

## Supplementary document

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**Table E1. Search strategy**

Database	Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions(R) <1946 to 14 January, 2022>.		
<b>Date of search</b>	20210719	20210923	20220118
<b>Search history</b>	1 Coronavirus/ or Betacoronavirus/ or Coronavirus Infections/ or COVID-19/ or SARS-CoV-2/ (99842) 2 coronavirus*.ti,ab,kw,kf. 3 ("COVID-19*" or COVID19* or "COVID-2019*" or covid).ti,ab,kw,kf. 4 1 or 2 or 3 5 exp Asthma/ 6 asthma*.ti,ab,kw. 7 5 or 6 8 4 and 7 9 (201912* or 2020* or 2021* or 2022*).ed. 10 8 and 9 11 Meta-Analysis as Topic/ 12 meta analy\$.tw. 13 metaanaly\$.tw. 14 Meta-Analysis/ 15 (systematic adj (review\$1 or overview\$1)).tw. 16 exp Review Literature as Topic/ 17 or/11-16 18 cochrane.ab. 19 embase.ab. 20 (psychlit or psyclit).ab. 21 (psychinfo or psycinfo).ab. 22 (cinahl or cinhal).ab 23 science citation index.ab. 24 bids.ab. 25 cancerlit.ab. 26 or/18-25 27 reference list\$.ab. 28 bibliograph\$.ab. 29 hand-search\$.ab. 30 relevant journals.ab. 31 manual search\$.ab. 32 or/27-31 33 selection criteria.ab. 34 data extraction.ab. 35 33 or 34 36 Review/ 37 35 and 36 38 Comment/ 39 Letter/ 40 Editorial/ 41 animal/ 42 human/ 43 41 not (41 and 42) 44 or/38-40,43 45 17 or 26 or 32 or 37 46 45 not 44 47 10 and 46 48 10 not 47		
<b>Number of results</b>	624	110	168
<b>Systematic reviews</b>	21	2	5
<b>Others</b>	603	108	163
Database	WHO Covid literature database		
<b>Date of search</b>	20210719	20210923	20220118
<b>Search history</b>	(tw:(asthma)) Sub set to identify SRs: (tw:(("systematic review" or "meta analy*" or metaanaly* or meta-analys* or "rapid review" or "evidence summary" or "evidence synthesis")))		
<b>Number of results</b>	1836	270	575

<b>Systematic reviews</b>	47	7	16
<b>Others</b>	1789	263	559
<b>Database</b>	<b>Medrxivr (<a href="https://mcguinlu.shinyapps.io/medrxivr/">https://mcguinlu.shinyapps.io/medrxivr/</a>)</b>		
<b>Date of search</b>	20210719	20210923	20220118
<b>Search history</b>	2019nCoV Betacoronavirus Corona Virus Coronavirus Coronavirus \\bCoV\\b \\bCoV2\\b COVID HCoV-19 \\bnCoV\\b SARS CoV 2 SARS2 SARSCoV SARS-CoV  [Aa]sthma  Sub set to identify SRs: [Ss]systematic review [Mm]eta analy [Mm]etaanaly [Mm]eta-analys [Rr]apid review [Ee]vidence summary [Ee]vidence synthesis		
<b>Number of results</b>	90	7	2
<b>Systematic reviews</b>	4	1	0
<b>Others</b>	86	6	2

Note: Searches were updated on 23 September 2021 and 18 January 2022. 1. Ovid MEDLINE(R): Date of search 20210923 with entry date limit applied to prior search [(2021072\* or 2021073\* or 202108\* or 202109\*).ed.], date of search 20220118 on database segment <1946 to January 14, 2022> with entry date limit applied to prior search ed=20210924-20220117. Entry date limit in line 9 (to focus on Covid-19 pandemic period) edited to allow additions from 2022; WHO COVID literature database: Date of search 20210923 with entry date limit applied to prior search [entry\_date:(2021072\* or 2021073\* or 202108\* or 202109\*)] , Date of search 20220118 with entry date limit applied to prior search [(entry\_date:(2021092\* or 20211\* or 2022\*))]; Medrxivr: Date of search 20210923 with entry date limit applied to prior search [records added from 20 July 2021] . Date of search 20220118 with entry date limit applied to prior search [records added from 24 September 2021].

