Safety Platform for Emergency vACcines

SO2-D2.1.3 Priority List of COVID-19 Adverse events of special interest

Part 2. Update for COVID-19 complications other than Long COVID

Work Package: WP2 Standards and tools

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ACE2	Angiotensin Converting Enzyme 2
AESI	Adverse event of special interest
CEPI	Coalition for Epidemic Preparedness and Innovation
CFS	Chronic Fatigue Syndrome
CI	Confidence Interval
EBV	Epstein Barr Virus
GACVS	Global Advisory Committee on Vaccine Safety
ME	Myalgic encephalomyelitis
PASC	Post-Acute Sequelae of SARS-CoV-2
PACS	Post-Acute Covid-19 Syndrome
PICS	Post-Intensive Care Syndrome
PTSD	Post-Traumatic Stress Disorder
SEID	Systemic Exertion Intolerance Disease
SPEAC	Safety Platform for Emergency vACcines

THIS PROJECT HAS BEEN FUNDED IN WHOLE BY CEPI.

EXECUTIVE SUMMARY

As part of its work to harmonize safety assessment of CEPI-funded vaccines, the Safety Platform for Emergency vACcines (SPEAC) Project has generated a list of adverse events of special interest (AESI) for safety monitoring based on one or more of the following criteria:

1) known association with immunization or a specific vaccine platform;
2) occurrence during wild-type disease as a result of viral replication and/or immunopathogenesis.
3) theoretical association based on animal models;

COVID-19 is relatively unique as an emerging pandemic pathogen with an ever-expanding variety of clinical manifestations which might occur as presenting complaints and/or emerge during and following the course of acute disease. The first SPEAC COVID-19 AESI list was created in March 2020 based on the experience in China. As the global experience with the SARS-CoV-2 viral infection expanded, a first update to the list was done in May 2020 and subsequently adopted by the WHO Global Advisory Committee on Vaccine Safety (GACVS) at their May 27-28, 2020, meeting. Subsequently, SPEAC implemented a systematic review process to ensure an ongoing understanding of the full spectrum of COVID-19 disease and modification of the AESI list accordingly. The second update was completed in September 2020 with no AESIs added to the May 2020 list. The third update was completed in December 2020 and three new entities were added to the AESI list: rhabdomyolysis, subacute thyroiditis, and acute pancreatitis.

This document provides detailed methods and results of the fourth update completed in August 2021. The primary objectives were to review the evidence on the following outcomes:

1) Long COVID (Part 1, presented as a separate document);
2) acute cardiac injury other than myocarditis/pericarditis;
3) maternal, foetal and neonatal outcomes;
4) pediatric and adult COVID-19 related complications;
5) system-specific COVID-19 complications.

For this fourth update, the search focused on meta-analyses and reviews and excluded case reports, case series, studies, guidelines and commentaries. The system specific annexes from previous reports have been updated with the newly published meta-analyses and reviews. New annexes have been added for specific populations: adult, pediatric, pregnant/foetal/neonatal. A companion "COVID Review Citations Jan2020 to Aug2021" excel spreadsheet has been prepared which contains the full citations with download links included in the March, May, September and December 2020 and August 2021 updates separated into tabs by body system. New tabs have been added for adult, pediatric and pregnant populations.

Based on the findings presented in the August 2021 update, including those in Part one on Long COVID, SPEAC recommends the following:

1. Long COVID should not be added to the COVID-19 AESI list at the present time.
2. Continued review of the evidence on Long COVID should be a focused activity of the fifth update due in December 2021.

3. Work on a standard 'Brighton' case definition for Long COVID should be initiated starting with a small group of experts. Review of existing case definitions and comparison to what exists for Systemic Exertion Intolerance Disease (SEID) formally referred to as Chronic Fatigue Syndrome or Myalgic Encephalomyelitis; Post-Intensive Care Syndrome (PICS) and Post-Traumatic Stress Disorder (PTSD) will be needed.
4. Convene an expert forum to share what is known on Long COVID in a webinar format, similar to what was done for Vaccine Associated Enhanced Disease sometime in the next two to three months.
5. Beyond myocarditis and pericarditis, for which Brighton case definitions have been completed, no new case definitions need to be created for the other acute cardiac injuries.
6. Since myocarditis and/or pericarditis may present with some of these syndromes, in particular arrhythmias or heart failure, the companion guide to those case definitions will include background rates, risk factors and coding for all the acute cardiac injury syndromes on the AESI list.
7. No maternal, foetal or neonatal outcomes will be added at this time to the COVID-19 AESI list.
8. No new AESI will be added to the COVID-19 AESI list related to COVID-19 course and complications in children or adults.
9. No new system-specific AESIs will be added to the COVID-19 AESI list.
10. The next update (fifth update due December 2021) will use the same methods as described for this update to focus on new evidence related to Long COVID, Pregnancy and perinatal outcomes, pediatric course and complications and system specific AESIs or those seen in adult populations. The only recommended change in the current search strategy will be to incorporate search terms specific to the varied case definitions of Long COVID (including post-acute sequelae of SARS-CoV-2, 'PASC', Post-acute COVID-19 syndrome, 'PACS') and the delta variant.
11. In addition to gathering new evidence via searches for meta-analyses and systematic reviews as per the 10th recommendation above, the living review of maternal/perinatal outcomes at the University of Birmingham website (https://www.birmingham.ac.uk/research/who-collaborating-centre/pregcov/index.aspx) will be checked every 2 weeks for any newly emerging evidence that could change the current recommendation that no pregnancy or perinatal outcomes be added to the AESI list.
12. The COVID-19 AESI list, as published in the 3rd update of December 2020, remains the same (as shown in Annex 1).

1. Background

CEPI has contracted with the Brighton Collaboration, through the Task Force for Global Health, to harmonize the safety assessment of CEPI-funded vaccines via its Safety Platform for Emergency vACcines (SPEAC) Project.

A key aspect of this harmonization has been creation of lists of priority potential adverse events of special interest (AESI) that are relevant to vaccines targeting CEPI target diseases. Given the emerging and pandemic nature of COVID-19, ongoing systematic reviews of the literature have been necessary and there have been several updates to the AESI list. These are summarized in the table below along with links to each of the landscape updates done for COVID-19.

TABLE 1. Evolution of COVID-19 AESI literature reviews and AESI list and updates.

COVID-19 AESI List	Deliverable Document (with link)	Date Completed	Literature Review End Date	Comment
Initial list	SO1-D2.3 V1.1	Mar 5, 2020	February 2020	Based on first 5 publications from China
1st Update	SO1-D2.3 V1.2	May 25, 2020	May 16, 2020	Adopted by WHO GACVS[1]
2nd Update	SO2-D2.1.1	Sept 9, 2020	August 8, 2020	No new AESI added
3rd Update	SO2-D2.1.2	Jan 11, 2021	November 13, 2020	Three AESI added: acute pancreatitis, rhabdomyolysis, and subacute thyroiditis
4th Update	SO2-D2.1.3 Part 1 SO2-D2.1.3 Part 2	Sept, 2021	July 12, 2021 August 2, 2021	No AESI added, but Brighton Case definition to be done for Long COVID and list

Two of the key recommendations from the 3rd update had direct relevance to the fourth update, specifically

- Focus the next literature update on the entity known as Long COVID as well as on COVID-19 disease outcomes related to pregnancy and childhood.
- Defer a decision regarding development of Brighton case definitions for the following manifestations of cardiac injury: arrhythmia, acute coronary syndrome, heart failure, cardiogenic shock, stress cardiomyopathy and microangiopathy. Full text review to be done of already retrieved and newly published meta-analyses and systematic reviews as part of the next update due in the summer of 2021.

The focus of this fourth update follows from the recommendations above and is the subject of this deliverable.

2. Objectives

Part 1 of the 4th update focused on Long COVID to determine if the evidence supports its addition to the AESI list. Only the recommendations related to Long COVID will be presented in this report. For Part 2, the main objectives are to:

1. Update the evidence on acute cardiac injury associated with COVID-19 to determine if there is a rationale to add more than myocarditis / pericarditis to the COVID-19 AESI list.
2. Determine whether there are any adverse pregnancy outcomes that are associated with COVID-19 infection and if so if they should be added to the COVID-19 AESI list.
3. Determine whether, aside from Multisystem Inflammatory Syndrome, there are any newly identified COVID-19 complications specific to the pediatric population.
4. Determine whether there are any newly identified COVID-19 complications specific to adult populations.
5. Determine whether there are any newly identified COVID-19 complications specific to body systems, already included on the AESI list.
6. Add newly retrieved COVID-19 systematic review citations to the tabular summaries by body system and the excel spreadsheet completed as part of the 3 previous systematic searches.

3. Methods

3.1 Literature Search for evidence related to possible new AESI by special populations and body systems

New, streamlined search strategies were developed to achieve the main objectives of this fourth update. A full description of the search methodologies used for the original landscape analysis and all updates are available in the deliverable documents shown in Table 1 above, including links to each.

A key difference for this fourth update relative to previous ones was to narrow the focus by study type to systematic reviews and meta-analyses for all previously identified COVID-19 AESI as well as for pregnancy outcomes and pediatric disease course and complications. The enormous volume of case reports/series, studies, commentaries, and letters to the editor were not only beyond the scope of this review, but also not expected to contribute new information beyond what would be available in reviews given the 15-to-19-month duration of the pandemic at the time of the searches conducted for this update. The full search strategies are presented in Annex 2. Of note, the PMIDs of all previously retrieved articles were included in the search terms (as 'NOT' to exclude their retrieval) to cut down on duplicates. Non-English articles were excluded. For the current update, searches were conducted on March 15 and on August 2, 2021. As for all previous literature searches, the results from each search were loaded into an excel spreadsheet. A single expert (Barb Law) screened all citations.

The brief category name and descriptive rationale for exclusion included:

- 'Therapy/Testing/Prevention': as implied, articles with the main focus on COVID-19 therapy, testing or prevention of disease.
- 'Healthcare': focus on healthcare during the COVID-19 pandemic.
- 'Unrelated': articles that focused on risk factors for severe or fatal COVID-19 or aspects of disease unrelated to possible AESI such as general aspects of pathogenesis, immunity, epidemiology or psychiatric impacts of the pandemic.
- 'Noncontributory': articles with no information (e.g., planned protocols) speculative articles based on pathogenesis or immunology or those with no new information on already identified AESI.

All screened in articles were categorized according to Primary topic, which included terms for:

- Categories from previous AESI list: Cardiac, Dermatologic, Endocrine, Gastrointestinal (GI), Hematologic, Liver, Kidney, Multisystem inflammatory syndromes, Musculoskeletal, Neurologic, Ocular and Respiratory.

- Additional categories relevant to AESI list: Mixed clinical (capturing citations that focused on specific age-groups and/or patient populations by specific regions), Pregnancy

Two additional classifications were used to enable grouping of subcategories within each of the main primary topics as well as to identify the type of study, which for this fourth update were primarily, by design, reviews or meta-analyses.

3.2 Review of evidence on acute cardiac injury associated with COVID-19

As part of systematic searches conducted in previous updates as well as done for this fourth update, a full text review was done for all reviews and meta-analyses collected. As has been done for myocarditis and pericarditis, this research was done in order to determine the scope and patterns of cardiac injury. Additionally, these systematic searches were conducted to determine whether each entity as noted in the May 2020 AESI list was distinct requiring a standard case definition.

3.3 Review of evidence on pregnancy outcomes associated with COVID-19

A full text review was done for all reviews and meta-analyses collected as part of systematic searches conducted for previous updates as well as done for this fourth update. A 1st year public health masters student (RD) reviewed each article and screened out any reviews that were non-systematic. For the remainder, she extracted the following information into an excel spreadsheet including:

- latest date of the literature search;
- geographic location of included studies;
- eligibility criteria;
- language restrictions;
- whether maternal, foetal and/or neonatal outcomes were captured;
- methods for identifying duplicate cases;
- whether study quality was assessed and related instruments/scoring systems used;
- total number of studies, and where possible broken down into total number of:
    - case-control studies,
    - cohort studies,
    - case series and case reports;
- total pregnancies, deliveries, infants included; and
    - overall occurrence (%) of maternal death (based on number of deaths / total pregnancies included);
    - perinatal complications; and
    - vertical transmission (based on number of proven COVID-19 infection in newborn/total newborns).

Missing values for any category were denoted ‘nd’ for no data and the cell was orange highlighted. She also compiled overarching results for each included meta-analysis and systematic review by capturing results from the abstract categorized into separate columns for maternal, foetal and neonatal outcomes. Where studies did not include results in the abstract, data were obtained from the results section of the publication.

In addition, a crosstabulation grid was prepared in an excel spreadsheet, listing all studies cited in the included meta-analyses and systematic reviews and cross-referencing them against each specific meta-analysis and review. Most of the studies had already been identified as part of the repeated literature searches throughout 2020 and up to August 2, 2021. Any study included in the reviews and meta-analyses but not retrieved by the search strategy

used in the 1st through 3rd updates, was added to the spreadsheet. Alphanumeric identification codes were added to each systematic review (R01, R02 etc), meta-analysis (M01, M02 etc) systematic review of published reviews (RR01, RR02 etc), and the studies cited by the included Systematic Reviews and Meta-Analyses (S01, S02 etc).

Once prepared, the documents noted above were reviewed by the principal author (BL) in order to gain an overview of the quality and contribution of each Systematic Review and Meta-analysis. Additionally, the principal author reviewed in depth the articles considered most informative in terms of evidence of adverse pregnancy outcomes associated with COVID-19.

3.4 Review of evidence on pediatric complications associated with COVID-19

A full text review was done for all reviews and meta-analyses collected as part of systematic searches conducted for this and previous updates. Full text review of each article was done looking for any unique complications not already included on the COVID-19 AESI list. Articles on the Multisystem inflammatory syndrome in children were not included since this is part of the current COVID-19 AESI list and a Brighton case definition has already been developed and published.[2]

Updates done during 2020 included articles classified by body system. While infrequent, for several of the systems there were pediatric case reports, case series, studies and reviews. For this fourth update all previously identified articles focused on specific systems were scanned and any involving pediatric age groups were relocated into a separate tab in the "COVID Review Citations Jan2020 to Aug2021" excel spreadsheet. (see tab named Populations_Pediatric) and a tabular summary of each article by type of study was prepared for the pediatric publications and added as a new annex in this document.

