28, 1.65)	
Black							
Stead*	524	495			│                 •         •       •       •       •     •     •     •     •   •   •   •   •   •   •   •   • •   •	1.95 (1.43, 2.67)	Low
Jugwanth*	129	25				1.37 (1.22, 1.54)	High
Subgroup, DL ( $l^2 = 76.8\%$ , p = 0.0	038)					1.58 (1.13, 2.23)	
Mixed							
Stead*	29	69			<b>↓</b> ◆	1.12 (0.73, 1.73)	Low
Jugwanth*	39	0			│	1.64 (1.49, 1.80)	High
Subgroup, DL ( $I^2 = 65.1\%$ , p = 0.0	091)					1.44 (1.01, 2.05)	
Other							
Stead*	18	35			•	1.29 (0.79, 2.10)	Low
Subgroup, DL ( $I^2 = 0.0\%$ , p = .)				$\sim$		1.29 (0.79, 2.10)	
Heterogeneity between groups: p	= 0.923						
Overall, DL (I <sup>2</sup> = 53.8%, p = 0.055	5)					1.49 (1.34, 1.67)	
			І .5		 1 2		

Figure S23. Forest plot showing the pooled adjusted risk of infection by ethnic group, for studies in LMIC.

Subgroup and Author N	_Infectend_N	lon_Infected	Adjusted RR (95% CI)	Risk o bias
Asian				
Martin (post-vaccine)	502	1555	•	Lov
Chang*	39846	1172556	◆ 0.80 (0.79, 0.81)	Lov
Guijarro	3	1436	1.28 (0.63, 2.57)	Lov
Jefferies*	183	1450	→ 0.68 (0.58, 0.79)	Mediun
Subgroup, DL (I <sup>2</sup> = 64.6		7)	0.08 (0.36, 0.79)           0.80 (0.72, 0.88)	weului
South_Asian				
Al_Kuwari*	47728	82992	7.14 (6.06, 8.40)	Lov
Mathur Subgroup, DL (I <sup>2</sup> = 99.3	9679 %, p = 0.000	1015640 ))	<b>2</b> .64 (2.57, 2.70) <b>4</b> .33 (1.63, 11.47)	Lov
Toot Acien				
East_Asian	140	100750		1
Mathur	140	103752	•• 0.49 (0.42, 0.58)	Lov
loannou (adjOR)			0.84 (0.80, 0.87)	Lov
Subgroup, DL (I <sup>2</sup> = 97.5	%, p = 0.000	0)	0.65 (0.38, 1.09)	
Black				
Al_Kuwari*	2670	7787	4.99 (4.23, 5.89)	Lov
Mathur	2286	338626	◆ 2.04 (1.95, 2.13)	Lov
Guijarro	12	645	<b>5.22 (3.37, 8.09)</b>	Lov
Chang*	171648	3021445	♦ 1.31 (1.30, 1.31)	Lo
Martin (post-vaccine)	134	328	0.94 (0.79, 1.12)	Lov
oannou (adjOR)			1.39 (1.37, 1.41)	Lo
Subgroup, DL ( $I^2 = 99.3$	%, p = 0.000	))	<b>♦</b> 1.85 (1.63, 2.10)	
Mixed				
Martin (post-vaccine)	95	351	0.88 (0.73, 1.04)	Lov
Mathur	840	169644	◆ 1.59 (1.48, 1.70)	Lov
Subgroup, DL (I <sup>2</sup> = 97.4			1.19 (0.67, 2.12)	LOV
Indigenous				
•	6742	05040		Low
Chang*	6742	95049	◆ 1.61 (1.58, 1.65)	Lov
loannou (adjOR)	=0		0.98 (0.93, 1.02)	Lov
Jefferies*	79		0.70 (0.55, 0.88)	Mediur
Subgroup, DL (I <sup>2</sup> = 99.5	%, p = 0.000	0)	1.05 (0.69, 1.59)	
Hispanic				
Chang*	139686	2187715	◆ 1.46 (1.45, 1.47)	Lov
Guijarro	121	5705	<b>6.50 (5.22, 8.27)</b>	Lov
Subgroup, DL ( $I^2 = 99.4$	%, p = 0.000	))	3.07 (0.71, 13.25)	
Other				
Martin (post-vaccine)	54	170	0.85 (0.66, 1.08)	Lo
Al_Kuwari*	240	2146	<b></b> 1.97 (1.61, 2.41)	Lov
_ Thomas	3	38	1.06 (0.26, 3.71)	Lov
Vathur	1073	215823	♦ 1.53 (1.44, 1.63)	Lov
Subgroup, DL ( $I^2 = 89.0$			1.37 (0.98, 1.92)	
Heterogeneity between		0.000		
Overall, DL (l <sup>2</sup> = 99.8%,	p = 0.000)		<b>♦</b> 1.46 (1.32, 1.61)	
		<b> </b> .0625	<b>I I</b> 16	
		0625	1 16	

Figure S24. Forest plot showing the pooled adjusted risk of infection by ethnic group, for studies in HIC.

In a synthesis of three studies from LMIC, there was no increased risk of mortality once hospitalised with COVID-19, for any minoritised ethnic group, compared to White people (Figure S25). Among HIC, only Indigenous people had an increased risk of mortality once hospitalised with COVID-19, compared to White people (Figure S26). Comparing with the main analyses, these findings suggest that Indigenous people are only at an increased risk of mortality in HIC and not LMIC.