**Table E2. Demographic characteristics of included studies (n=12)**

	<b>Control group (N, %)</b>	<b>Control group with severe COVID-19 outcome cases*</b>	<b>Severe asthma (N, %)</b>	<b>Severe asthma with severe COVID-19 outcome cases</b>
<b>Aveyard (2021)</b>	No respiratory disease 4,693,447	Hospitalisation: 3127 ICU: 672 Death: 1475	385,702	Hospitalisation: 1369 ICU admission: 124 Death: 476
<b>Bloom (2021)</b>	No asthma 7,083	Death: 382	201	Death: 24
<b>Choi (2021)</b>	Step 1 (mild asthma) 51	ICU admission: 3 Death: 5	4	ICU admission: 0 Death: 0
<b>Eger (2020)</b>	Dutch population 13,363,687	Hospitalisation: 10,691 ICU for intubation: 2,673 Death 4,009	634	Hospitalisation: 7 ICU for intubation: 5 Death: 1
<b>Fong (2021)</b>	Non-SA <sup>§</sup> 63	Death: 32	39	Death 1
<b>Robinson (2021)</b>	No asthma <sup>§</sup> 210	Hospitalisation: 45 Ventilation: 12 Death: 9	44	Hospitalisation: 14 Ventilation: 5 Death: 0
<b>Schultze (2020)</b>	SABA only: 108,411	SABA only Death: 49 (0.05%)	101,077	Death: 105
<b>Williamson (2020)</b>	With no recent OCS use 2,454,403	Death: 1,211	291,670	Death: 335
<b>Jung (2021)</b>	No asthma 3,704	Death: 108	40	Death: 4
<b>aShi (2022)</b>	No asthma 39,518	Hospitalisation: 366	965	Hospitalisation: 15
<b>bShi (2022)</b>	No asthma 215,345	Hospitalisation: 21,487 ICU admission: 1,679 Death: 7,875	9,154	Hospitalisation: 1,464 ICU admission: 85 Death: 450
<b>Zein (2022)</b>	No asthma 62,042	Hospitalisation: NA ICU admission: NA Death: NA	290	Hospitalisation: NA ICU admission: NA Death: NA

NA, Not available; SD, Standard deviation; IQR, Interquartile range; SA, Severe asthma; \*matched with cases in severe asthma group; <sup>§</sup>calculated from COVID0-19 tested SA and total number of patients with asthma ;

<sup>§</sup>Age, sex, and date of SARS-CoV-2 diagnosis matched comparators

**Table E3. Markers of asthma severity of the included studies (n=12)**

<b>Author (year)</b>	<b>Markers of asthma severity</b>
Aveyard (2021)	Patients who were treated with at least three different classes of asthma medication, including <b>ICS</b> , the year prior to cohort entry
Bloom (2021)	Patients who were treated with <b>ICS</b> plus LABA plus another maintenance medication
Choi (2021)	Patients who were treated with <b>OCS</b> for a duration of over 90 days (Step 5, GINA guidelines)
Eger (2020)	Patients who were treated with <b>high-dose ICS</b> , plus a second controller (and/or systemic corticosteroids) according to ERS/ATS guidelines.
Fong (2021)	Patients who were treated with high-dose treatment or continuous/frequent OCS use according to BTS guidelines
Robinson (2021)	Patients who were treated with (1) asthma biologics (anti-IgE, anti-interleukin-5/interleukin-5 receptor, or anti-interleukin-4 receptor) in the last 1 year or (2) <b>OCS <math>\geq</math> 3 times in the last 12 months</b> , or (3) theophylline in the last 1 year
Schultze (2020)	Patients who were treated with <b>high-dose ICS</b> within 4 months before entering the study cohort
Williamson (2020)	Patients who were treated with <b>OCS</b> in the preceding 12 months
Jung (2021)	Patients who were treated with one of the following medications within 24 months: (1) ICS/LABA + long-acting muscarinic antagonists (LAMAs), (2) ICS/LABA + LTRA, (3) ICS/LABA + xanthine, and (4) <b>corticosteroids for over 90 days</b> .
<sup>a</sup> Shi (2022)*	Patients who were treated with <b>OCS</b> in the preceding 12 months
<sup>b</sup> Shi (2022)*	Patients who were treated with <b>OCS</b> in the preceding 12 or 24 months
Zein (2022)	Patients who were treated with <b>high-dose ICS</b> equivalent to or exceeding 800 µg/d of budesonide (Step 4 and 5, GINA guidelines)

Abbreviations: ICS, Inhaled corticosteroids; LABA, Long-acting beta-agonist; OCS, Oral corticosteroids; ERS/ATS, European Respiratory Society (ERS) and American Thoracic Society (ATS); BTS, British Thoracic Society; SIGN, Scottish intercollegiate Guidelines Network; GINA, Global Initiative for Asthma; \* also defined one, two, three or more, or no courses of corticosteroids in the preceding 12 and 24 months.

**Table E4. JBI Quality assessment of included studies (n=12)**

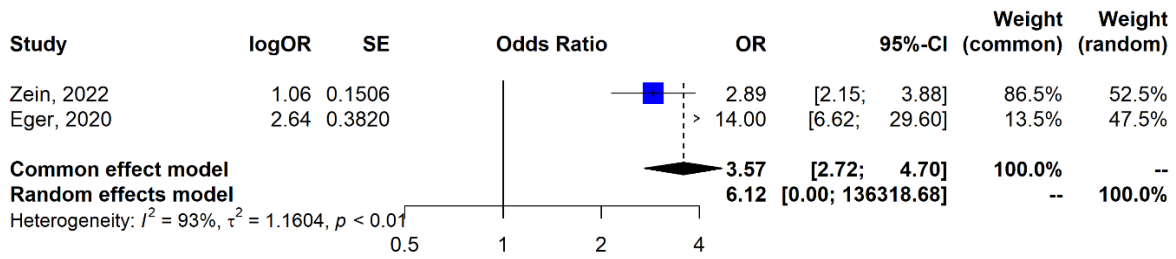
Study	Were the two groups similar and recruited from the same population?	Were the exposures measured similarly to assign people to both exposed and unexposed groups?	Was the exposure measured in a valid and reliable way?	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	Were the outcomes measured in a valid and reliable way?	Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	Were strategies to address incomplete follow up utilised?	Was appropriate statistical analysis used?	Scoring <sup>§</sup> (%)	Overall Study Quality
Aveyard (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	High
Bloom (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	High
Choi (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	81	High
Eger (2020)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	63	Moderate
Fong (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	High
Robinson (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	81	High
Schultze (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	High
Williamson (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	91	High
Jung (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	81	High
aShi (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	91	High
bShi (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	91	High
Zein (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	81	High