3.5 Review of evidence on adult complications associated with COVID-19

A full text review was done for all reviews and meta-analyses collected as part of systematic searches conducted for previous updates as well as done for this fourth update. This full text review covered the course of COVID-19 in adult populations and were not limited to a specific body system. Full text review of each article was done looking for any unique complications not already included on the COVID-19 AESI list.

3.6 Review for newly recognized body system specific COVID-19 complications

Focused on specific body systems, a full text review was done of all newly identified systematic reviews and meta-analyses that focused on specific body systems. This was done to identify any new complications of COVID-19 disease that might be considered for addition to the AESI list.

4. Results

4.1 Systematic Literature Search: Articles retrieved, screened in, and excluded

From November 13, 2020, through August 2, 2021, two separate searches were run (March 15 and August 2, 2021). Of the 360 citations identified, 150 (41.7%) were screened in and the other 210 (58.3%) were screened out. The reasons for excluding articles were as follows:

- 148 unrelated to COVID AESI. The majority of these were focused on risk factors for severe COVID-19 illness including mortality (138) with the remainder focused on psychiatric impacts of COVID-19 (4 articles), pathogenesis (2), immunity (2), epidemiology (1) or co-infection (1).
- 38 focused on therapeutics, diagnostics or prevention of COVID-19 illness
- 13 focused on aspects of healthcare during the pandemic

- 10 were deemed non-contributory to the review focus on AESI. Specifically there were 3 review articles on cardiac manifestations that were very early on in the pandemic, with searches ending in March or April 2020 and as a result mostly based in China; 3 were reports on protocols to be conducted; 2 focused on pathogenesis of neurologic AESI; 1 focused on thromboembolic phenomena before and during pandemic encompassing non-COVID as well as COVID related events; and 1 discussing the absence of images of skin of colour in publications of COVID-19 skin manifestations.
- 1 article in Spanish that was retrieved despite it being non-English

The distribution by main topic for the 150 retained articles in decreasing order of frequency is shown below, including a breakdown by meta-analysis/review. Each article has been added to those retrieved during earlier updates in the specified Annex table in this document as well as in the "COVID Review Citations Jan2020 to Aug2021" excel spreadsheet.

- 36 neurologic (11 meta-analyses, 25 reviews) see Annex 13
- 27 pregnancy (8 meta-analyses, 19 reviews) see Annex 17
- 23 hematologic (15 meta-analyses, 8 reviews) see Annex 7
- 17 cardiac (13 meta-analyses, 4 reviews) see Annex 3
- 12 multisystem inflammatory syndrome (6 meta-analyses, 6 reviews) see Annex 11
- 7 adult populations (4 meta-analyses, 3 reviews) see annex 15
- 5 pediatric populations (4 meta-analyses, 1 review) see Annex 16
- 8 acute kidney injury (6 meta-analyses, 2 reviews) see Annex 8
- 4 gastrointestinal (1 meta-analysis, 3 reviews) see Annex 6
- 5 acute liver injury (all meta-analyses) see Annex 9
- 5 dermatologic (1 meta-analysis, 4 reviews) see Annex 4
- 1 endocrine (review) see Annex 5

4.2 Evidence on acute cardiac injury associated with COVID-19[3-7]

Annex 4 lists all articles retrieved for the first COVID-19 landscape review and all subsequent updates through August 2nd, 2021. All 52 reviews and 26 meta-analyses were read, and notes made. There was a great deal of repetition and ultimately 6 were selected as representative of current evidence related to acute cardiac injury associated with COVID-19.[3-7]

A meta-analysis by a global group of investigators focused on arrhythmias and electrocardiographic changes in COVID-19 infection.[3] The analysis included 30 studies with a total of 12,713 participants. The prevalence of arrhythmias was 10.3% (95% CI of 8.4-12.3) and the risk was clearly linked to the severity of COVID-19 illness. Relative to patients with non-critical illness, critically ill individuals had substantially higher risk of developing both ventricular (RR 10.5; 95% CI 3.9-27.9) and supraventricular (RR 10.1; 95% CI 5.7-17.2) arrhythmias. In addition to myocarditis, causes of arrhythmias included a combination of hypoxia, myocardial strain and ischemia, imbalance in intravascular volume, electrolyte derangements and drug-related adverse reactions.

Roshdy et al. did a systematic review of cardiac autopsies including 36 studies (13 case reports, 24 case series, 3 case-control studies) with a total of 316 cases.[4] There was a high prevalence of pre-existing comorbidities including 48% hypertension, 33% coronary artery disease, 21.5% cardiomyopathy/heart failure, 11% atrial fibrillation, 29% chronic lung disease, 26% diabetes and 17% chronic kidney disease. Non-primary cardiac injury was noted including coagulopathy with thrombosis and ischemic damage due to a mismatch in blood supply and demand. Nearly 25% had evidence of myocardial fibrosis which is strongly associated with aging and comorbidities. In

almost 50% of cases SARS-CoV-2 was detectable by RT-PCR testing in the heart but only 1.5% had the pattern of inflammatory myocarditis.

Two excellent reviews focused on arrhythmias associated with COVID-19 are recommended and were used in preparing a slide presentation to accompany this document. [5,6.] One entity that could arise from primary cardiac injury as a result of COVID-19 infection is stress cardiomyopathy, also known as Takotsubo syndrome. A single meta-analysis has focused on this, including 10 publications, all case reports with a total of 12 patients.[7] Cardiac comorbidities were present in over 50% of the group. More evidence is needed regarding this particular entity but as with the other acute cardiac injuries (arrhythmias, heart failure, myocardial infarction, and coronary artery disease) the context of hosts with pre-existing cardiac disease adding to their risk of critical illness with COVID-19, along with management in Intensive care with multiple drugs that have cardiac side effects, the degree of cardiac injury in COVID-19 disease is not unexpected.

4.3 Evidence on pregnancy outcomes associated with COVID-19[8-16]

Annex 18 shows all meta-analyses (n=22), systematic reviews (n=51) and reviews of systematic reviews (n=2) that have been recovered in searches done covering December 2019 through August 2, 2021. An additional 20 review articles were found but excluded because they were not systematic reviews. Annex 19 provides a summary of the key findings from each of the included citations. The "COVID Review Citations Jan2020 to Aug2021" Excel spreadsheet has a new tab 'Pregnancy_Rev_MetaAnal' which contains all 95 citations, identifying the non-systematic reviews that were not included in this review. An adjacent tab, named 'Pregnancy_Studies by Reviews', lists all 528 studies included by one or more meta-analyses or systematic reviews. Full citation details are provided for all but 56 of the cited studies. All of these were included in the living systematic review by Allotey et al.[8] Despite downloading all the supplemental material, it was impossible to determine a specific citation for each of the 56 studies. What information was available from their supplemental material Appendix 3 was included in the Authors column in terms of lead Author name, and number of subjects included. A column was created for each meta-analysis and review and a cross-tabulation was done identifying the studies included by each separate meta-analysis and review. The cross tabulation was done to help select the reviews that were based on the most evidence in terms of included studies. Table 1 summarizes the total number of meta-analyses and reviews that provided information on Maternal, Fetal and Neonatal outcomes.

TABLE 1. Number of Meta-analyses and Systematic Reviews reporting on each pregnancy outcome. The total number in each category is shown. Numbers in brackets are the (median; range) of the number of studies included in each type of review.

	Maternal outcomes	Foetal Outcomes	Neonatal Outcomes
Meta-Analyses	18 (23.5; 7-191)	12 (23.5; 9-51)	18 (34.5; 7-191)
Systematic Reviews	38 (18.5; 3-161)	23 (25; 3-161)	45 (25; 3-161)

It was not possible to review in depth each meta-analysis and systematic review. Fortunately, there was one that stood above all others in terms of number of studies covered (191) and methodology and this is summarized in detail below.[8] The Allotey study was based on published evidence through Oct 6, 2020, and thus 4 more recent meta-analyses with searches conducted into early 2021 were also reviewed in depth to see if any different patterns of pregnancy outcomes associated with COVID-19 were seen.[9-12]

The PregCOV-19 Living Systematic Review Consortium is a global collaborative effort led by the UK University of Birmingham Institute of Applied Health Research.[9] The consortium is conducting an ongoing systematic review

and meta-analysis of clinical manifestations, risk factors and maternal and perinatal outcomes of COVID-19 in pregnancy. The review is registered (PRosPERO CRD42020178076) and there are plans to continue to update results for up to two years. Two summaries have been published, the first in September 2020 and the one reviewed here in February 2021. Search updates are done weekly, and analyses done every 2 to 4 months. There is a dedicated website where updates are provided (https://www.birmingham.ac.uk/research/who-collaborating-centre/pregcov/about/index.aspx). Methodology is rigorous and too detailed to repeat here but in brief they include studies in the following categories:

- Comparisons of COVID-19 infection rates, clinical symptoms, laboratory and radiology results, risk factor prevalence and morbidity and mortality among pregnant or recently pregnant (defined as women in the postpartum or post-abortion period) women versus non-pregnant women of reproductive age
- Comparisons of maternal and perinatal outcomes among pregnant women with and without COVID-19 infection
- Cohort studies that sampled participants based on COVID-19 exposure and followed them over time to ascertain outcomes
- Non-comparative cohort studies with 10 or more subjects providing clinical and outcome information with historical pre-pandemic controls.

Methodology was designed to try to address many of the major issues in the over 150 review articles on pregnancy outcomes published from the onset of COVID-19 through September 1, 2020 including:

- Biased meta-analyses done using predominantly case reports and case series
- Multiple reviews including similar but not exactly the same primary studies, with duplicate data
- Variable sampling frames from universal testing for SARS-CoV-2 done on all pregnant women admitted to hospital to only symptom-based testing.
- Including unconfirmed COVID-19 cases based on epidemiologic exposure or clinical presentation

A total of 192 cohort studies was included, of which 131 were comparative. By country of origin there were 58 US studies, 31 from China, 17 from Italy, 15 from Spain, 8 from Turkey, 5 from each of Brazil, France and Mexico; 3 from each of Iran and Portugal; 2 each from UK and India and 1 from each of: Bangladesh, Chile, Estonia, Israel, Japan, Germany, Ireland, Kuwait, Pakistan, Qatar, Romania, Russia and Switzerland.

COVID-19 prevalence was assessed in 73 studies, risk factors for COVID-19 and complications in 108 studies and clinical manifestations among pregnant versus non-pregnant women of reproductive age in 82 studies. None of these provided information relevant to the AESI list, and so no results are summarized here.

COVID-19 outcomes were assessed in 92 studies involving 49,433 pregnant women and 568,386 non-pregnant women of reproductive age. Maternal and perinatal outcomes were assessed in 95 studies and included 54,943 women and 9466 neonates. The key results from the meta-analysis of these studies are shown in Table 2.

TABLE 2. Maternal and perinatal outcomes among pregnant and recently pregnant women with or without COVID-19 infection.[9]

Outcome	Number of studies	Number of participants	Pooled prevalence Mean (95% CI)	Risk if COVID infected vs non-COVID infected: Odds Ratio (95% CI)
All cause mortality	8	4820		2.85 (1.08-7.51)
Preterm birth	70	9638	17% (14-19)	
	18	8549		1.47 (1.14-1.91)

Spontaneous preterm birth	17	1629	6% (4-9)	
Stillbirth	47	9020	0.8% (72 stillbirth)	
	9	5794		2.84 (1.25-6.45)
NICU admission	41	3323	33% (24-43%)	
	10	5873		4.89 (1.87-12.81)
Neonatal death	51	8263	0.5% (41 deaths)	

The findings of this updated review were considered to be consistent with the earlier review in terms of COVID-19 prevalence, clinical manifestations and outcomes. Given small numbers of events such as maternal death and stillbirths (only 9 in the COVID-19 group) it was noted that confidence was not high in the results despite having demonstrated an increased risk for maternal death and stillbirths. Further it was noted that the overall rates of stillbirths and neonatal deaths associated with COVID-19 did not seem to exceed background rates. Not observed was a higher complication rate associated with specific trimester of pregnancy or multiparous versus primiparous, however sample sizes were not large. While an increase in preterm births was associated with COVID-19 it was not clear if this was because of a medically indicated need to end pregnancy in COVID-19 severe illness. The overall rate of spontaneous preterm birth was considered similar to what had been seen prior to the pandemic. The increased risk of NICU admissions was likely multifactorial related to local policies on observation / quarantine of infants possibly exposed to COVID-19.

Chmielewska et al[9] did a systematic review and meta-analysis of studies comparing maternal and perinatal outcomes prior to and during the pandemic comparing results for High income countries (HICs) and Low-Middle income countries (LMICs). A total of 40 studies were included, only 2 of which were also in the Allotey review. Among the studies were 5 reports from national registries, 6 regional reports, 4 multicentre studies and 25 single centre studies. The comparison period was: comparable period of 2019 relative to period used for 2020 (11 studies); matched periods from several preceding years (9 studies) and the immediate pre-lockdown period in the same country (18 studies). Table 3 summarizes the key significant findings from the analyzed studies. Of note there were no significant differences from pre-pandemic to post pandemic for maternal gestational diabetes, spontaneous vaginal delivery, Caesarean section or instrumental delivery; preterm birth prior to 37 or 32 weeks, Birthweight <2500 grams or NICU admission for both HICs and LMICs. Preterm birth before 34 weeks, postpartum haemorrhage, and neonatal 5-minute Apgar score <7 did not change from pre-pandemic to pandemic periods for HICs and there were no studies on these factors from LMICs.

As shown in table 3, for LMICs only, the pandemic period versus prior to the pandemic was associated with significant increases in hypertensive disorders of pregnancy, Maternal death (although this result was driven by one very large study from Mexico[13]) and stillbirth. For HICs the only significant finding was an increased risk of ruptured ectopic pregnancy needing surgical intervention during pandemic.