Subgroup and Author	N_Death	N_Survive	Adjusted RR (95% CI)	Risk of bias
Asian				
Sansone	2532	4576	1.00 (0.98, 1.02)	Low
lkram*	6	14	0.80 (0.26, 2.45)	Medium
Rodrigues*	3900	6512	• 1.00 (0.97, 1.02)	High
Subgroup, DL (I <sup>2</sup> = 0.0%, p = 0.928)			1.00 (0.98, 1.01)	
Black				
Sansone	13289	18583	♦ 1.09 (1.08, 1.09)	Low
lkram*	44	163	0.57 (0.22, 1.44)	Medium
Rodrigues*	20444	25719	♦ 1.18 (1.17, 1.19)	High
Subgroup, DL (I <sup>2</sup> = 98.9%, p = 0.000)			<b>♦</b> 1.13 (1.04, 1.22)	
Mixed				
Sansone	92049	143059	♦ 1.05 (1.05, 1.05)	Low
lkram*	0	1	♦ 0.64 (0.05, 8.12)	Medium
Rodrigues*	142712	203419	♦ 1.10 (1.09, 1.10)	High
Subgroup, DL ( $I^2$ = 98.7%, p = 0.000)			<b>0</b> 1.07 (1.03, 1.12)	
Indigenous				
Sansone	773	1148	♦ 1.07 (1.04, 1.10)	Low
Rodrigues*	969	1382	♦ 1.10 (1.05, 1.15)	High
Subgroup, DL (I <sup>2</sup> = 6.6%, p = 0.301)			1.07 (1.05, 1.10)	
Heterogeneity between groups: p = 0.00	0			
Overall, DL (l <sup>2</sup> = 98.8%, p = 0.000)			1.07 (1.03, 1.11)	
		l .0625	1 I 1 16	
NOTE: Weights and between-subgroup heterogeneity	test are from rando	m-effects model		

Figure S25. Forest plot showing the pooled adjusted risk of mortality among hospitalised COVID-19 cases by

ethnic group, for studies in LMIC.

Subgroup and Author	N_Death	N_Survive	Adjusted RR (95% Cl)	Risk o bias
Asian				
Adeji (post-vaccine)*	721	4586	• 0.97 (0.91, 1.04)	Lov
Ramos_Rincon	12	98	1.08 (0.94, 1.17)	Lov
Passos Castilho	8	91 🗕	0.85 (0.04, 1.81)	Lov
Acosta			♦ 1.64 (1.55, 1.74)	Lov
Subgroup, DL ( $I^2 = 98.0\%$ , p = 0.000)			1.18 (0.83, 1.70)	201
South Asian				
Thomas (adjOR)	10	52	0.48 (0.27, 0.85)	Lov
Gray	1759	6893	• 0.85 (0.82, 0.89)	Lov
Gray (post-vaccine)	3688	19515	0.79 (0.76, 0.81)	Lov
Subgroup, DL ( $I^2 = 81.6\%$ , p = 0.004)	5000	19919	•         0.81 (0.75, 0.88)	LOV
East Asian				
Thomas (adjOR)			0.97 (0.10, 9.36)	Lov
Subgroup, DL ( $I^2 = 0.0\%$ , p = .)			0.97 (0.10, 9.38)	Low
Black				
Passos_Castilho	29	190	1.56 (1.00, 2.43)	Low
Acosta	23	150	◆ 2.58 (2.48, 2.69)	Low
	1550	10331	◆ 2.58 (2.48, 2.69) 0.64 (0.62, 0.68)	Low
Gray (post-vaccine)		37869		Low
Adeji (post-vaccine)*	5244		◆ 0.87 (0.85, 0.90)	
Gray	1503	6122	• 0.83 (0.79, 0.87)	Low
Ramos_Rincon	4	120	0.64 (0.34, 0.95)	Low
Song*	131	465	0.69 (0.57, 0.83)	Higł
Subgroup, DL ( $I^2$ = 99.8%, p = 0.000)			0.98 (0.63, 1.51)	
Mixed				
Gray (post-vaccine)	295	2366	1.00 (0.97, 1.04)	Low
Passos_Castilho	2	12	1.02 (0.71, 2.08)	Low
Gray	215	1007	1.06 (1.02, 1.09)	Low
Subgroup, DL ( $I^2 = 59.2\%$ , p = 0.086)			<b>9</b> 1.03 (0.99, 1.08)	
Indigenous				
Acosta			7.19 (6.47, 7.99)	Low
Subgroup, DL ( $I^2 = 0.0\%$ , p = .)			<b>•</b> 7.19 (6.47, 7.99)	
Hispanic				
Ramos_Rincon	130	1709	1.02 (0.98, 1.06)	Low
Adeji (post-vaccine)*	5343	36197	0.92 (0.90, 0.95)	Low
Acosta			♦ 3.85 (3.68, 4.01)	Low
Passos_Castilho	2	50	0.48 (0.12, 1.91)	Low
Subgroup, DL ( $I^2$ = 99.9%, p = 0.000)			1.29 (0.59, 2.82)	
Other				
Thomas (adjOR)			0.25 (0.06, 1.12)	Low
Gray (post-vaccine)	1074	8047	• 0.99 (0.97, 1.01)	Low
Gray	791	3842	1.01 (0.99, 1.03)	Low
Adeji (post-vaccine)*	1672	9248	♦ 1.09 (1.05, 1.15)	Low
Song*	24	83	0.70 (0.49, 1.01)	High
Subgroup, DL ( $I^2 = 82.4\%$ , p = 0.000)			1.02 (0.97, 1.07)	
Heterogeneity between groups: p = 0.0	000			
Overall, DL (l <sup>2</sup> = 99.7%, p = 0.000)			1.10 (0.93, 1.29)	
		I		
		.03125	1 32	

NOTE: Weights and between-subgroup heterogeneity test are from random-effects model

Figure S26. Forest plot showing the pooled adjusted risk of mortality among hospitalised COVID-19 cases by

ethnic group, for studies in HIC.