<sup>§</sup>Scoring scale: high 80 – 100%, moderate 50 – 79%, low <50%

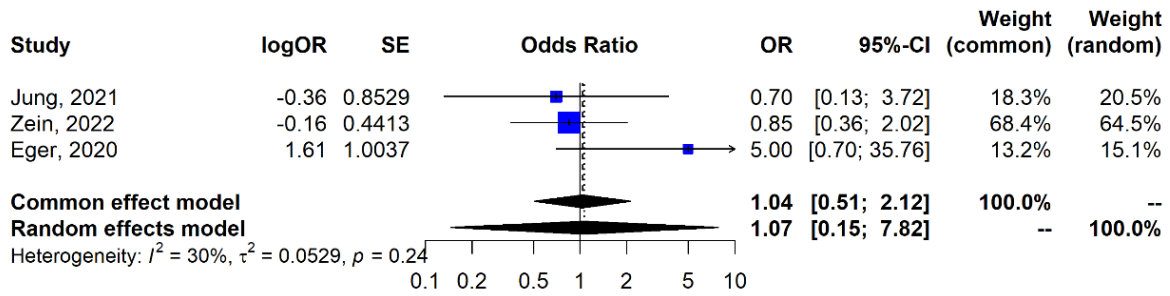
**Table E5. Covariates adjusted in a statistical model for estimates used in this review**

<b>Author (year)</b>	<b>Covariates</b>
Aveyard (2021)	age, sex, ethnicity, socioeconomic status, region of England, body-mass index (categorical variable), smoking status, non-smoking-related illness (hypertension, type 1 diabetes, chronic liver disease, and chronic neurological disease), smoking-related illness (coronary heart disease, stroke, atrial fibrillation, type 2 diabetes, and chronic kidney disease), and all other respiratory diseases
Bloom (2021)	only RT-PCR confirmed cases, age, sex, ethnicity, deprivation, obesity, smoking, chronic cardiac disease, chronic kidney disease, and malignancy
Choi (2021)	age, sex, underlying disease, and asthma medications/severity
Eger (2020)	Not available
Fong (2021)	age, sex, ethnicity, obesity, other co-morbidities
Robinson (2021)	age, sex, race, ethnicity, payor, smoking status, body mass index, and Charlson comorbidity index.
Schultze (2020)	age, sex, BMI, Indices of multiple deprivations, diagnosed hypertension, heart disease, diabetes, cancer, immunosuppressive conditions, chronic kidney disease, influenza vaccination status, pneumococcal vaccination status, statin use, exacerbation history, oral steroids use
Williamson (2020)	age, sex, BMI, smoking, Ethnicity, IMD quintile, hypertension or high blood pressure, asthma, chronic heart disease, diabetes, non-haematological cancer, haematological malignancy, reduced kidney function, liver disease, stroke or dementia, other neurological disease, organ transplant, asplenia, rheumatoid arthritis, lupus or psoriasis, and other immunosuppressive condition
Jung (2021)	age, sex, income, obesity, smoking, alcohol consumption, systolic blood pressure, diastolic blood pressure, fasting blood glucose, total cholesterol, CCI scores, number of NSAIDs used, number of steroids used and hypertension, asthma or COPD
aShi (2022)	age, sex, socioeconomic status, nine other risk groups of interest, and number of non-asthma hospital admissions within the 2 years before March 1, 2020.
bShi (2022)	age, sex, socioeconomic status, body mass index, number of risk groups of interest, number of non-asthma related hospitalisations within the two-year period prior to March 1, 2020 and vaccine status.
Zein (2022)	age, sex, race, ethnicity, body mass index, smoking history, pack-years smoking, medications (nonsteroidal anti-inflammatory drugs, angiotensin converting enzyme 2 inhibitor, angiotensin receptor blocker, and intranasal corticosteroids), comorbidities (allergic rhinitis, diabetes, hypertension, coronary artery disease, heart failure, cancer [historical or current], and immunosuppressive disease), and month of testing

**Figure E1. Adjusted odds ratios (aORs) for hospitalisation for COVID-19**



**Figure E2. Adjusted odds ratios (aORs) for mortality for COVID-19**



**Figure E3. Adjusted odds ratios (aORs) for ICU admission for COVID-19**