Table 3. Maternal and perinatal outcomes during and before COVID-19 pandemic by country income level. HIC = High income countries; LMIC = low – middle income countries.[9]

Outcomes	Total Studies	Pandemic		Before Pandemic		Odds Ratio (95% CI)	P	I^2 %
		Events	Pregnancies	Events	Pregnancies			
Maternal morbidity /complications								

Hypertensive disorders of pregnancy: HICs only LMICs only	 5 1	 279 14	 6675 271	 431 3	 9826 311	 0.99 (0.67-1.46) 5.59 (1.59-19.7)	 0.95 0.0073	 77 NA
Early pregnancy outcomes – Surgical treatment of ectopic pregnancy: HICs only LMICs only	 3 0	 27 NA	 37 NA	 73 NA	 272 NA	 5.81 (2.16-15.6)	 .0005	 26
Delivery Outcomes								
Induction of Labour: HICs only LMICs only	 6 1	 2478 2282	 9294 7165	 2950 2258	 11403 13189	 103 (0.90-1.19) 2.26 (2.12-2.42)	 0.64 <.0001	 76 NA
Spontaneous preterm birth HICs only LMICs only	 2 0	 208 NA	 4204 NA	 374 NA	 6818 NA	 0.81 (0.67-0.97) NA	 0.02 NA	 0 NA
Death								
Stillbirth HICs only LMICs only	 8 4	 625 474	 150,404 17,891	 640 685	 165,118 33,875	 1.38 (0.94-2.02) 1.29 (1.06-1.58)	 0.099 0.012	 52 64
Neonatal death HICs only LMICs only	 1 2	 5 57	 2538 10,676	 6 114	 1262 21,308	 0.41 (0.13-1.36) 1.37 (0.42-4.46	 0.14 0.59	 NA 90
Maternal death HICs only LMICs only	 0 2	 NA 530	 NA 1,237,018	 NA 698	 NA 2,224,859	 NA 1.37 (1.22-1.53)	 NA <.0001	 NA 0

LaVerde et al[10] focused on maternal death related to COVID-19 including 13 reports of 154 maternal deaths. Two were studies [13,14] and the remainder were case reports or small series. Six of the studies were covered by Allotey including the two quantitative studies that contributed to the meta-analysis. There were two findings of relevance made by LaVerde et al. First, of 146 deaths where timing was provided, 52.1% occurred during pregnancy and 47.9% in the postpartum period, several of which were more than 6 months following delivery. Secondly presence of one or more risk factors was associated with increased mortality (Risk Ratio 2.26; 95% CI 1,77, 2.89). Obesity was the key risk factor, but maternal diabetes was also important. Lumbreras-Vasquez[13], which was one of the studies included by both Allotey and LaVerde, looked at annual maternal mortality in Mexico from 2011 through August 11, 2020. The major increase seen in 2020 was due to respiratory diseases, whereas there was minimal change for deaths related to hypertensive disorders of pregnancy, postpartum hemorrhage, venous thromboembolism, or other causes.

Lassi et al[11] compared pregnant women with severe COVID-19 (defined as dyspnoea with respiratory rate ≥30/min and hypoxemia on room air, needing oxygen or invasive/non-invasive mechanical ventilation including ECMO) vs non-severe COVID-19 (defined as asymptomatic or mild without evidence of viral pneumonia or hypoxemia OR moderate with clinical signs of pneumonia but no hypoxemia on room air) in terms of clinical presentation and pregnancy/perinatal outcomes. Their search extended to February 15, 2021, and of their 62 included studies 23 were not part of the Allotey review. A total of 31,016 pregnant women was included. Table 4 shows results for

key perinatal outcomes. Similar to previous reviews, severe COVID-19 was associated with maternal comorbidities (obesity, smoking, diabetes, pre-eclampsia).

TABLE 4. Perinatal outcomes among pregnant women with COVID-19: severe vs non-severe illness[11]

Outcome	# Studies	Total events / Participants	Pooled proportion (95% CI)	Risk ratio (95% CI) for Severe vs non-Severe COVID
1st TM spontaneous abortion	5	21/387	7.3% (1.9 to 15.2)	Non-estimable (0 cases in severe COVID)
Fetal loss / miscarriage	9	28/874	2.6% (0.5 to 5.6)	Non-estimable (0 cases in severe COVID)
Stillbirths	7	21/1121	1.6% (0.8 to 2.7)	1.45 (0.31 to 6.81)
Preterm birth <37 weeks	27	5539/2393	23.4% (18.9-28.1)	4.91 (3.98 to 6.08)
Preterm birth <32 weeks	7	45/465	18.2% (0.4-38.5)	8.47 (4.02 to 17.85)
Neonatal deaths	9	24/1161	1.6% (0.4-3.3)	Non-estimable (0 cases in either group)

The meta-analysis by Wei et al[12] searched to January 29, 2021, and of 42 studies included, 15 were not in the Allotey review, notably three additional studies on stillbirth in COVID-19 infected women. This increased the number of observed stillbirth events with COVID-19 from 7 to 48 and gave a tighter estimate for an associated risk (Odds ratio) of 2.11 (1.14-3.90). By far the largest was the study by Jering et al[15] which was done in the USA using ICD-10 codes within the Premier Healthcare Database for women giving birth and discharged between April 1, and November 23, 2020. A total of 406,446 were identified including 6380 with COVID-19. There were 1289 (0.3%) and 34 (0.5%) stillbirths in the two groups, respectively. Of interest, the unadjusted odds ratio of 1.66 (1.18-2.33) was the one used in the Forrest plot by Wei et al, yet Jering et al based their conclusions of no significant increased risk of stillbirth in COVID-19 on the adjusted Odds Ratio of 1.23 (0.87-1.75). Among pregnant women giving birth in the context of COVID-19 infection there were significantly higher rates of preeclampsia (adjusted OR 1.21; 95% CI 1.11-1.33), thrombotic events (adjusted OR 4.47; 95% CI 2.87-6.96), venous thromboembolism (adjusted OR 3.43 (2.01-5.82), myocardial infarction (adjusted OR 30.89; 95% CI 12.56-75.99) and HELLP syndrome (adjusted OR 1.96; 95% CI 1.36-2.81). Limitations of this study included possible ICD-10 misclassification, lack of confirmatory testing and overall low event rates.

Finally, Wei et al cited a unique study by Patberg et al[16] on placental histopathology in women delivering at term with COVID-19 infection. This was retrieved for detailed review. This was a retrospective cohort study conducted at a single New York City hospital where all women admitted for delivery were tested for COVID-19 regardless of symptomatology. Included were women known to have singleton term pregnancies. Testing for COVID-19 was done at the time of admission for labor and delivery, with cases being those who tested positive for (n=77) and controls those who tested negative (n=56) for COVID-19. Most cases were asymptomatic (67; 87%). SARS-CoV-2 testing was done on 71 infants born to cases and all were negative. There were no differences in neonatal outcomes for infants of cases vs controls. Significant differences in placental histopathology for cases versus controls included fetal vascular malperfusion: 32.5% vs 3.6% (p<.0001) and villitis of unknown etiology: 20.8% vs 7.1% (p=.03). In their review, Wei et al noted that the placental findings could relate to adverse outcomes like stillbirth and preterm birth. While interesting, the meaning of these changes is not clear and further research is needed.

4.4 Evidence on pediatric complications associated with COVID-19

Annex 17 shows all articles retrieved in the current and past landscape updates involving children. Only 3 new articles were retrieved as part of the current update, all meta-analyses, one focused on neurologic complications and the other

two on gastrointestinal complications. Articles retrieved from previous updates included 20 general meta-analyses, 20 general reviews, 7 body system specific reviews (4 neurologic, 1 liver function abnormalities, 1 hematologic complication and 1 on chest imaging findings), 12 studies of which 4 were focused on neonatal cases and the other 8 on older infants and children and 50 case reports. All were scanned for evidence of any previously unrecognized complications or AESI not already on the COVID-19 list and nothing of note was found.

4.5 Evidence on adult complications associated with COVID-19

Annex 16 shows all reviews and meta-analyses retrieved in the current and past landscape updates involving adult populations. In all there were 14 meta-analyses and 19 reviews with 4 and 3, respectively, retrieved as part of the searches done in March and August 2021. All articles were read looking for newly identified AESI and none were found.

4.6 Evidence for previously unrecognized body system-specific COVID-19 complications

Dermatologic (see annex 4): Only 5 new publications (1 meta-analysis and 4 reviews) were identified in the search for this fourth update. Nothing new has emerged. Most focused on the frequency of occurrence of already identified patterns in COVID-19 from chilblains to cutaneous vasculitis.

Endocrine (see annex 5): A single review article was published on acute pancreatitis noting a bimodal presentation that was already known at the time of the third update when this was a special focus and it was added to the AESI list. Nothing new was observed.

Gastrointestinal (see annex 6): Only 4 new publications (1 meta-analysis and 3 reviews) were identified in the search for this fourth update. Nothing new has emerged.

Hematologic (see annex 7): From January 2020 through August 2, 2021 there have been a total of 73 reviews and 36 meta-analyses identified. All deal with already identified AESIs including coagulopathy, stroke, venous thromboembolism including pulmonary embolism, other thrombosis, thrombocytopenia and endothelial dysfunction. Nothing new was identified.

Kidney (see annex 8): Acute kidney injury was a specific focus of the third COVID-19 update. Only 8 new publications were retrieved for the fourth update – 6 meta-analyses and 2 reviews. Many of these focused on the relevance of prior chronic kidney disease for developing acute kidney injury during COVID-19. Nothing new has emerged in terms of kidney -related complications.

Liver (see annex 9): A total of 5 new meta-analyses were identified as part of the fourth update. Most focused on the correlation between liver injury and severity of COVID-19. Nothing new was identified.

Neurologic (see annex 13): From Jan 2020 through August 2, 2021, there have been a total of 135 reviews and 29 meta-analyses identified. The majority are focused on smell and taste abnormalities (30 reviews, 17 meta-analyses). GBS has been the focus of 13 reviews and 1 meta-analyses. For other entities already on the AESI list there have been 5 reviews on seizure, 3 on encephalitis and/or encephalopathy, 1 on Bell's Palsy and 1 on intracerebral hemorrhage. None of these were reviewed given the fact that all of these entities are on the AESI list already.

There was a total of 11 meta-analyses and 10 reviews retrieved as part of the fourth update, that presented general overviews of neurologic complications. All were reviewed and notes made. Nothing new in terms of specific neurologic complications was identified.

There were no new publications related to ocular, musculoskeletal or respiratory systems.

5. Recommendations & discussion

The results of the fourth update for the COVID-19 AESI priority list have been presented above. The key findings are summarized below as relevant to the main objectives of this update.

5.1 Regarding Long COVID

Part 1 of this deliverable contains the detailed report on the systematic review of Long COVID. Recommendations at this time are based on the key findings of that report, namely:

- Long-COVID is a real phenomenon impacting a significant proportion of people who have had SARS-CoV-2 infection. The impact can be prolonged and debilitating and is not explained by the psychosociologic impact of the global COVID-19 pandemic.
- Long COVID is seen in people of all ages, with and without comorbidities, in the context of both mild and severe infection. As such it is not yet clear if it is a single entity or many in terms not only of disease presentation but also pathogenesis.
- Long COVID shares some features of other post-viral disorders once referred to as Chronic Fatigue, then Myalgic Encephalomyelitis and more recently as Systemic Exertion Intolerance Disease (SEID). Similar features are also seen in the Post Intensive Care Syndrome (PICS) and Post Traumatic Stress Disorder (PTSD).
- Hampering the synthesis of evidence is heterogeneity in definitions of the syndrome, case ascertainment and study methodology.

Based on these findings, SPEAC recommends that:

1. Long COVID not be added to the COVID-19 AESI list at the present time.
2. Continued review of the evidence be a focused activity of the fifth update due in December 2021.
3. Work on a standard 'Brighton' case definition be initiated starting with a small group of experts. Review of existing case definitions and comparison to what exists for SEID, PICS and PTSD will be needed.
4. It is also proposed that an expert forum be convened to share what is known on Long COVID in a webinar format, similar to what was done for Vaccine Associated Enhanced Disease (VAED) sometime in the next two to three months.

5.2 Regarding the need for case definitions for acute cardiac injury beyond myocarditis & pericarditis

Current evidence, as reviewed above (see Section 4.3) shows that arrhythmias, heart failure, myocardial infarction, and coronary artery disease that have been seen in acute COVID-19 infection are strongly correlated with critical COVID-19 illness. These health conditions may result from multiple insults including hypoxemia, myocardial blood supply-demand imbalance, coagulopathy, polypharmacy and the comorbidities like pre-existing cardiovascular disease, obesity and diabetes that predispose to severe illness. There is minimal evidence on the origins of stress cardiomyopathy, also known as Takotsubo syndrome, but it is also infrequently seen with COVID-19.

Based on these conclusions SPEAC further recommends that:

1. Beyond myocarditis and pericarditis, for which Brighton case definitions have been completed, no new case definitions need to be created for the other acute cardiac injuries.

2. Since myocarditis and pericarditis may present with some of these syndromes, in particular arrhythmias or heart failure, the companion guide to the myocarditis and pericardits case definitions will include background rates, risk factors and coding for all the acute cardiac injury syndromes on the AESI list.

5.3 Regarding adding AESI related to pregnancy outcomes, pediatric/adult/system specific COVID-19 complications

As noted in section 4.4 above, the evidence on pregnancy outcomes associated with COVID-19 is expanding and has been extensively reviewed, albeit with variable methodologies and quality of investigation and data synthesis. The living systematic review for pregnancy and perinatal outcomes, being conducted in ongoing fashion for up to two years at the University of Birmingham[8], is an outstanding resource for monitoring changes in the understanding of the impact of COVID-19 infection on maternal, foetal and neonatal outcomes. There are some data showing COVID-19 infection, and/or the COVID-19 pandemic to be associated with an increased risk of surgical treatment of ruptured ectopic pregnancy (In high income countries only); maternal mortality (primarily in low-middle income countries); preterm birth; stillbirth; and neonatal NICU admission. That said, several of the reported adverse outcomes can be explained by change in healthcare seeking behaviours during pandemic (re the ruptured ectopic pregnancies), by inequities in health care capacity and organization [maternal mortality]), changes in NICU admission policies for infants exposed to COVID-19 infected mothers, medical indications for terminating pregnancy in the face of critical maternal illness well ahead of term gestations (pre-term births, stillbirths). The overall numbers of stillbirths and neonatal deaths are low and it is not clear that the incidence of that or of spontaneous preterm birth is above the expected background incidence.