# Sensitivity analyses: adjusted meta-analyses excluding studies with a high risk of bias.

After removing one study with a high risk of bias, Mixed people were no longer at an increased risk of infection (Figure S27). There were no seroprevalence studies with a high risk of bias.

Subgroup and Author N	_Infected	N_Non_Infected	Adjusted RR (95% Cl)	
Asian				
Chang*	39846	1172556	• 0.80 (0.79, 0.	81) Lov
Guijarro	3	1436	1.28 (0.63, 2.	57) Lov
Jefferies*	183		↔ 0.68 (0.58, 0.	
Martin (post-vaccine)	502	1555	◆ 0.87 (0.78, 0.	
Subgroup, DL ( $I^2 = 64.6$ )		1000	•         0.80 (0.72, 0.	
South_Asian				
Al_Kuwari*	47728	82992	7.14 (6.06, 8.	40) Lov
Mathur	9679	1015640	♦ 2.64 (2.57, 2.	70) Lov
Subgroup, DL (I <sup>2</sup> = 99.39	%, p = 0.000)		4.33 (1.63, 11	.47)
East_Asian				
loannou (adjOR)			◆ 0.84 (0.80, 0.	87) Lov
Mathur	140	103752	••• 0.49 (0.42, 0.	58) Lov
Subgroup, DL ( $I^2 = 97.5$ )	%, p = 0.000)		0.65 (0.38, 1.	09)
Black				
Al_Kuwari*	2670	7787	4.99 (4.23, 5.	89) Lov
Chang*	171648	3021445	♦ 1.31 (1.30, 1.	31) Lov
Guijarro	12	645	5.22 (3.37, 8.	09) Lov
loannou (adjOR)			♦ 1.39 (1.37, 1.	41) Lov
Martin (post-vaccine)	134	328	0.94 (0.79, 1.	
Mathur	2286	338626	♦ 2.04 (1.95, 2.	,
Stead*	524	495	1.95 (1.43, 2.	
Subgroup, DL (I <sup>2</sup> = 99.2%		400	<ul> <li>↓ 1.86 (1.65, 2.</li> </ul>	
Mixed				
Martin (post-vaccine)	95	351	0.88 (0.73, 1.	04) Lov
Mathur	840	169644	♦ 1.59 (1.48, 1.	
Stead*	29	69	1.12 (0.73, 1.	,
Subgroup, DL ( $I^2 = 95.0$ )		00	1.17 (0.74, 1.	,
Indigenous				
Chang*	6742	95049	♦ 1.61 (1.58, 1.	65) Lov
loannou (adjOR)			0.98 (0.93, 1.	02) Lov
Jefferies*	79		<b>—</b> 0.70 (0.55, 0.	,
Subgroup, DL (I <sup>2</sup> = 99.5%			1.05 (0.69, 1.	
Hispanic				
Chang*	139686	2187715	♦ 1.46 (1.45, 1.	
Guijarro	121	5705	<b>6.50 (5.22, 8</b> .	27) Lov
Subgroup, DL ( $I^2 = 99.4$ )	%, p = 0.000)		3.07 (0.71, 13	3.25)
Other				
Al_Kuwari*	240	2146	1.97 (1.61, 2.	
Martin (post-vaccine)	54	170	<b>0.85 (0.66, 1</b> .	
Mathur	1073	215823	♦ 1.53 (1.44, 1.	63) Lov
Stead*	18	35	1.29 (0.79, 2.	
Thomas	3	38	1.06 (0.26, 3.	71) Lov
Subgroup, DL ( $I^2 = 85.6$ )	%, p = 0.000)		1.36 (1.01, 1.	
Heterogeneity between o	groups: p = 0.0	000		
		0005		
		.0625	1 16	

*Figure S27.* Forest plot showing the pooled adjusted risk of infection by ethnic group, removing one study with a high risk of bias.

For hospital admission, there were no population-based studies with a high risk of bias. One study of confirmed COVID-19 cases had a high risk of bias and removing this study did not alter the findings (Figure S28).