The overwhelming volume of evidence reviewed on pediatric complications still favours a conclusion that, for the most part, disease is milder in children, notwithstanding the multisystem inflammatory syndrome which is on the COVID-19 AESI list and for which a Brighton definition has been published.[2] Among those children with severe or even critical acute COVID-19 infection, the spectrum of involved systems and specific syndromes, is similar to what has been seen in adults and matches AESIs that are already on the COVID-19 AESI list. It is still early in the 4th wave of COVID-19 which has been dominated by SARS-CoV-2 delta variant and in several countries, in particular in the USA, pediatric COVID-19-related hospitalizations have substantially increased. It is not clear, however, if that reflects a true increased incidence or a much higher overall infection rate given the high transmissibility of the delta variant. It is anticipated that several new descriptive studies will be published in the near future informing the disease course and complications that may be uniquely associated with the delta variant in children as well as adults.

In terms of what has been published since the previous third update nothing new has been observed in terms of general adult population COVID-19 disease or system-specific manifestations of COVID-19.

Given these findings SPEAC further recommends that:

1. No maternal, foetal or neonatal outcomes be added at this time to the COVID-19 AESI list.
2. No new AESI be added to the COVID-19 AESI list related to COVID-19 course and complications in children or adults.
3. No new system-specific AESI be added to the COVID-19 AESI list.
4. The next update (fifth update due December 2021) should use the same methods as described for this update to focus on new evidence related to Long COVID, pregnancy and perinatal outcomes, pediatric course and complications as well as system specific AESI or those seen in adult populations. The only recommended change in the current search strategy will be to incorporate search terms specific to the varied case definitions of Long COVID (including post-acute sequelae of SARS-CoV-2, 'PASC', Post-acute COVID-19 syndrome, 'PACS') and the delta variant.

5. In addition to gathering new evidence via searches for meta-analyses and systematic reviews as per the 10th recommendation above, the living review of maternal/perinatal outcomes at the University of Birmingham website (https://www.birmingham.ac.uk/research/who-collaborating-centre/pregcov/index.aspx) will be checked every 2 weeks for any newly emerging evidence that could change the current recommendation that no pregnancy or perinatal outcomes be added to the AESI list.
6. Update the COVID-19 AESI list to reflect the change in acute cardiac injury (see Annex 1).

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ANNEXES

Annex 1

Updated (Aug 2021) COVID-19 AESI including status of associated Brighton case definitions

AESI [Rationale to include as AESI (1, 2, 3, 4 and/or 5)]	Brighton Case Definition Status
AESI included because they are seen with COVID-19 Disease [3,4]	
Acute respiratory distress syndrome	Published[6]
Multisystem inflammatory syndrome (children & adults)	Published[6]
1. Myocarditis / pericarditis 2. Other forms of acute cardiac injury including arrhythmias, heart failure, coronary artery disease, myocardial infarction, stress cardiomyopathy	1.Completed, submitted to Vaccine[6] 2.No Brighton case definition to be developed but companion guide to myocarditis/pericarditis will include background rates and ICD/MedDRA codes
Coagulation disorder (includes thrombotic disorders, bleeding disorders)	Thrombosis near completion. Bleeding disorder WG to be formed
Anosmia, ageusia	WG formed & developing case definition
Chilblain – like lesions	WG to be formed
Erythema multiforme	Not yet started
Single Organ Cutaneous Vasculitis	Published
Acute kidney injury	Published lab-based criteria (see *)
Acute liver injury	Published lab-based criteria (see #)
Acute pancreatitis	Not yet started
Rhabdomyolysis	Not yet started
Subacute thyroiditis	Not yet started
AESI included because they have a proven or theoretical association with immunization in general	
Anaphylaxis [1,2]	Published[6]
Thrombocytopenia[1,2,3,4]	Published[6]
Generalized convulsion[1,2]	Published[6]
Acute disseminated encephalomyelitis[4]	Published[6]
Guillain Barré Syndrome[3,4]	Published[6]
AESI included because they have a proven or theoretical association with specific vaccine platform(s)	
Acute aseptic arthritis [r-VSV]	Published[6]
Aseptic meningitis [Live vaccines]	Published[6]
Encephalitis / Encephalomyelitis [Live vaccines]	Published[6]
Bell's Palsy [Intranasal EColi Heat Labile Toxin Adjuvanted Vaccine]	Published[6]
Vaccine associated enhanced disease [1(Formalin inactivated measles/RSV; HIV), 2(Chimeric YF Dengue), 5 (SARS / MERS-CoVs)]	Published [6]

[1] Proven association with immunization encompassing several different vaccines

[2] Proven association with vaccine that could theoretically be true for novel COVID-19 vaccines

[3] Theoretical concern based on wild type disease immunopathogenesis

[4] Theoretical concern related to viral replication during wild type disease

[5] Theoretical concern because it has been demonstrated in an animal model with ≥ 1 vaccine platform

* Acute kidney injury–consensus definition of Kidney Disease Improving Global Outcomes expert consensus group [www.kdigo.org]

- Increase in serum creatinine by ≥ 0.3 mg/dl (≥26.5 umol/l) within 48 hours; OR

- Increase in serum creatinine to ≥ 1.5 times baseline, known or presumed to have occurred within prior 7 days OR
- Urine volume ≤0.5 ml/ kg/ hour for 6 hours

Acute liver injury – definition as used in majority of COVID-19 publications (but no international consensus):

- > 3-fold elevation above the upper normal limit for ALT or AST OR
- > 2-fold elevation above the upper normal limit for total serum bilirubin or GGT or ALP

[6]Case Definition and resources available at: https://docs.google.com/spreadsheets/d/1QgF35nYcsaFN3DZTOtV_lP0TYqQzsDMUQBAd5M9brrM/edit#gid=1666959512

Annex 2

Search Strategy for COVID-19 AESI August 2021 Update

The same search strategy was used for retrieving articles on March 15, 2021 and again on August 2, 2021 with the sole exception that the yellow highlighted PMIDs marked for exclusion from the search results, were all those recovered in the first search on March 15, 2021. The other PMIDs were Reviews and Meta-analyses retrieved from searches done as part of update 1 (May 2020), update 2 (Aug 2020) and update 3 (Dec 2020)

("Coronavirus"[Mesh] OR "coronavirus"[ti] OR "nCoV"[ti] OR "COVID"[ti] OR "SARS-CoV-2"[ti]) AN English[lang]

AND("2020/01/01 12.00"[EDAT] : "3000/12/31 15.00"[EDAT]). AND

("brain involvement"[ti] OR "neurological"[ti] OR "neurologic"[ti] OR "seizure"[ti] OR "seizures"[ti] OR "convulsion"[ti] OR "convulsions"[ti] OR "epilepsy"[ti] OR "status epilepticus"[ti] OR "leukoencephalopathy"[ti] OR "olfactory"[ti] OR "gustatory"[ti] OR "neuropathy"[ti] OR "paresthesia"[ti] OR "paraesthesia"[ti] OR "Miller Fisher"[ti] OR "smell"[ti] OR "taste"[ti] OR "nervous system"[ti] OR "stroke"[ti] OR "cerebrovascular"[ti] OR "myoclonus"[ti] OR Guillain*[ti] OR "encephalitis"[ti] OR "encephalopathy"[ti] OR "encephalitic"[ti] OR "encephalomyelitis"[ti] OR "rhomboencephalitis"[ti] OR "meningitis"[ti] OR "myelitis"[ti] OR "meningomyelitis"[ti] OR "meningoencephalitis"[ti] OR "anosmia"[ti] OR "hyposmia"[ti] OR "ageusia"[ti] OR "hypogeusia"[ti] OR "optic neuritis"[ti] OR "viral meningitis"[ti] OR "aseptic meningitis"[ti] OR "palsy"[ti] OR "cranial nerve"[ti] OR "dysphagia"[ti] OR "subarachnoid"[ti] OR "confusion"[ti] OR "confusional"[ti] OR "coma"[ti] OR "comatose"[ti] OR "unresponsive"[ti] OR "neuroinvasive"[ti] OR "neuroinvasion"[ti] OR "neurotropism"[ti] OR "neurotropic"[ti] OR "sensorineural hearing loss"[ti] OR "ataxia"[ti] OR "cerebellitis"[ti] OR "radiculitis"[ti] OR "neuritis"[ti] OR "polyneuritis"[ti] OR "polyneuropathy"[ti] OR "neuralgia"[ti] OR "weakness"[ti] OR "focal deficit"[ti])

OR

("inflammatory"[ti] OR "hyperinflammatory"[ti] OR "hyper-inflammation"[ti] OR "hyper-inflammatory"[ti] OR "macrophage activation syndrome"[ti] OR "cytokine storm syndrome"[ti] OR "cytokine release syndrome"[ti] OR "kawasaki"[ti] OR "hemophagocytic lymphohistiocytosis"[ti] OR "haemophagocytic lymphohistiocytosis"[ti] OR "shock"[ti] OR "hyponatremia"[ti] OR "inflammation"[ti] OR "hyperferritinaemia"[ti] OR "hyperferritinemia"[ti] OR "hyperferritinaemic"[ti] OR "hyperferritinemic"[ti] OR "multisystem inflammatory syndrome"[ti] OR "inflammatory multisystem syndrome"[ti] OR "viral sepsis"[ti])

OR

("chilblain"[ti] OR "chilblains"[ti] OR "acral"[ti] OR "acro-ischemia"[ti] OR "urticaria"[ti] OR "urticarial"[ti] OR "rash"[ti] OR "rashes"[ti] OR "skin lesion"[ti] OR "skin lesions"[ti] OR "skin finding"[ti] OR "skin findings"[ti] OR "alopecia"[ti] OR "purpura"[ti] OR "purpuric"[ti] OR "vasculitis"[ti] OR "vasculitic"[ti] OR "angioedema"[ti] OR "Sweet's syndrome"[ti] OR "cutaneous"[ti] OR "Stevens-Johnson"[ti] OR "erythema multiforme"[ti] OR "pernio"[ti] OR "maculopapular"[ti] OR "varicella-like"[ti] OR "chickenpox-like"[ti] OR "papulovesicular"[ti] OR "exanthem"[ti] OR "exanthems"[ti] OR "exanthema"[ti] OR "exanthematous"[ti] OR "morbilliform"[ti] OR "erythema nodosum"[ti] OR "vesicular"[ti] OR "bullous"[ti] OR "bullae"[ti] OR "vesiculobullous"[ti] OR "livedoid"[ti] OR "livedo"[ti] OR "necrotic"[ti] OR "papule"[ti] OR "papules"[ti] OR "macule"[ti] OR "macules"[ti] OR "macular"[ti] or "papular"[ti] OR "petechial"[ti] OR "petechiae"[ti] OR "gangrene"[ti] OR "erythroderma"[ti] OR "pustulosis"[ti] OR "pustular"[ti] OR "pustule"[ti] OR "pustules"[ti] OR "angioedema"[ti] OR "vesicle"[ti] or "vesicles"[ti])

OR

("myocarditis"[ti] OR "cardiomyopathy"[ti] OR "infarction"[ti] OR "infarct"[ti] OR "infarcts"[ti] OR "cardiac arrest"[ti] OR "microangiopathy"[ti] OR "micro-angiopathy"[ti] OR "microvascular inflammation"[ti] OR "vascular inflammation"[ti] OR "cardiogenic"[ti] OR "cardiogenic shock"[ti] OR "right ventricular failure"[ti] OR "cor pulmonale"[ti] OR "aneurysm"[ti] OR "aneurysmal"[ti] OR "mediastinum"[ti] OR "pneumomediastinum"[ti] OR "arrhythmia"[ti] OR "arrhythmias"[ti] OR "dysrhythmia"[ti] OR "dysrhythmias"[ti] OR "arrhythmic"[ti] OR "myopericarditis"[ti] OR "pericarditis"[ti] OR "pericardial effusion"[ti] OR "endotheliitis"[ti] OR "heart failure"[ti] OR "vasculature"[ti] OR "acute coronary syndrome"[ti] OR "acute coronary syndromes"[ti] OR "STEMI"[ti] OR "wide complex tachycardia"[ti] OR "vascular leak"[ti] OR "vascular leakage"[ti] OR "endothelial dysfunction"[ti] OR "microvascular dysfunction"[ti] OR "myocardial injury"[ti] OR "myocardial damage"[ti] OR "cardiac injury"[ti] OR "tachyarrhythmia"[ti] OR "tachyarrhythmias"[ti] OR "bradyarrhythmia"[ti] OR "bradyarrhythmias"[ti] OR "sudden cardiac death"[ti] OR "ischemia"[ti] OR "ischemic"[ti] OR "pericyte"[ti] OR "pericytes"[ti] OR "tachycardia"[ti] OR "bradycardia"[ti] OR "ventricular fibrillation"[ti] OR "atrial fibrillation"[ti] OR "atrial flutter"[ti] OR "cardiomegaly"[ti] OR "endomyocardial biopsy"[ti] OR "cardiac biopsy"[ti] OR "plaque rupture"[ti] OR "AV block"[ti] OR "bundle branch block"[ti] OR "asystole"[ti] OR "autoimmune hemolytic anemia"[ti] OR "disseminated intravascular coagulation"[ti] OR "lupus anticoagulant"[ti] OR "thromboembolic"[ti] OR "thromboembolism"[ti] OR "thrombosis"[ti] OR "thromboses"[ti] OR "thrombotic"[ti] OR "microthrombus"[ti] OR "microthrombi"[ti] OR "embolism"[ti] OR "emboli"[ti] OR "embolic"[ti] OR "hemostasis disorder"[ti] OR "hemostasis disorders"[ti] OR "hemorrhage"[ti] OR "haemorrhage"[ti] OR "hemorrhagic"[ti] OR "haemorrhagic"[ti] OR "coagulopathy"[ti] OR "hypercoagulability"[ti] OR "microhemorrhage"[ti] OR "microhaemorrhage"[ti] OR "microhemorrhages"[ti] OR "microhaemorrhages"[ti] OR "microhemorrhagic"[ti] OR "microhaemorrhagic"[ti] OR "DIC"[ti] OR "Takotsubo"[ti] OR "Tako-Tsubo"[ti] OR "cardiac tamponade"[ti] OR "thrombocytopenia"[ti] OR "idiopathic thrombocytopenic purpura"[ti] OR "ITP"[ti] OR "antiphospholipid syndrome"[ti] OR "antiphospholipids"[ti] OR "complement-mediated"[ti] OR "complement activation"[ti])

OR

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OR
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AND ("Meta-Analysis"[Publication Type] OR "Systematic Review"[Publication Type])