Subgroup and Author	N_HospitaN_N	onHospital	Adjusted RR (95% CI)	ROE
Asian				
Bennett*	717	4180	♦ 17.06 (15.91, 18.	30) Mediur
Subgroup, DL (	l <sup>2</sup> = 0.0%, p = .)		17.06 (15.91, 18.3)	30)
South_Asian				
Mathur*	2836	9679	• 0.68 (0.66, 0.71)	Lov
Chu*	715	2744	• 0.88 (0.82, 0.94)	Mediur
Subgroup, DL (	l <sup>2</sup> = 97.7%, p = 0.0	000)	0.77 (0.60, 0.99)	
East_Asian				
Mathur*	70	140	0.98 (0.81, 1.19)	Lov
Chu*	370	816	◆ 1.33 (1.22, 1.45)	Mediur
Subgroup, DL (	l <sup>2</sup> = 87.6%, p = 0.0	005)	1.16 (0.86, 1.56)	
Black				
Mathur*	1051	2286	• 0.95 (0.90, 1.00)	Lov
Bennett*	8003	293991	♦ 3.09 (3.00, 3.18)	Mediur
Subgroup, DL (	l <sup>2</sup> = 99.9%, p = 0.0	000)	1.71 (0.54, 5.44)	
Mixed				
Mathur*	302	840	• 0.80 (0.72, 0.88)	Lov
Subgroup, DL (	I <sup>2</sup> = 0.0%, p = .)		0.80 (0.72, 0.88)	
Indigenous				
Bennett*	66	2968	2.53 (1.99, 3.22)	Mediur
Subgroup, DL (	l <sup>2</sup> = 0.0%, p = .)		2.53 (1.99, 3.21)	
Other				
Mathur*	434	1073	◆ 0.85 (0.78, 0.92)	Lov
Bennett*	373	20253	<ul> <li>◆ 2.11 (1.90, 2.33)</li> </ul>	Mediur
Subgroup, DL (	l <sup>2</sup> = 99.5%, p = 0.0	000)	1.34 (0.55, 3.26)	
Heterogeneity t	petween groups: p	= 0.000		
		.0625	1 16	

*Figure S28.* Forest plot showing the pooled adjusted risk of hospital admission among confirmed COVID-19 cases, by ethnic group, removing one study with a high risk of bias.

One population-based study investigating ICU admission as the outcome had a high risk of bias (Figure S29). After excluding this study, we now see that people from Other ethnic groups are at an increased risk of ICU admission. Three of the four studies which assessed the risk of ICU admission among confirmed COVID-19 cases had a high risk of bias, therefore, it was not possible to conduct a sensitivity analysis removing these studies. Among studies of hospitalised COVID-19 cases, there were no studies with a high risk of bias.

Subgroup and Author N	_ICU	N_NonICU			Adjusted RR (95% CI)	ROE
South_Asian						
Mathur	410	1024909		<b>-+-</b>	3.30 (2.93, 3.71)	Lov
Subgroup, DL ( $I^2 = 0.0\%$ , p = .	)			$\diamond$	3.30 (2.93, 3.71)	
East_Asian						
Mathur	18	103874		<b>—</b>	3.21 (2.01, 5.12)	Lov
Subgroup, DL ( $I^2 = 0.0\%$ , p = .	)				3.21 (2.01, 5.12)	
Black						
Egede*	116	6131		<b>—</b>	5.32 (4.02, 7.04)	Lov
Mathur	186	340726		<b></b>	3.91 (3.34, 4.58)	Lov
Zerbo				<b></b>	2.70 (2.06, 3.56)	Mediur
Zerbo (post-vaccine)				<b></b>	2.23 (1.53, 3.26)	Mediur
Zerbo (wave 2)				<b>—</b>	1.93 (1.54, 2.42)	Mediur
Subgroup, DL (I <sup>2</sup> = 90.7%, p =	0.000)			$\sim$	3.01 (2.10, 4.33)	
Mixed						
Mathur	56	170428		<b>—</b>	3.19 (2.44, 4.17)	Lo
Zerbo				<b>→</b>	1.49 (0.70, 3.19)	Mediur
Zerbo (post-vaccine)			 	◆	1.11 (0.35, 3.52)	Mediur
Zerbo (wave 2)			1	<b>—</b>	1.71 (1.03, 2.83)	Mediur
Subgroup, DL (I <sup>2</sup> = 66.7%, p =	0.029)			<>	1.98 (1.20, 3.26)	
Indigenous						
Zerbo				<b>_</b>	4.12 (2.33, 7.28)	Mediur
Zerbo (post-vaccine)				<b>_</b>	<ul> <li>4.53 (2.17, 9.43)</li> </ul>	Mediur
Zerbo (wave 2)					3.60 (2.28, 5.69)	Mediur
Subgroup, DL ( $I^2 = 0.0\%$ , p = 0	).856)			$\sim$	3.93 (2.85, 5.41)	
Hispanic						
Egede*	23	1491		<b>_</b>	4.35 (2.75, 6.89)	Lov
Zerbo				_ <b>_</b>	5.85 (4.84, 7.07)	Mediur
Zerbo (post-vaccine)				<b>_</b> _	1.73 (1.26, 2.39)	Mediur
Zerbo (wave 2)					3.51 (3.01, 4.08)	Mediur
Subgroup, DL (I <sup>2</sup> = 93.2%, p =	0.000)			$\sim$	3.54 (2.23, 5.64)	
Other						
Mathur	79	216817			3.41 (2.70, 4.31)	Lov
Subgroup, DL ( $I^2 = 0.0\%$ , p = .	)			$\sim$	3.41 (2.70, 4.31)	
Heterogeneity between groups	s: p = 0.4	174				
		105	1	 8		
		.125	1	8		

*Figure S29.* Forest plot showing the pooled adjusted risk of ICU admission among population-based studies, by ethnic group, removing one study with a high risk of bias.

There were no population-based studies of mortality with a high risk of bias. One study assessing the risk of mortality among confirmed COVID-19 cases had a high risk of bias and two studies among hospitalised COVID-19 cases had a high risk of bias. Excluding these studies did not alter the findings (Figure S30 & S31). However, we no longer observe a trend towards an increased risk of mortality for Indigenous peoples, among studies of hospitalised COVID-19 cases.