NOT

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NOT

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OR 32575786 OR 32282949 OR 32718343 OR 32958372 OR 32936400 OR 32926671 OR 32953201 OR 33009893 OR 32661757 OR 32992199 OR 33123082 OR 33103610 OR 32606519 OR 32527073 OR 32634813 OR 32618498 OR 32527987 OR 32761396 OR 32835295 OR 32825182 OR 32998398 OR 32992196 OR 32934172 OR 33101164 OR 33053948 OR 32920964 OR 32178975 OR 32929506 OR 32285448 OR 32984764 OR 32882719 OR 32823173 OR 32853978 OR 32850990 OR 33074717 OR 33043231 OR 32640479 OR 32501145 OR 32805702 OR 32773098 OR 32829885 OR 32939266 OR 33137615 OR 33091905 OR 33006163 OR 32994052 OR 33156016 OR 33099284 OR 32396903 OR 32392613 OR 32723343 OR 32654082 OR 32485418 OR 32339221 OR 32685883 OR 32866574 OR 32857878 OR 33074732 OR 33067157 OR 33044129 OR 32947478 OR 33001051 OR 33136681 OR 33036855 OR 32462305 OR 32340507 OR 32389782 OR 32410212 OR 32615555 OR 32546191 OR 32533197 OR 32552872 OR 32677972 OR 32655013 OR 32643418 OR 32739424 OR 32888033 OR 32775814 OR 33023941 OR 33046323 OR 32667578 OR 32742978 OR 32777758 OR 33022712 OR 32965368 OR 33013062 OR 33150674 OR 33124548 OR 33060844 OR 32405603 OR 32749643 OR 32243269 OR 32274341 OR 32476796 OR 32386449 OR 32474033 OR 32418852 OR 32445489 OR 32623633 OR 32579984 OR 32532945 OR 32530989 OR 32638436 OR 32639420 OR 32864250 OR 32796355 OR 32882393 OR 33031191 OR 33148326 OR 33094594 OR 32170806 OR 32145190 OR 32450787 OR 32487506 OR 32403255 OR 32489654 OR 32649840 OR 32793619 OR 32807512 OR 32879813 OR 32879591 OR 32875680 OR 32367837 OR 32621206 OR 33139693 OR 33122448 OR 33083389 OR 32849908 OR 33070904 OR 32823540 OR 32725545 OR 32852580 OR 33006087 OR 33177481 OR 32562846 OR 32425996 OR 32623083 OR 32849908 OR 33006087 OR 32242947 OR 32283155 OR 32420674 OR 32371463 OR 32574165 OR 32566603 OR 32596248 OR 32108351 OR 32765952 OR 33070547 OR 32425338 OR 32450197 OR 32620220 OR 32633327 OR 32651579 OR 32687917 OR 32648973 OR 32720223 OR 32696264 OR 32851877 OR 32903492 OR 33001783 OR 32940201 OR 33090515 OR 32554345 OR 33029489 OR 32792262 OR 32632198 OR 32847748 OR 32856065 OR 32837224 OR 33029451 OR 32943533 OR 33060565 OR 32558955 OR 32583808 OR 32839729 OR 32320004 OR 32492251 OR 32424745 OR 32440661 OR 32473151 OR 32531620 OR 32557789 OR 32577325 OR 32574286 OR 32679582 OR 32994372 OR 32980319 OR 32575114 OR 32544146 OR 33090987 OR 32920092 OR 32582743 OR 33075298 OR 32635752 OR 32588191 OR 32579952 OR 32876096 OR 32965372 OR 32924089 OR 32921711 OR 32818434 OR 32735721 OR 32768466 OR 32803422 OR 32884871 OR 32946801 OR 32925547 OR 32924059 OR 32921728 OR 33043252 OR 33181794 OR 33152254 OR 33106783 OR 33057783 OR 32561873 OR 32423471 OR 32675661 OR 33140308 OR 32530326 OR 32725610 OR 32672843 OR 32558956 OR 33112450 OR 32518172 OR 32678460 OR 32696312 OR 32757404 OR 32840686 OR 32876777 OR 32855289 OR 32995555 OR 32529575 OR 32574250 OR 32665054 OR 32676052 OR 33134959 OR 33074036 OR 33089477 OR 32240762 OR 32299017 OR 32312873 OR 32361745 OR 32399719 OR 32401352 OR 32409215 OR 32412088 OR 32416028 OR 32422545 OR 32447746 OR 32455089 OR 32458197 OR 32464367 OR 32469387 OR 32490966 OR 32503088 OR 32506549 OR 32528783 OR 32530389 OR 32561990 OR 32562214 OR 32565914 OR 32574246 OR 32574248 OR 32601577 OR 32622375 OR 32652139 OR 32655489 OR 32660520 OR 32682454 OR 32691236 OR 32740766 OR 32853453 OR 32778985 OR 32828027 OR 32876900 OR 32761914 OR 32820884 OR 32847818 OR 32737861 OR 32758257 OR 32563494 OR 32839585 OR 32865638 OR 33027418 OR 32998763 OR 32981023 OR 32937949 OR 32910826 OR 31861926 OR 33175635 OR 33128130 OR 33125542 OR 33106811 OR 33089707 OR 33083695 OR 33081863 OR 33052822 OR 33052573 OR 33041989 OR 33035589 OR 32819907 OR 32822060 OR 32927628 OR 32656033 OR 32298803 OR 32944929 OR 33071468 OR 32369429 OR 32387496 OR 32626853 OR 32741085 OR 32753137 OR 32842563 OR 32975884 OR 32964177 OR 33048282 OR 32548209 OR 32580925 OR 32587887 OR 32587902 OR 32748211 OR 32750752 OR 32762282 OR 32854871 OR 32765712 OR 32776905 OR 32928323 OR 32918429 OR 32915650 OR 33100334 OR 32386285 OR 32447496 OR 32470238 OR 32539346 OR 32556089 OR 32556781 OR 32563019 OR 32563232 OR 32584324 OR 32600982 OR 32366160 OR 33013637 OR 32909060 OR 33120898 OR 33072867 OR 32418055 OR 32505878 OR 32974019 OR 32973655 OR 32973590 OR 32328758 OR 33151999 OR 33110745 OR 32310553 OR 32503820 OR 32543262 OR 33027461 OR 32963819 OR 33009081 OR 32985317 OR 33154692 OR 32599304 OR 32733490 OR 32753148 OR 33007683 OR 32969772 OR 33164601 OR 32396949 OR 32706925 OR 32898910 OR 32292902 OR 32429786 OR 32713730 OR 32746801 OR 32873575 OR 32887660 OR 32795828 OR 32838230 OR 33148440 OR 33093582 OR 32311350 OR

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Annex 3

Cardiovascular System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Cardiac Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Akhmerov A	USA	COVID-19 and the heart
	May2020	2. Atri D	USA	COVID-19 for the cardiologist: current review
	May2020	3. Gupta AK	Multiple	Current perspectives on COVID-19 and CV disease; A white paper by JAHA editors
	May2020	4. Matsushita K	France	Impact of COVID-19 on the Cardiovascular System: a review
	May2020	5. Larson AS	USA	COVID-19 and Cerbro-Cardiovascular Systems: What do we know so far?
	May2020	6. Long B	USA	Cardiovascular complications of COVID-19
	May2020	7. Madjiid M	USA	Potential Effects of Coronaviruses on the cardiovascular system: Review
	May2020	8. Clerkin KJ	USA	COVID-19 and cardiovascular disease
	May2020	9. Bansal M	India	Cardiovascular disease and COVID-19
	May2020	10. Basu-Ray I	USA	Cardiac manifestations of COVID-19
	May2020	11. Kochi AN	Italy/Switz	Cardiac & arrhythmic complications in COVID-19
	May2020	12. Tan W	USA	The cardiovascular burden of COVID-19 (focus on congenital heart disease)
	May2020	13. Fried JA	USA	The variety of cardiovascular presentations of COVID-19
	May2020	14. Zhao M	China	Advances in relationship between coronavirus infection & cardiovascular diseases
	Aug2020	15. Anupama BK	USA	Review of acute myocardial injury in COVID-19
	Aug2020	16. Bandyopadhyay D	USA	COVID 19 pandemic: cardiovascular complications and future implications
	Aug2020	17. Bavishi C	USA	Acute myocardial injury in patients hospitalized with COVID-19 infection
	Aug2020	18. Hatami F	Iran	Emerging mechanisms for the new coronavirus-related myocardial injury & ischemia.
	Aug2020	19. Imazio M	Italy	COVID-19 & troponin: indirect myocardial injury, inflammation or myocarditis?
	Aug2020	20. Kariyanna PT	USA	A systematic review of COVID-19 and myocarditis.
	Aug2020	21. Kim IC	Korea	Updates of cardiovascular manifestations in COVID-19: Korean experience
	Aug2020	22. Li L	China	Changes of lab cardiac markers and mechanisms of cardiac injury in COVID-19
	Aug2020	23. Ma L	China	COVID-19 and cardiovascular complications.
	Aug2020	24. Mitrani RD	USA	COVID-19 cardiac injury: implications for long-term surveillance and outcomes

	Aug2020	25. Ranard LS	USA	Approach to acute cardiovascular complications in COVID-19 infection.
	Aug2020	26. Shafi AMA	UK	Cardiac manifestations in COVID-19 patients – a systematic review.
	Aug2020	27. Singh R	USA	A review of cardiac complications in COVID-19.
	Aug2020	28. Sisti N	Italy	COVID-19 in patients with heart failure: the new and the old epidemic.
	Aug2020	29. Tahir F	USA	Cardiac manifestations of COVID-19.
	Aug2020	30. Tomasoni D	Italy/USA	COVID-19 & heart failure: infection to inflammation and angiotensin II stimulation.
	Dec2020	31. Babapoor-Farrok S	USA	Arrhythmia in COVID-19.
	Dec2020	32. Cinar T	Turkey	COVID-19 and acute myocarditis: current literature review and diagnostic challenges.
	Dec2020	33. Cruz Rodriguez JB	USA	Gamut of cardiac manifestations and comlications of COVID-19.
	Dec2020	34. Dherange P	USA	Arrhythmias and COVID-19.
	Dec2020	35. Dou Q	Chin2	Cardiovascular manifestations and Mechanisms in Patients with COVID-19.
	Dec2020	36. Hu TY	USA	Cardiovascular considerations in COVID-19 with a special focus on arrhythmia.
	Dec2020	37. Karamchandani K	USA	Cardiac arrhythmias in critically ill patients with COVID-19: brief review.
	Dec2020	38. Manolis AS	Greece	COVID-19 infection and cardiac arrhythmias.
	Dec2020	39. Nandy S	USA	Cardiovascular manifestations of COVID-19.
	Dec2020	40. Ozieranski K	Poland/Italy	Clinically suspected myocarditis in the course of SARS-CoV-2 infection: fact or fiction?
	Dec2020	41. Shchedrygina A	Ger/Rus/Spain	COVID-19 myocarditits and prospective heart failure burden.
	Dec2020	42. Singh S	Neth/US/India	Takotsubo syndrome in patients with COVID-19: systematic review.
	Dec2020	43. Tavazzi G	Italy	Contextualizing cardiac dysfunction in critically ill patients with COVID-19.
	Dec2020	44. Wang Y	China	Cardiac arrhythmias in patients with COVID-19.
	Aug 2021	45. Mahenthiran AK	USA	Cardiovascular system and COVID-19: manifestations and therapeutics.
	Aug2021	46. Omidi F	Iran	COVID-19 and cardiomyopathy: systematic review.
	Aug2021	47. Roshdy A	UK	COVID-19 and the heart: a systematic review of cardiac autopsies.
	Aug2021	48. Yi Y	China	Cardiovascular disease and COVID-19: Insight from cases with heart failure
	Aug2021	49. Paterson I	Canada	Long COVID-19: a primer for cardiovascular health professionals
	Aug2021	50. Kawakami R	Italy/USA	Pathologic evidence for SARS-CoV-2 as a cause of myocarditis
	Aug2021	51. Chilazi M	USA	COVID and cardiovascular disease: what do we know in 2021
	Aug2021	52. Crea F	Italy	Central role of amygdala in stress-related cardiac diseases & update on long COVID
2. Meta-Analyses	May2020	1. Li JW	China/UK/Aus	Impact of COVID-19 on heart injury: systematic review and meta-analysis
	May2020	2. Lippi G	Italy/Spain/US	Cardiac troponin I in patients with COVID-19: Meta-analysis
	May2020	3. Krittanawong C	USA/China	COVID-19 & cardiovascular risk: meta-analysis
	Aug2020	4. De Lorenzo A	BrazilQ2	Acute cardiac injury in patients with COVID-19.