Subgroup and Author	N_Death	N_Survive				Adjusted RR (95% CI)	
South_Asian							
Mathur*	734	8945	-			0.42 (0.39, 0.45)	Low
Subgroup, DL (I <sup>2</sup> = 0.0%, p = .)			$\diamond$			0.42 (0.39, 0.45)	
East_Asian							
Mathur*	20	120		•	<u> </u>	0.74 (0.49, 1.11)	Low
Subgroup, DL ( $I^2 = 0.0\%$ , p = .)			$\sim$		>	0.74 (0.49, 1.11)	
Black							
Cifuentes	1421	37883		-	┝-	1.01 (0.96, 1.08)	Low
Mathur*	268	2018		►		0.64 (0.57, 0.72)	Low
Sacoto*	104	952			<b>↓</b>	1.09 (0.76, 1.54)	Low
Subgroup, DL (I <sup>2</sup> = 95.8%, p = 0.000)			-	<	$\geq$	0.88 (0.61, 1.26)	
Mixed							
Mathur*	65	775	<b></b>			0.42 (0.34, 0.54)	Low
Sacoto*	6572	199146 —	<b></b>			0.35 (0.26, 0.48)	Low
Subgroup, DL (l <sup>2</sup> = 0.0%, p = 0.352)			$\diamond$			0.39 (0.33, 0.47)	
Indigenous							
Cifuentes	776	22011			→	1.27 (1.13, 1.43)	Low
Sacoto*	215	4534		_		0.50 (0.36, 0.69)	Low
Subgroup, DL (l <sup>2</sup> = 96.4%, p = 0.000)						0.81 (0.32, 2.01)	
Other							
Mathur*	87	986	<b></b>			0.42 (0.34, 0.51)	Low
Subgroup, DL ( $I^2$ = 0.0%, p = .)			$\diamond$			0.42 (0.34, 0.51)	
Heterogeneity between groups: p = 0.00	0						
		.25			<b>i</b> 1	4	
NOTE: Weights and between-subgroup heterogeneity	test are from rand					-	

*Figure S30.* Forest plot showing the pooled adjusted risk of mortality among confirmed COVID-19 cases, by ethnic group, removing one study with a high risk of bias.

Subgroup and Author	N_Death	N_Survive	Adjusted RR (95% Cl)	
Asian				
Acosta			1.64 (1.55, 1.74)	Low
Adeji (post-vaccine)*	721	4586	0.97 (0.91, 1.04)	Low
lkram*	6	14	0.80 (0.26, 2.45)	Medium
Passos_Castilho	8	91 —	0.85 (0.04, 1.81)	Low
Ramos_Rincon	12	98	1.08 (0.94, 1.17)	Low
Sansone	2532	4576	◆	Low
Subgroup, DL (I <sup>2</sup> = 98.1%, p = 0.000)			1.12 (0.88, 1.43)	
South_Asian				
Gray	1759	6893	♦ 0.85 (0.82, 0.89)	Low
Thomas (adjOR)	10	52	0.48 (0.27, 0.85)	Low
Gray (post-vaccine)	3688	19515	• 0.79 (0.76, 0.81)	Low
Subgroup, DL (I <sup>2</sup> = 81.6%, p = 0.004)			0.81 (0.75, 0.88)	
East_Asian				
Thomas (adjOR)			0.97 (0.10, 9.36)	Low
Subgroup, DL (I <sup>2</sup> = 100.0%, p = .)			0.97 (0.10, 9.38)	
Black				
Acosta			♦ 2.58 (2.48, 2.69)	Low
Adeji (post-vaccine)*	5244	37869	• 0.87 (0.85, 0.90)	Low
Gray	1503	6122	0.83 (0.79, 0.87)	Low
lkram*	44	163	0.57 (0.22, 1.44)	Medium
Passos_Castilho	29	190	1.56 (1.00, 2.43)	Low
Ramos_Rincon	4	120	0.64 (0.34, 0.95)	Low
Sansone	13289	18583	◆ 1.09 (1.08, 1.09)	Low
Gray (post-vaccine)	1550	10331	• 0.64 (0.62, 0.68)	Low
Subgroup, DL ( $l^2 = 99.7\%$ , p = 0.000)	1000	10001	1.01 (0.77, 1.33)	2011
Mixed				
Gray	215	1007	1.06 (1.02, 1.09)	Low
Ikram*	213	1 1	0.64 (0.05, 8.12)	Medium
Passos Castilho	2	12	1.02 (0.71, 2.08)	Low
Sansone	92049	143059	1.05 (1.05, 1.05)	Low
Gray (post-vaccine)	295	2366	1.00 (0.97, 1.04)	Low
Subgroup, DL ( $l^2 = 46.2\%$ , p = 0.114)	200	2300	1.04 (1.02, 1.07)	LOW
1				
Indigenous				1
Acosta Sansone	773	1148	◆ 7.19 (6.47, 7.99)	Low Low
	113	1140	1.07 (1.04, 1.10)	LOW
Subgroup, DL (I <sup>2</sup> = 99.9%, p = 0.000)			2.77 (0.43, 17.96)	
Hispanic				
Acosta	50.40	00107	◆ 3.85 (3.68, 4.01)	Low
Adeji (post-vaccine)*	5343	36197	0.92 (0.90, 0.95)	Low
Passos_Castilho	2	50	0.48 (0.12, 1.91)	Low
Ramos_Rincon Subgroup, DL ( $l^2$ = 99.9%, p = 0.000)	130	1709	1.02 (0.98, 1.06) 1.29 (0.59, 2.82)	Low
Other Adeji (post-vaccine)*	1672	9248	♦ 1.09 (1.05, 1.15)	Low
Gray	791	3842	1.03 (1.03, 1.13)	Low
Thomas (adjOR)	151	3042	0.25 (0.06, 1.12)	Low
Gray (post-vaccine)	1074	8047	0.23 (0.06, 1.12)	Low
Gray (post-vaccine) Subgroup, DL ( $I^2 = 84.0\%$ , p = 0.000)	1074	0047	0.99 (0.97, 1.01) 1.02 (0.98, 1.07)	LOW
Heterogeneity between groups: p = 0.0	000			
		.03125	1 32	