	Aug2020	5. Kunutsor SK	UK/Finland	Cardiovascular complications in COVID-19.
	Aug2020	6. Li X	China	Cardiac injury associated with severe disease, ICU admission or death.
	Aug2020	7. Zuin M	Italy	Incidence and mortality risk in COVID-19 patients complicated by acute cardiac injury.
	Dec2020	8. Gu ZC	China	Incidence of myocardial injury in COVID-19: pooled analysis (7,679 pts/53 studies).
	Dec2020	9. Ho JS	UK/Singapore	Coronavirus-induced myocarditis.
	Dec2020	10. Pranata R	Indonesia	Incidence and impact of cardiac arrhythmias in COVID-19.
	Dec2020	11. Prasitlumkum N	USA	Incidence of myocardial injury in COVID-19 infected patients.
	Dec2020	12. Zeng L	China	Clinical characteristics of COVID-19 with cardiac injury.
	Dec2020	13. Zou F	China	Cardiac injury and COVID-19.
	Aug2021	14. Bansal A	USA	Outcomes in patients with and without cardiac injury and COVID-19.
	Aug2021	15. Fu L	China	Prevalence and impact of cardiac injury on COVID-19.
	Aug2021	16. Garcia-Zamora S	Multicountry	Arrhythmias and ECG findings in COVID-19.
	Aug2021	17. Huang Z	China	Prevalence and clinical outcomes of cardiac injury in patients with COVID-19.
	Aug2021	18. Liao SC	Taiwan	Incidence rate and clinical impacts of arrhythmia following COVID-19.
	Aug2021	19. Martha JW	Indonesia	Tricuspid annular plane systolic excursions measured by echo & mortality in COVID.
	Aug2021	20. Parohan M	Iran	Cardiac injury is associated with severe outcome and death in COVID-19 infection.
	Aug2021	21. Santoso A	Indonesia	Cardiac injury is associated with mortality and critically ill pneumonia in COVID-19.
	Aug2021	22. Tondas AE	Indonesia	Arrhythmia risk profile and ventricular repolarization indices in COVID-19 patients.
	Aug2021	23. Wen W	China	Arrhythmia in patients with severe COVID-19.
	Aug2021	24. Wungu CDK	Indonesia	Cardiac markers for predictive factors on severity and mortality in COVID-19.
	Aug2021	25. Yang H	China	Atrial fibrillation in patients with COVID-19.
	Aug2021	26. Zhao YH	China	Cardiovascular complications of COVID-19.
3. Pathogenesis / hypothesis*	May2020	1. Cheng P	USA	Cardiovascular risks in COVID-19: Potential mechanisms and areas of uncertainty
	May2020	2. Lazzerini PE	Italy/USA	Arrhythmic risk and inflammation
	May2020	3. Wu	Europe(7)	COVID-19 and inherited arrhythmia syndromes
	May2020	4. Nan J	USA	Hypoxia in acute cardiac injury of COVID-19. Lessons from pathological studies
	May2020	5. South AM	USA	COVID-19, ACE2 and cardiovascular consequences
	May2020	6. Giudicessi JR	Germany	Genetic susceptibility for COVID-19 associated sudden cardiac death in Afro-Americ.
	May2020	7. Thum T	USA	ACE2 expression in human heart: cause of post-pandemic wave of heart failure?
	May2020	8. Cremer PC	Sweden +multi	SARS-CoV-2 and myocardial injury: Few answers, many questions.
	May2020	9. He L	China	
	Aug2020	17 new publications	Multiple	

	Dec2020	13 new publications	Multiple	Pericyte vascular expression SARS-CoV-2 receptor ACE2 & microvascular inflammationFor Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (Subgroup 2=pathogenesis)
4. Guidelines or Registry*	May2020 May2020 May2020 Aug2020 Dec2020	1. NICE 2. Siripanthong B 3. Boukhris M 3 guidelines/1registry 1 new guideline	UK UK/USA Global Multiple Multiple	COVID-19 rapid guideline: acute myocardial injury Recognizing COVID-19 related myocarditis: possible pathophysiology, Dx/Rx guideline Cardiovascular implications of the COVID-19 pandemic For Aug20/Dec20 updates see cardiac tab in excel file 'COVID Review Citations Jan2020 to Aug2021' (Subgroup 2=guideline)
5. Studies*	May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Zhou B 2. Deng Q 3. Chen L 4. Guo T 5. Han H 6. Stefanini GG 7. Ma L 8. Shi S 32 new publications 21 new publications	China China China China-Wuhan China-Wuhan Italy China China Multiple Multiple	Clinical characteristic of myocardial injury in severe & very severe COVID-19 patients Suspected myocardial injury in patients with COVID-19 The ACE2 expression in human heart indicates new potential mechanism of injury Cardiovascular implications of fatal COVID-19 outcomes Analysis of heart injury lab parameters in 273 COVID-19 patients STEMI in patietns with COVID-19: clinical and angiographic outcomes COVID-19 myocarditis and severity factors: an adult cohort study Characteristics_& clinical significance of myocardial injury in severe COVID-19 disease For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (Subgroup 2=study)
[5] Case Reports/Series*				
Arrhythmias	May2020 May2020 Aug2020 Dec2020	1. Kir D 2. Seecheran R 6 more case reports 16 more case reports	USA Trinidad-Toba Multiple Multiple	AV block in COVID-19 Atrial arrhythmias in a patient presenting with COVID-19 For Aug20/Dec20 updates see cardiac tab-COVID spreadsheet (subgroup1=arrhythmia; subgroup2=case reports)
Cardiac injury / Endotheliitis	May2020 Aug2020 Dec2020	1. Varga Z 4 more case reports 4 more case reports	Switz Multiple Multiple	Endothelial cell infection and endotheliitis in COVID-19 For Aug20/Dec20 updates see cardiac in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup1=injury or endothelial dysfunction; subgroup2=case reports)

Myocarditis	May2020	1. Farina A	Italy	SARS-CoV-2 detection in pericardial fluid of patient with cardiac tamponade
	May2020	2. Chen C	China	SARS-CoV-2: A potential etiology of fulminant myocarditis
	May2020	3. Cizgici H	Turkey	COVID-19 myopericarditis
	May2020	4. Doyen D	France	Myocarditis in a patient with COVID-19
	May2020	5. Inciardi RM	Italy	Cardiac involvement in a patient with COVID-19
	May2020	6. Hu	China	Fulminant myocarditis saved with glucocorticoid and human Ig
	May2020	7. Sala S	Italy	Acute myocarditis presenting as a reverse Tako-Tsubo syndrome in SARS-CoV2
	May2020	8. Zeng JH	China	First case of COVID-19 compicated with fulminant myocarditis
	May2020	9. Hua A	China	Life threatening cardiac tamponade complicating myo-pericarditis in COVID-19
	May2020	10. Luetkens JA	Germany	Diffuse myocardial inflammation in COVID19 detectted by Cardiac MRI
	May2020	11. Craver R	USA	Fatal eosinophilic myocarditis in a healthy 17yr old male
	Aug2020	31 more case reports	Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup1=myocarditis; subgroup2=case reports)
	Dec2020	35 more case reports	Multiple	
Heart Failure and Cardiogenic Shock	May2020	1. Tavazzi G	Italy	Myocardial localization of Coronavirus in COVID-19 cardiogenic shock
	May2020	2. Creel-Bulos C	USA	Cor Pulmonale in Critically Ill Patients
	Aug2020	5 more case reports	Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup1=Heart failure; subgroup2=case reports)
	Dec2020	2 more case reports	Multiple	
Stress cardio-myopathy (Takotsubo Síndrome)	May2020	1. Minhas AS	USA	Takostubo syndrome in setting of COVID-19
	May2020	2. Jussela A	USA	COVID-19 related cardiomyopathy in pregnancy
	May2020	3. Roca E	Italy	Takotsubo syndrome associated with COVID-19
	May2020	4. Nguyen D	Belgium	A case of Takotsubo cardiomyopathy with COVID-19
	Aug2020	6 more case reports	Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup1=Takotsubo; subgroup2=case reports)
	Dec2020	12 more case reports	Multiple	
Acute Coronary Syndrome (ACS)	May2020	1. Fernandez Gasso	Spain	Multivessel spontaneous coronary artery dissection in COVID19
	May2020	2. Dominguez Erquic	Spain	Multivessel coronary thrombosis in patient with COVID-19 pneumonia
	May2020	3. Kumar K	USA	Spontaneous coronary arter dissection in 48 yr old – presenting complaint of COVID
	May2020	4. Salido-tahoces L	Spain	Unusual presentation of ACS (plaque destabilization) in SARS-CoV2 infection
	Aug2020	3 more case reports	Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup 1 = ACS; subgroup 2 = case reports)
	Dec2020	1 more case reports	Multiple	
STEMI	May2020	1. Bangalore S	USA	ST-Segment elevation in patients with COVID19 – case series.
	Aug2020	13 more case reports	Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup 1 = STEMI; subgroup 2 = case reports)
	Dec2020	3 more case reports	Multiple	

MI / sudden death	Aug2020 Dec2020	4 more case reports 2 more case reports	Multiple Multiple	For Aug20/Dec20 updates see cardiac tab in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' (subgroup1=MI or sudden death; subgroup2=case reports)
Other	May2020 Aug2020 Aug2020 Aug2020 Aug2020 Dec2020 Dec2020 Dec2020	1. Tape 2. Birlutiu V 3. Powezka K 4. Shih M 5. Roncati L 6. Oda R 7. Kishore R 8. Balata D	USA Romania UK USA Italy Japan India Sweden	Syncope as a presenting feature of COVID-19 SARS-CoV-2 infection associated with micturition syncope Ruptured popliteal artery aneurysm complicted with ARDS Ruptured Abdominal aortic aneurysm in a patient with COVID-19 Type 3 hypersensitivity in COVID-19 vasculitis Case of adult large vessel vasculitis after SARS-CoV-2 infection Dilated cardiomyopathy in a child with COVID-19 Non-bacterial thrombotic endocarditis: a presentation of COVID19

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 4

Dermatologic System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Dermatologic Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Wollina U	Germany	Cutaneous signs in COVID-19 patients
	May2020	2. Sachdeva M	Italy	Cutaneous manifestations of COVID-19: report of 3 cases and review of literature
	May2020	3. Tang K	China	Cutaneous manifestations of COVID-19: a brief review
	May2020	4. Almutairi N	USA	COVID-19 with Dermatologic Manifestations & implications: an unfolding Conundrum
	May2020	5. Young S	USA	Skin manifestations of COVID-19
	Aug2020	6. Elmas AF	Turkey	Cutaneous manifestations of COVID19
	Aug2020	7. Jia JL	USA	Cutaneous manifestations of COVID19-preliminary review
	Aug2020	8. Marzano AV	Italy	Cutaneous manifestations in patients with COVID19 – preliminary review
	Aug2020	9. Gisondi P	Italy	Cutaneous manifestations of SARS-CoV-2: clinical update
	Aug2020	10. Kaya G	Switz	Clinical & Histopathological Features_Potential Pathologic mechanisms
	Aug2020	11. Matar S	France	Cutaneous manifestations in COVID19: French experience and syst review
	Aug2020	12. Potekaev NN	Russia	Clinical characteristics of dermatologic manifestations; Case series & review
	Aug2020	13. Zhao Q	China	COVID19 and cutaneous manifestations: systematic review
	Aug2020	14. Criado PR	Brazil	Lessons from dermatology about inflammatory responses in COVID19
	Aug2020	15. SeirafianpourF	Iran	Cutaneous manifestations and considerations in COVID19: Syst review
	Aug2020	16. Rahimi MA	Iran	Comprehensive review of Cutaneous manifestations
	Aug2020	17. Ladha MA	Canada	Approach to Chilblains during COVID19 pandemic
	Aug2020	18. Massey PR	USA	Going viral: a brief history of chilblain-like lesions ("COVID toes"
	Aug2020	19. Gottlieb M	USA	Dermatologic manifestations and complications of COVID19
	Dec2020	20. Balestri R	Italy	Do we have serologic evidences that chilblain-like lesions are related to SARS-CoV2
	Dec2020	21. Almutairi A	SaudArab	Dermatologic manifestations: systematic review
	Dec2020	22. DaneshgaranG	USA	Cutaneous manifestations of COVID19: evidence-based review
	Dec2020	23. Li H	China	Cutaneous, skin histopathologic manifestations and relationship to COVID19
	Dec2020	24. MarrahaF	Morocco	Review of Dermatological manifestations of COVID19
	Dec2020	25. Nieto-BenitoLM	Spain	Histopathologic findings in COVID19 induced cutaneous lesions: clinicopathology

	Dec2020	26. AlgaadiSA	SaudiArab	Urticaria and COVID19: review
	Dec2020	27. AndinaD	Global	Skin manifestations of COVID19 in children: Part 1 (focus on chilblain like lesions)
	Dec2020	28. Andina D	Global	Skin manifestations of COVID19 in children: Part 2
	Dec2020	29. Garduno-SotoM	Mexico	Dermatologic aspects of SARS-CoV-2: mechanisms and manifestations
	Dec2020	30. MirzaFN	USA	Dermatologic manifestations of COVID019: comprehensive syst review
	Dec2020	31. MawhirtSL	USA	Cutaneous manifestations in adult pts with COVID19
	Dec2020	32. SinghH	USA	Cutaneous manifestations of COVID19: systematic review
	Aug2021	33. Lee DS	USA	Cutaneous manifestations of COVID-19
	Aug2021	34. Perna A	Italy	Skin manifestations in COVID-19 patients
	Aug2021	35. Jamshidi P	Iran/USA	Skin manifestations in COVID-19 patients: are they indicators for disease severity
	Aug2021	36. Shams S	Ind/Pak/Peru	Maculopapular skin eruptions associated with COVID-19
2. Meta-Analyses	Dec2020	1. Bandhala R	India	Trend of cutaneous lesions during COVID19 pandemic: meta-anal & syst review
	Aug2021	2. Sameni F	Iran	COVID-19 and Skin Manifestations
3. Patho-genesis / hypothesis	Aug2020	1. Criado PR	Brazil	Are cutaneous manifestations during or due to COVID-19 frequent or not?
	Dec2020	2. Criado PR	Brazil	Potential interactions of SARSCoV2 with human cell receptors in the skin
	Dec2020	3. Allegra A	Italy	Urticaria and coronavirus infection: a lesson from the pandemic
	Dec2020	4. Magro C	USA	SARSCoV2 proteins within cutaneous/subcutaneous microvasculature
4. Guidelines	Aug2020	1. Ortega-QuijanoD	Spain	Algorithm for the classification of COVID19 rashes
5. Studies	May2020	1. Galvan Casas C	Spain	Classification of the cutaneous manifestations of COVID-19
	May2020	2. Recalcati S	Italy	Cutaneous manifestations in COVID-19: a first perspective
	May2020	3. Bouaziz	France	Vascular skin symptoms in COVID-19: French observational study
	May2020	4. Young S	USA	Skin manifestations of COVID19
	Aug2020	5. Docampo-Simon	Spain	Are chilblain-like acral skin lesions really indicative of COVID19
	Aug2020	6. ElHachem M	Italy	Clinical, histopath and lab study of 19 Italian children with chilblain-like lesions
	Aug2020	7. Reymundo A	Spain	Clinical and histologic characterization of late macpap eruptions in COVID19
	Aug2020	8. Freeman EE	USA	Pernio-like skin lesions in COVID19: 318pts from 8 countries
	Aug2020	9. Hughes M	UK	Furter evidence that chilblains are a cutaneous manifestation of COVID19
	Aug2020	10. Kanitakis J	France	Chilblain-like acral lesions: histology, immunofluorescence, immunohistochemistry
	Aug2020	11. Mahieu R	France	No antibody respons in acral cutaneous manifestations associated with COVID19
	Aug2020	12. Piccolo V	Italy	Acral findings during COVID19
	Aug2020	13. SaenzAguirre A	Spain	Novel outbreak of acral lesions in times of COVID19: 74 cases – Spain