*Figure S31*. Forest plot showing the pooled adjusted risk of mortality among hospitalised COVID-19 cases, by ethnic group, removing two studie with a high risk of bias.

# Table S3. GRADE Certainty.

### Table S3. GRADE Certainty.

N Studies	Study design	Risk of Bias	Imprecision	Inconsistency	Indirectness	Certainty
Infection						
10	Observational	Not serious	Not serious	Serious	Not serious	0000
						Moderate
Seropositiv	ity					
7	Observational	Not serious	Not serious	Serious	Not serious	$\bigcirc \bigcirc \oplus \bigcirc$
						Moderate
Hospital ad	mission (general J	population)				
5	Observational	Not serious	Not serious	Serious	Not serious	$\bigcirc \bigcirc \oplus \bigcirc$
						Moderate
ICU admiss	sion (general popu	lation)				
6	Observational	Serious	Serious	Serious	Serious	$\oplus \oplus \oplus \oplus$
						Very low
Mortality (	general population	ı)				1
5	Observational	Not serious	Not serious	Serious	Serious	$\bigcirc \bigcirc \oplus \oplus$
						Very low

#### Synthesis Without Meta-analysis (SWiM)

#### Methods

This narrative synthesis presents the findings of studies that were not amenable to metaanalysis, for each outcome (i.e., infection, seropositivity, hospital admission, ICU admission, mortality). The findings are first presented for the analysis of the ethnic majority group (varying by study) compared with minoritised ethnic groups (combined). Then, the findings are presented for the analysis of disaggregated ethnic groups compared to the reference group for that study.

For the analysis of the ethnic majority group compared to minoritised ethnic groups (combined), crude numbers were used to calculate unadjusted risk ratios (RR). For disaggregated ethnic groups compared to the reference group, age and sex adjusted RR were extracted where possible. As with the main analyses, adjusted odds ratios (OR) were extracted and converted to adjusted RR using a validated conversion method (Zhang & Kai, 1998). Adjusted hazard ratios (HR) were extracted and assumed to approximate an adjusted RR. Unadjusted or over-adjusted RR were included if age and sex adjusted RR were not available. Effect direction plots, not taking account of statistical significance (as recommended by the Cochrane handbook), and sign tests were conducted to assess evidence of associations, by counting the number of effects showing an increased risk, a decreased risk, or no effect. The certainty of evidence was not assessed for the SWiM, as there were too few studies reporting effect sizes for each outcome or ethnic group.

Effect direction plots are used to present the effects. Separate plots are presented for the analysis of ethnic minority groups (combined) compared to the ethnic majority group, and for the analysis of disaggregated ethnic groups. Studies are grouped by risk of bias. To informally

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investigate heterogeneity in the findings, the tables of studies for each outcome are ordered by region.

#### Ethnic majority group versus minoritised ethnic groups

In total, 16 studies were not included in the meta-analysis investigating the risk of COVID-19 health outcomes for minoritised ethnic groups (combined) compared with the ethnic majority group (varied across studies). These studies were excluded as crude numbers were not reported, meaning it was not possible to calculate the overall RR for minoritised ethnic groups combined. The number of studies reporting findings for each outcome are as follows: infection (N = 3), seropositivity (N = 3), hospital admission (N = 5), ICU admission (N = 3), mortality (N = 6). Table S3 presents the effect direction plot for these studies. Across all outcomes, there are only a small number of effect sizes, and the findings are mixed. Of the three studies reporting effects for infection, one identified an increased risk for minoritised ethnic groups, one identified a decreased risk, and one study found no difference or conflicting findings compared to the ethnic majority group. For seroprevalence, one UK study identified an increased risk, whereas the two other studies (conducted in Oman and Mexico) identified no difference. Most studies identified an increased risk of hospital admission for minoritised ethnic groups compared to the majority, though the findings for the risk of ICU admission were mixed, as were the findings for the risk of mortality.

Table S4. Effect direction plot for studies not included in the meta-analysis (ethnic majority group *versus* minoritised ethnic groups <sup>a</sup>).

<sup>4</sup> This includes closely related mansures of oth	nighty such as h	ndiganoug/Aboriginal	around race migrant statue	and country of hirth
<sup>a</sup> This includes closely related measures of eth	nenty, such as h	nuigenous/Auoriginai	groups, race, migrain status	s, and country of onthe.