	Aug2020	14. Battesti G	France	New insights in COVID19 associated chilblains: comparison with chilblain LE
	Aug2020	15. Colmenero I	Spain	SARS-CV2 endothelial infection causes chilblains: histopah/IHC/ultrastructure-7child.
	Aug2020	16. ColonnaC	Italy	Outbreak of chilblain like acral lesions in Milan
	Aug2020	17. Fernandez-Nieto	Spain	Characterization of acute acral skin lesions in non-hsp pts – case series 132 pts
	Aug2020	18. Hubiche T	France	Negative SARS-CoV2 PCR in patients with chilblain-like lesions
	Aug2020	19. LeCleach L	France	Most chilblains observed during COVid19 outbreak occur in PCR/serology neg
	Aug2020	20. Lesort C	France	COVID19 and outbreak of chilblains: related?
	Aug2020	21. Navarro L	Spain	Dermoscopy features of COVID19 related chilblains in children and adolescents
	Aug2020	22. Rizzoli L	Italy	Chilblain-like lesions during COVID-19 pandemic: a serological study on a case series.
	Aug2020	23. Rouanet J	France	Outbreak of chilblain-like lesions not directly related with SARS-CoV-2 infection.
	Aug2020	24. Hebert V	France	Lack of association: chilblains&SARS-CoV-2: histological and serological findings
	Aug2020	25. Bitar C	USA	Cutaneous manifestations of hospitalized COVID19: biopsy & in situ hybridization
	Dec2020	26. Magro C	USA	Diff pathophysiologies in COVID-19 perniosis & thrombotic retiform purpura
	Dec2020	27. Denina M	Italy	All that glisters is not COVID: low SARS-CoV-2 seroconversion in ped Chilblain-like
	Dec2020	28. Ko CJ	USA	Anti-SARS-CoV-2 S protein&RNA staining in perniotic lesions
	Dec2020	29. Stavert R	USA	SARS-CoV-2 antibodies in 24 patients with chilblains-like lesions
	Dec2020	30. Occidental M	USA	Dermatologic Spectrum in COVID-19 Severely Ill Patients - A Series of Four Cases
	Dec2020	31. Baeck M	Belgium	Chilblains and COVID-19: further evidence against a causal association
	Dec2020	32. Roses-Gilbert P	Spain	Acral lesions in pediatric population: case series (36) from a single hospital in Spain
	Dec2020	33. Piccolo V	Italy	Dermoscopy of chilblain-like lesions: A multicenter study on 10 patients
	Dec2020	34. Docampo-Simon	Spain	No SARS-CoV-2 antibody response in 25 patients with pseudo-chilblains
	Dec2020	35. Feito-Rodriquez	Spain	Chilblain-like lesions & covid-19: a prospective observational Spanish study
	Dec2020	36. Fabbrocini	Italy	New dermoscopic pattern for Chilblain-COVID-like skin lesion in the adolescent
	Dec2020	37. Diociaiuti	Italy	Meaning of SARS-CoV-2 IgA Abs in ped pts with chilblain-like lesions
	Dec2020	38. Kluger N	Finland	Why are chilblains underreported in Nordic countries
	Dec2020	39. Fertitta L	France	Immunological & virological profile of children with chilblain-like lesions
	Dec2020	40. Gomez-Fernandez	Spain	High prevalence of cryofibrinogenemia in patients with chilblains
	Dec2020	41. Sohier P	France	Histopathological features of Chilblain-like lesions
	Dec2020	42. Caselli D	Italy	No evidence of SARS-CoV-2 by PCR/serology in children with pseudo-chilblain
	Dec2020	43. DeGiorgi V	China/Italy	Cutaneous manifestations in COVID-19: A prospective study from China and Italy
	Dec2020	44. Guarneri C	Italy	Diversity of clinical appearance of cutaneous manifestations in COVID-19
	Dec2020	45. Rubio0Muniz CA	Spain	Dermatological manifestations in COVID-19. Clinical & histopathology – 34 cases

	Dec2020	46. Ruggiero G	Italy	Reply to: "acute acro-ischemic lesions in non-hsp pts (132 case series)
	Dec2020	47. Freeman EE	USA	Spectrum of COVID-19 dermatologic manifestations: Intl registry(716pts/31countries)
	Dec2020	48. Askin O	Turkey	Cutaneous manifestations in hospitalized patients diagnosed as COVID-19.
	Dec2020	49. Gionotti R	Italy	Similar Cutaneous Histopatholgotic Patterns: COVID-19-pos&COVID-19 High-risk Pts
	Dec2020	50. Perez-Suarez B	Spain	Skin findings in the COVID-19 pandemic in the Region of Murcia
	Dec2020	51. Rerknimitr P	Thailand	Skin manifestations in COVID-19: The tropics experience
	Dec2020	52. Avancini J	Brazil	Absence of specific cutaneous manifestations of SARS-Cov-2 in a Brazil ref center
	Dec2020	53. MendezMaestro I	Spain	Skin manifestations in COVID-19: a cross-sectional study in a tertiary hospital
	Dec2020	54. Nuno-Gonzalez A	Spain	Mucocutaneous_oral_palmoplantar findings in 666 Spanish pts with COVID-19
	Dec2020	55. Punyaratabandhu	Thailand	Cutaneous eruption in COVID-19-infected patients in Thailand
	Dec2020	56. Miot HA	Brazil	Self-reported skin manifestations in 1,429 Brazilian COVID-19 patients
	Dec2020	57. Strom MA	USA	Cutaneous findings in critically-ill patients with COVID-19: case series(15)
	Dec2020	58. Giavedoni P	Spain	Skin Manifestations in COVID-19: Prevalence & Relationship with Disease Severity
	Dec2020	59. Freeman EE	USA	Timing of PCR/Ab Testing in Pts with COVID-19 associated skin manifestations
	Dec2020	60. Dursun R	Turkey	Clinics of HHV-6 infection in COVID-19 pandemic: Pityriasis rosea & Kawasaki disease
	Dec2020	61. Duong TA	France	Did Whatsapp(®) reveal a new cutaneous COVID-19 manifestation?
	Dec2020	62. Herrero-Moyano	Spain	A clinicopathologic study of 8 pts with COVID-19 pneumonia & late-onset exanthema
	Dec2020	63. Catalia A	Spain	Maculopapular eruptions associated to COVID-19: a subanalysis of COVID-Piel study
	Dec2020	64. Pangti R	India	COVID19 Recognizable vascular skin changes uncommon in pts with skin-of-color
6. Case Reports/Series				
Rash – general or multiple forms	May2020	1. Najarian DJ	USA	Morbilliform exanthema associated with COVID-19
	May2020	2. Gianotti R	Italy	Cutaneous clinicopathological findings in 3 COVID-19 positive patients
	Aug2020	3. Anunziata MC	Italy	Cutaneous involvement during COVID19 pandemic
	Aug2020	4. GoldustM	China	Fever with Rash in COVID19: viral exanthema or secondary lesions
	Aug2020	5. Ho WYB	Singapore	Two cases of cutaneous eruptions due to COVID19 in Singapore
	Aug2020	6. Amatore F	France	SARS-CoV2 infection presenting as a febrile rash
	Aug2020	7. Jimenez-Cauhe J	Spain	Enanthem in patients with COVID19 and skin rash
	Aug2020	8. Rossi E	Italy	Acute maculopapular eruption in a COVID19 patient
	Aug2020	9. Patel N	UK	Polymorphic cutaneous manifestations of COVID19 infection in a single host
	Aug2020	10. Mizutani Y	Japan	Late onset cutaneous manifestations in a patient with severe COVID19
	Aug2020	11. Avellana Moreno	Romania	Cutaneous manifestation of COVID 19 in images: a case report
	Dec2020	12. Tatu AL	Spain	Familial clustering of COVID19 skin manifestations

	Aug2020	13. Bursal Duramaz	Turkey	3 Case presentations of Pediatric COVID with rash
	Aug2020	14. Klimach A	UK	Rash as a presenting complaint in a child with COVID19
	Aug2020	15. Olisova OY	Russia	Cutaneous manifestations in COVID19: a skin rash in a child
	Aug2020	16. Estabanez A	Spain	Cutaneous manifestations in COVID19
	Dec2020	17. Aragao MT	Brazil	COVID19 presenting as an exanthematic disease: case report
	Dec2020	18. Oksum Solak E	Turkey	COVID19 accompanies by maculopapular rash
	Dec2020	19. Redondo-Sendino	Spain	Skin manifestations associated with COVID19
	Dec2020	20. Kulkarni RB	USA	Morbilliform rash: an uncommon herald of SARS CoV2
	Dec2020	21. Farabi B	Turkey	Isolated maculopapular eruption
	Dec2020	22. Serafini A	Italy	Itchy erythematous papular skin rash as a possible early sign of COVID19
Chillblain like lesions	May2020	1. Locatelli AG	Italy	Histologic features of long lasting chilblain-like lesions in a pediatric COVID-19 patient
	May2020	2. Andina D	Spain	Chillblains in children in the setting of COVID19 pandemic
	May2020	3. Lopez-Robles J	Spain	Chillblain-like lesions: case series of 41 patients during COVID19 pandemic
	May2020	4. Suarez-Valle A	Spain	Acro-ischemia in hospitalized COVID-19 patients
	May2020	5. Alramthan A	Middle East	COVID19 presenting with chilblain – like disease
	May2020	6. Garcia-Lara G	Spain	Chilblain-like lesions in pediatric dermatologic outpatients
	May2020	7. Piccolo V	Italy	Chilblain-like lesions during COVID19 epidemic: preliminary stud on 63 patients
	May2020	8. Landa N	Spain	Chilblain-like lesions on feet and hands during COVID-19 pandemic
	Aug2020	16 more case reports	Multiple	See literature spreadsheet, dermatologic tab
	Dec2020	13 more case reports	Multiple	See literature spreadsheet, dermatologic tab
Livedo +/or purpura	May2020	1. Conforti C	Italy	COVID-Mask: an atypical livedoid manifestation of COVID-19
	Aug2020	2. Bosch-Amate X	Spain	Retiform purpura as a dermatologic sign of COVID19 coagulopathy
	Aug2020	3. Novara E	Italy	Severe acute dried gangrene in COVID19 – Case Report
	Aug2020	4. Verheyden M	Belgium	Relapsing symmetric livedo reticularis in a patient with COVID19
	Aug2020	5. Kappel C	Canada	A case of possible Fournier's gangrene associated with proning in COVID19 ARDS
	Aug2020	6. Wollina U	Germany	Schamberg-like purpuric eruptions and tonsililitis in mild COVID19
	Aug2020	7. Llamas-Velasco	Madrid	Thrombotic occlusive vasculopathy in skin biopsy from a livedoid lesion
	Aug2020	8. Droesch C	USA	Livedoid and purpuric skin eruptions associated with coagulopathy
	Aug2020	9. Karaca Z	Turkey	A unilateral purpuric rash in a patient with COVID19 infection
	Aug2020	10. Larrondo J	Chile	Papular-purpuric exanthem in a COVID19 patient
	Dec2020	11. Trellu LT	Switz	Livedo reticularis as a presenting sign of SARS-CoV-2 infection
	Dec2020	12. Khalil S	USA	COVID fingers: another severe vascular manifestation

	Dec2020	13. Martino GP	Italy	Concomitant calciphylaxis and COVID19 associated thrombotic retiform purpura
	Dec2020	14. Rotman JA	USA	Digital gangrene as a sign of catastrophic COVID19 related microangiopathy
	Dec2020	15. Wang JS	USA	Large sacral/buttocks ulcerations in the setting of coagulopathy
	Dec2020	16. Young S	USA	Livedo reticularis and acrocyanosis as late manifestations of COVID19
	Dec2020	17. Garcia-Gil MF	Spain	Unilateral livedo reticularis in COVID19 patient – case with fatal outcome
	Dec2020	18. Tusheva I	Macedonia	COVID-19 wounds: unusual lower extremity bullae
	Dec2020	19. Zinder R	USA	Microthrombi on skin biopsy in COVID19 patient
	Dec2020	20. Shehi E	USA	Acrofacial purpura and necrotic ulcerations in COVID19
	Dec2020	21. Karagounis TK	USA	Mixed purpuric and maculopapular lestions in COVID 19 – Case Report\
	Dec2020	22. Beaupre R	USA	Mixed purpuric and maculopapular lesions in a COVID 19 patient
	Dec2020	23. Heald M	USA	Skin manifestations of COVID19 resembling acute limb ischemia
Petechial rash	May2020	1. Diaz-Guimaraens	Spain	Petechial skin rash associated with SARS-CoV2
Vesiculo-bullous varicella-like	May2020	1. Marzano AV	Italy	Varicella like exanthema as a specific COVID19 associated skin manifestation: 22 cases
	May2020	2. Martin Carreras	Spain	Oral vesiculobullous lesions associated with SARS-CoV-2 infection
	May2020	3. Genovese G	Italy	Varicella-like exanthema associated with COVID-19 in an 8 year old girl
	May2020	4. Fernandez-Nieto	Spain	Clinical and histological characterization of vesicular COVID-19 rashes
	Aug2020	5. Mahe A	France	Histology of skin lesions establishes that COVID vesicular rash is not varicella like
	Aug2020	6. Aghazadeh	Iran	Oral vesicles and acral erythema
	Aug2020	7. Dadras MS	Iran	Probable atypical skin manifestation of COVID19 infection (necrotic 'spider bite' like)
	Aug2020	8. Goudarzi S	Iran	Cystic painful lesion in a case with positive SARS-CoV2
	Dec2020	9. Soares CD	Brazil	Oral vesiculobullous lesions as an early sign: detection of SARS-CoV-2 spike protein
	Dec2020	10. Boix-Vilanova J	Spain	Grover-like skin eruption: another cutaneous manifestation in COVID19
Pustulosis / erythema multiforme like	May2020	1. Robustelli Test	Italy	Acute generalized exanthematous pustulosis with erythema multiforme-like lesions
	May2020	2. Janah H	Morocco	Atypical erythema multiforme palmar plaques lesions due to SARS-CoV-2
	May2020	3. Jimenez-Cauhe J	Spain	Erythema multiforme-like eruption in patients with COVID-19: clinical/histological
	Aug2020	4. Torello A	Spain	Erythema multiforme-like lesions in children and COVID19
	Aug2020	5. Gargiulo L	Italy	Fatal case of COVID19 presenting with erythema multiforme like eruption & fever
	Aug2020	6. Labe P	France	Erythema multiforme and Kawasaki disease associated with COVID19 in children
	Dec2020	7. Ayatollahi A	Iran	Late onset AGEP like skin pustular eruption following COVID19
	Dec2020	8. SanchezVelazquez	Spain	Erythema multiforme in the context of COVID19
	Dec2020	9. Reguero-DelCura	Spain	Onset of Erythema multiforme like lesions with COVID symptom recurrence