Study	Country	Ethnic Majority Group	Minoritised Ethnic Groups	Infection	Seropositivity	Hospital	ICU	Mortality
Thomas	UK	White	Irish, White Other, Bangladeshi, Chinese, Indian, Pakistani, Black, Other Black, Hispanic, Asian, American Indian/Alaska Native,				4>	<b>4</b> ►
Ioannou	USA	White	Pacific Islander/Native Hawaiian	<b>.</b>				
Coyer	Netherlands	Dutch	Non-Dutch			<b>4</b>		
Cacciani	Italy	Italian	Foreign-born					
Ward	UK	White	Asian, Black, Mixed, Other					
Al Abri	Oman	Omani	Non-Omani		       			
Nwaru	Sweden	Swedish	Immigrant High-income country, middle income country, low-income				<b>4</b> Þ	
Gustafsson	Sweden	Swedish	country					<b>A</b>
Acosta	USA	White	Hispanic, American Indian/Alaska Native, Black, Asian/Pacific Islander					
			Black, Asian/Indigenous/Unknown, Hawaiian/Pacific Islander, Native American/Alaska Native, Multiracial,					
Zerbo	USA	White	Hispanic					<b>&lt;</b>
Borjorquez-Chapela	Mexico	Mexican	Foreign-born		<b>4</b> ►			
Abu Ruz	United Arab Emirates	Middle Eastern	Other					
Jefferies	New Zealand	European	Māori, Pacific Peoples, Asian	▼				
Da Silva	Brazil	White	Non-White					
Ramli	Malaysia	Malay	Non-Malay					
Sultanoglu	Cyprus	Northern Cyprus	German, Turkmenistan					<b>4</b> ►

Effect direction: upward arrow  $\blacktriangle$  = increased risk, downward arrow  $\blacktriangledown$  = decreased risk, sideways arrow  $\blacktriangleleft$  = no difference/mixed effects/conflicting findings

Study quality: denoted by row colour: green = low risk of bias; amber = some concerns; red = high risk of bias

#### **Disaggregated ethnic groups**

When investigating the risk of COVID-19 health outcomes for disaggregated ethnic groups, there were 37 studies which either (i) could not be included in the meta-analyses at all, or (ii) included some ethnic groups which could not be included in the meta-analysis. Studies could not be included in the meta-analyses if the reference group was not White, and an ethnic group could not be included in the meta-analysis if only one study reported an effect size for that group. Studies which used country of birth or nationality as an indicator of ethnicity could not be included in the meta-analysis of disaggregated ethnic groups due to inconsistencies across the studies (i.e., nationalities and reference groups were widely varied across studies).

Table S4 presents the synthesis of studies which reported ethnicity (N = 12). For infection, the risk was increased for all ethnic groups in Nigeria compared to the reference group, and for Bedouin Arab patients compared with Jewish, in Israel. Indigenous peoples had an increased risk of hospital admission and mortality (compared with Non-Indigenous), across two studies conducted in Mexico. All minoritised groups in Ecuador had an increased risk of mortality, compared with Mestizo people. For ICU admission, three effects showed an increased risk and four showed no difference in risk. For mortality, seven effects showed an increased risk (including four effects from the Ecuador study, previously described), one showed a decreased risk, and three showed no difference in risk.

Table S5 presents the synthesis of studies which reported migrant status, country of birth, or nationality (N = 25). Most studies were of low risk of bias. For infection, three effect sizes showed a decreased risk (all from a study in Qatar), two showed an increased risk, and two showed no difference or conflicting findings. For seropositivity, most effects showed no difference, with two showed an increased risk for foreign-born people compared with Italian-born. Seven effects suggest an increased risk of hospital admission for minoritised ethnic groups (two showed a decreased risk, two showed no difference). For mortality, five effects showed an increased risk, six effects showed a decreased risk, and five showed no difference or conflicting findings.

This synthesis is limited as the studies are highly heterogenous. The studies differ by country, which influences the included ethnic groups and the reporting of ethnicity (i.e., some studies report nationality or country of birth). In addition, this synthesis does not explore prognosis (i..e., hospital admission, ICU admission, mortality) following infection or hospitalisation.

Study	Country	<b>Reference</b> Group	Minoritised Ethnic Group	Infection	Seropositivity	Hospital	ICI	Mortality	ROB
Saidel Odes	Isreal	Jewish	Bedouin Arab						aLow
Concha	Colombia	Colombian	Indigenous	<b>A</b>					aLow
Passos Castilho	Canada	White	Middle Eastern/African					   	aLow
Cifuentes	Colombia	White	Gipsy-Roman					<b>A</b>	aLow
Cifuentes	Colombia	White	Raizal					   	aLow
Dahal	Mexico	Non-Indigenous	Indigenous					<b>A</b>	aLow
Ibarra Nava	Mexico	Non-Indigenous	Indigenous						aLow
Jefferies	New Zeleand	European	Maori	▼					bSomeConcerns
Farrell	Ireland	White Irish	White Other					<b>&lt;</b>	bSomeConcerns
Farrell	Ireland	White Irish	BAME					▼	bSomeConcerns
Utulu	Nigeria	Other	Igbu	<b></b>					cHigh
Utulu	Nigeria	Other	Yoruba	<b></b>					cHigh
Utulu	Nigeria	Other	Hausa	<b>A</b>					cHigh
Servan Mori	Mexico	Non-Indigenous	Indigenous						cHigh
Al Zahmi	United Arab Emirates	Middle Eastern	White						cHigh
Al Zahmi	United Arab Emirates	Middle Eastern	South Asian						cHigh
Al Zahmi	United Arab Emirates	Middle Eastern	East Asian						cHigh
Al Zahmi	United Arab Emirates	Middle Eastern	Other						cHigh
Sacoto	Ecuador	Mestizo	White						cHigh
Sacoto	Ecuador	Mestizo	Black						cHigh
Sacoto	Ecuador	Mestizo	Indigenous						cHigh
Sacoto	Ecuador	Mestizo	Montubio						cHigh

Table S5. Effect direction plot for studies or ethnic groups not included in the meta-analyses of disaggregated ethnic groups (measures of ethnicity).

Effect direction: upward arrow  $\blacktriangle$  = increased risk, downward arrow  $\blacktriangledown$  = decreased risk, sideways arrow  $\blacktriangleleft$  = no difference/mixed effects/conflicting findings Study quality: denoted by row colour: green = low risk of bias; amber = some concerns; red = high risk of bias **Table S6.** Effect direction plot for studies or ethnic groups not included in the meta-analyses of disaggregated ethnic groups (indicated by migrant

status, country of birth, or nationality).

Study	Country	<b>Reference Group</b>	Country of Birth/Nationality	Infection	Seropositivity	Hospital	ICI	Mortality
Quality	74-1		European Union, Eastern Europe, Other Europe, Centre Southern Africa, West Africa, East Africa, North Africa, Centre Southern Asia, Western Asia, East Asia, Centre-South					
Consolazio	Italy	Italian	America, North America, Oceania, Other			•		
Labberton	Norway	Norweigen-born	Immigrant			<b>A</b>		
Guijarro	Spain	Spain	European Union, Eastern Europe, Asia, North Africa, Sub Saharan Africa, Caribbean, Latin America	<b>∢</b> ►				
Lombardi	Italy	Italy	Other					
Pagani	Italy	Italian	Non-Italian					
Vos	Netherlands	Dutch	Non-Dutch Western		<b>A</b>			
Vos	Netherlands	Dutch	Non Western		<b>A</b>			
Al Abri	Oman	Omani	Non-Omani		<b>A</b>			
Coyer	Netherlands	Dutch	South Asian Surinamese, African Surinamese, Ghanaian, Turkish, Moroccan		<►			
Coyer	Netherlands	Dutch	Western			<b>&lt;</b>		
Coyer	Netherlands	Dutch	Non Western			<b>A</b>		
Fabiani	Italy	Italian	Non-Italian			▼	<b>.</b>	▼
Islamoska	Denmark	Danish	Immigrant					
Cacciani	Italy	Italian	Foreign-born					
Nwaru	Sweden	Swedish	Immigrant				<b>.</b>	
Gustafsson	Sweden	Swedish	High Income Country					▼
Gustafsson	Sweden	Swedish	Middle Income Country					▼
Gustafsson	Sweden	Swedish	Low Income Country					                   
Stralin	Sweden	Swedish	Foreign-born					
Rostila	Sweden	Sweden	Other Nordic Countries					
Rostila	Sweden	Sweden	Middle East					V

Rostila	Sweden	Sweden	Africa					<b>A</b>
Rostila	Sweden	Sweden	Rest of the World					▼
Ishi	Japan	Japanese	Non-Native					
Borjorquez-								
Chapela	Mexico	Mexican	Foreign-born					
Al Awaidy	Oman	Omani	Non-Omani			▼		▼
Shaikh	Saudi Arabia	Saudi National	Non-Saudi National			<b>&lt;</b>		
			South Asian Surinamese, African Surinamese,					
Collard	Netherlands	Dutch	Ghanaian, Turkish, Moroccan					<b>&lt;</b>
Abu Ruz	United Arab Emirates	Middle Eastern	Other					
Al Kuwari	Qatar	Europe	South East Asian	▼				
Al Kuwari	Qatar	Europe	Northern Africa	▼				
Al Kuwari	Qatar	Europe	South East Asia	▼				
Ishi	Japan	Japanese	Non-Native					
Nasif	Saudi Arabia	Saudi National	Arabic, South Asia, Southest Asia, Africa					<b>&lt;</b>
Sultanoglu	Cyprus	Cyprus	German					<b>&lt;</b>
Sultanoglu	Cyprus	Cyprus	Turkmenistan		11.00	1 00 /	<u></u>	

Effect direction: upward arrow  $\blacktriangle$  = increased risk, downward arrow  $\blacktriangledown$  = decreased risk, sideways arrow  $\blacktriangleleft$  = no difference/mixed effects/conflicting findings

Study quality: denoted by row colour: green = low risk of bias; amber = some concerns; red = high risk of bias

# PRISMA Checklist

Section and Topic	ltem #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 4
INTRODUCTION	1		
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6/7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 6/7
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary material
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 7/8
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 7/8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 7/8
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 7/8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 9/10
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 9/10
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 9/10 & supplementary material

Section and Topic	ltem #	Checklist item	Location where item is reported
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 9/10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 10
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 10
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 10
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 9
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1 / Page 11
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1 / page 11
Study characteristics	17	Cite each included study and present its characteristics.	Table 1 / 2 / Page 11
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table 2
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figures 2-5
Results of	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Figures 2-5
syntheses	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 2-5 / Pages 11-15
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Page 14/15
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Supplementary materials
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Pages 11-15
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 15-18

Section and Topic	ltem #	Checklist item	Location where item is reported
	23b	Discuss any limitations of the evidence included in the review.	Page 17/18
	23c	Discuss any limitations of the review processes used.	Page 17/18
	23d	Discuss implications of the results for practice, policy, and future research.	Page 18
OTHER INFORMA	TION	·	
Registration and	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 6
protocol	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 11/19
Competing interests	26	Declare any competing interests of review authors.	Page 19
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 19

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71