	Dec2020	10. Hartmann M	Germany	COVID19 rash – erythema multiforme like
Urticaria / angioedema	May2020	1. Naziroglu T	Turkey	COVID-19 pneumonia presenting with acute urticarial
	May2020	2. Rodriguez-Jimen	Spain	Urticaria-like lesions in COVID19 are not really urticaria: case with clinicopath
	May2020	3. Gunawan C	Indonesia	Urticarial eruption in COVID-19: a case report
	Aug2020	4. Cepeda-Valdes R	Mexico	Family cluster of urticarial rash
	Aug2020	5. Diotallevi F	Italy	Skin involvement in SARS-CoV2 infections – case series
	Aug2020	6. Falkenhain-Lopez	Spain	SARS-CoV-2 and acute urticaria
	Aug2020	7. Najafzadeh M	UK	Urticaria (angioedema) and COVID19 infection
	Aug2020	8. Azmy V	USA	Idiopathic nonhistaminergic acquired angioedema in a patient with COVID19
	Aug2020	9. Henry D	France	Urticarial eruption in COVID19 infection
	Aug2020	10. Hassan K	UK	Urticaria and angioedema as a prodromal cutaneous manifestation of COVID19
	Aug2020	11. Sousa Gonzales C	Portugal	Erythematous papular rash: dermatologic feature of COVID19
	Aug2020	12. Lockey RF	USA	COVID19 associated urticaria with angioedema in a morbidly obese male
	Aug2020	13. Proietti I	Italy	Polymorphic eruption of pregnancy as a possible COVID 19 manifestations
	Aug2020	14. Van Damme C	Belgium	Urticaria in an infant with SARS-CoV2 positivity
	Aug2020	15. Proietti I	Spain	Acute urticaria with pyrexia as first manifestation of COVID19 infection
	Dec2020	16. Adelino R	UAR	Acute urticaria with angioedema in the setting of COVID19
	Dec2020	17. Elhag SA	USA	Angioedema and urticaria in a COVID19 patient: case report and review of literature
	Dec2020	18. Grewal E	Italy	Angioedema, ACE inhibitor and COVID19
	Dec2020	19. Rotulo GA	Italy	Giant urticaria and acral peelin in a child with COVID19
Vasculitic	May2020	1. Castelnovo L	Italy	Symmetric cutaneous vasculitis in COVID-19 pneumonia
	Aug2020	2. De Perosanz-Lobo	Spain	Urticarial vasculitis in COVID19 infection: vasculopathy related symptom?
	Aug2020	3. Dominguez-Santas	Spain	Cutaneous small-vessel vasculitis associated with COVID19
	Aug2020	4. Mayor-Ibarguren	Spain	Cutaneous small vessel vasculitis secondary to COVID19
	Aug2020	5. Ordieres-Ortega L	Spain	Atypical erythema nodosum in a patient with COVID19 pneumonia
	Aug2020	6. Papa A	Italy	Painful cutaneous vasculitis in a SARS-CoV-2 IgG positive child
	Aug2020	7. Taskin B	Turkey	COVID 19 presenting with Atypical Sweets syndrome
	Aug2020	8. Allez M	France	COVID19 related IgA vasculitis
	Aug2020	9. Caputo V	Italy	Generalized purpuric eruption with histopathology of leucocytoclastic vasculitis
	Aug2020	10. Negrini S	Italy	Unusual case of bullous hemorrhagic vasculitis
	Aug2020	11. Suter P	Switz	Erythema nodosum as a cutaneous manifestations of COVID19
	Dec2020	12. Sipfle DON	USA	Erythema nodosum-like rash in a COVID19 patient.

	Dec2020	13. Tahir A	Dubai	Widespread cutaneous small vessel vasculitis secondary to COVID19
	Dec2020	14. Adekiigbe R	USA	Hispanic man with cutaneous vasculitis lesions and gangrene of toes
	Dec2020	15. Camprodon G	Spain	Leukocytoclastic vasculitis with positive SARS-CoV2 PCR in skin biopsy
	Dec2020	16. Kosters K	Germany	Cutaneous vasculitis in COVID19
	Dec2020	17. Tammaro A	Italy	Cutaneous endothelial dysfunction and complement deposition in COVID19
Alopecia	Aug2020	1. Wambier CG	USA	Androgenetic alopecia and hospital outcomes in COVID19: Gabrin sign
	Dec2020	2. Sgubbi P	Italy	Alopecia areata in a patient with SARS-CoV-2 infection
Other	May2020	1. Joob B	Thailand	COVID-19 can present with a rash and be mistaken for Dengue
	Aug2020	2. De Medeiros VLS	Brazil	Follow-up of skin lesions during evolution of COVID19
	Aug2020	3. Krajewski PK	Poland	Cutaneous hyperesthesia: novel manifestation of COVID 19
	Aug2020	4. Putra BE	Indonesia	Viral exanthem with “spins and needles sensation” on extremities
	Aug2020	5. Tehranchinia Z	Iran	Lichenoid eruptions with interface dermatitis and necrotic subepidermal blister
	Aug2020	6. Skroza N	Italy	Late onset widespread skin rash: viral or multidrug
	Aug2020	7. Dertlioglu SB	Turkey	Skin manifestations in COVID 19: 5 Case Reports
	Dec2020	8. Farouk	Egypt	Cutaneous manifestations of COVID 19
	Aug2020	9. Mendez-Flores S	Mexico	COVID19 and nail manifestations: be on the lookout for the red half-moon nail sign
	Dec2020	10. Ng SM	UK	Prolonged skin manifestations 4 wks after COVID recovery in a child(pityriasis?)
	Dec2020	11. Altayeb A	UK	2 cases of skin manifestations prior to the onset of COVID respiratory symptoms
	Dec2020	12. Martin Enguix D	Spain	Pitryiasis rosea Gibert type rash in asymptomatic COVID+ case
	Dec2020	13. Alpalhao M	Portugal	Seborrheic dermatitis in COVID19: a case report
	Dec2020	14. Tammaro A	Italy	Severe palmar hyperkeratosis and hematochezia in COVID19
	Dec2020	15. Glick LR	USA	Unilateral laterothoracic exanthem in association with COVID19
	Dec2020	16. Danarti R	Indonesia	Follicular eruption as a cutaneous manifestation in COVID19
	Dec2020	17. Brin C	France	An isolated peculiar Gianotti-Crosti rash in the course of a COVID19 episode

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 5

Endocrine System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Endocrine Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020 Dec2020 Dec2020 Dec2020 Aug2021	1. Patel KP 2. Kralicka AL 3. Halboub E 4. Juhasz MF 5. Bircakova B	China/USA Poland Saudi Arabia Hungary Czech Repub	Gastrointestinal, hepatobiliary and pancreatic manifestations of COVID-19 Hyponatremia in infectious diseases: a literature review Orofacial manifestations of COVID-19: brief review Insufficient etiologic workup of COVID associated acute pancreatitis:SystReview Bimodal of COVID-19 acute pancreatitis supports cytotoxic&immune pathogenesis
2. Meta- Analyses				
3. Pathogenesis / hypothesis*				
4. Guidelines*				
5. Studies*	May2020 Aug2020 Aug2020 Dec2020 Dec2020 Dec2020 Dec2020	1. Wang F 2. Dirweesh A 3. Muller I 4. Inamdar S 5. Achua JK 6. Akarsu C 7. Lui DTW	China USA Italy USA USA Turkey China	Pancreatic injury patterns in patients with COVID-19 pneumonia Clinical outcomes of acute pancreatitis in patients with COVID-19 SARS-CoV-2 related atypical thyroiditis Prevalence/risk factors/outcomes of acute pancreatitis with COVID19 Histopathology and ultrastructural findings of fatal COVID-19 on Testis Association between acute pancreatitis and COVID-19 Thyroid dysfunction relative to COVID immune profile & outcome: 191 cases
6. Case Reports/Series*				
Thyroiditis	Aug2020 Aug2020 Aug2020 Aug2020 Aug2020 Dec2020	1. AsfuogluKalkan E 2. Brancatella A 3. Ippolito S 4. Ruggeri RM 5. Tee LY 6. Brancatella A	Turkey Italy Italy Italy Singapore Italy	A case of subacute thyroiditis associated with Covid-19 infection Subacute Thyroiditis After Sars-COV-2 Infection SARS-CoV-2: potential trigger for subacute thyroiditis? Subacute thyroiditis: endocrine complication linked to the COVID-19 COVID-19 complicated by Hashimoto's thyroiditis Is Subacute Thyroiditis an Underestimated Manifestation of SARS-CoV-2

	Dec2020	7. Mattar SAM	Singapore	Subacute thyroiditis associated with COVID-19
	Dec2020	8. Campos-Barrera	Mexico	Subacute Thyroiditis Associated with COVID-19
	Dec2020	9. Rotondi M	Italy	SARS-COV-2 receptor ACE-2 mRNA in thyroid cells-clue for thyroiditis?
	Dec2020	10. Mizuno S	Japan	A case of postpartum thyroiditis following SARS-CoV-2 infection
	Dec2020	11. Ruano R	Spain	Subacute thyroiditis might be a complication triggered by SARS-CoV-2
	Dec2020	12. Chong WH	USA	Subacute Thyroiditis in the Setting of Coronavirus Disease 2019
Pancreatitis	May2020	1. Hadi A	Denmark	COVID-19 with severe acute pancreatitis: case report on 3 family members
	Aug2020	2. Anand ER	UK	Acute pancreatitis in a COVID19 patient
	Aug2020	3. Aloysius MM	USA	COVID19 presenting as acute pancreatitis
	Aug2020	4. Miao Y	France	First case of acute pancreatitis related to SARS-CoV-2 infection
	Aug2020	5. Meireles PA	Portugal	Acalculous acute pancreatitis in a COVID19 patient
	Aug2020	6. Pinte L	Romania	Pancreatic involvement in SARS CoV2: case report and living review
	Aug2020	7. Alloway BC	USA	Suspected case of COVID19-associated pancreatitis in a child
	Aug2020	8. Karimzadeh S	Iran	COVID19 presenting as acute pancreatitis: lessons from a patient in Iran
	Aug2020	9. Gadiparthi C	USA	Hyperglycemia, Hypertriglyceridemia and acute pancreatitis in COVID infection
	Aug2020	10. Ali Bokhari SMMA	Pakistan	Case report: novel coronavirus – a potential cause of acute pancreatitis
	Aug2020	11. Al Mazrouei SSA	UAE	COVID19 associated acute pancreatitis: a rare cause of acute abdomen
	Aug2020	12. Brikman S	Israel	Acute pancreatitis in a 61 year old man with COVID19
	Dec2020	13. Alves AM	Brazil	SARS-CoV-2 leading to acute pancreatitis: an unusual presentation
	Dec2020	14. Kurihara Y	Japan	Pancreatitis in a Patient with Severe COVID Pneumonia treated with ECMO
	Dec2020	15. Lakshmanan S	USA	Acute Pancreatitis in Mild COVID-19 Infection
	Dec2020	16. Purayil N	Qatar	COVID-19 Presenting as Acute Abdominal Pain: A Case Report
	Dec2020	17. Wang K	China	Acute Pancreatitis as the PC in 2 Cases of COVID-19 in Wuhan, China
	Dec2020	18. Cheung S	USA	Recurrent Acute Pancreatitis in a Patient with COVID-19 Infection
	Dec2020	19. Gonzalo-Voltas A	Spain	Acute pancreatitis in a patient with COVID-19 infection
	Dec2020	20. Gupta V	India	COVID-19 and Acute Pancreatitis: What Do Surgeons Need to Know
	Dec2020	21. Kataria S	USA/Pakistan	COVID-19 Induced Acute Pancreatitis: Case Report & Literature Review
	Dec2020	22. Kumaran NK	UK	COVID-19 associated with acute necrotising pancreatitis (ANP)
	Dec2020	23. Tollard C	France	Inaugural diabetic ketoacidosis with acute pancreatitis during COVID-19
	Dec2020	24. Meyers Mh	USA	A Case of COVID-19-Induced Acute Pancreatitis
	Dec2020	25. Shinohara T	Japan	Acute Pancreatitis During COVID-19 Pneumonia
	Dec2020	26. Samies NL	USA	Pancreatitis in Pediatric Patients with COVID-19

	Dec2020	27. Fernandes DA	Brazil	SARS-CoV-2 and acute pancreatitis: a new etiological agent?
	Dec2020	28. Szatmary P	UK	Emerging Phenotype of severe SARS-CoV 2-associated Pancreatitis
Hyperglycemia	Aug2020	1. Armeni E	UK	Protracted ketonaemia in COVID hyperglycaemic emergencies: case series
	Aug2020	2. Hoe Chan K	USA	Clinical & Outcome in Pts with COVID19 DKA: Hospital case series
	Aug2020	3. Oriot P	Belgium	Euglycemic DKA in a patient with type 1 diabetes & COVID pneumonia
	Dec2020	4. Gianniosis M	USA	Clinical dilemma of DKA and Covid-19 infection: A case report
	Dec2020	5. Hollstein T	Germany	Autoantibody-negative type1 diabetes after SARS-CoV-2 infection
	Dec2020	6. Meza JL	Columbia	DKA Precipitated by COVID-19 in Patients Without Respiratory Symptoms
	Dec2020	7. Alsadhan I	Saudi Arabia	DKA precipitated by COVID-19 infection: Case series (all prior DM type 2)
Adrenal Injury	Aug2020	1. Iuga AC	USA	Adrenal Vascular Changes in COVID-19 Autopsies.
	Aug2020	2. Zinserling VA	Europe	Inflammatory Cell Infiltration of Adrenals in COVID-19.
	Aug2020	3. Alvarez-Troncoso J	Spain	Case Report: COVID-19 with Bilateral Adrenal Hemorrhage
	Aug2020	4. Frankel M	Israel	Bilateral adrenal hemorrhage in Coronavirus disease 2019 patient
	Dec2020	5. Freire Santana M	Spain	Case Report: Adrenal Pathology Findings in Severe COVID-19: An Autopsy Study
	Dec2020	6. Heidarpour M	Iran	Adrenal insufficiency in coronavirus disease 2019: a case report
	Dec2020	7. Kumar R	UK	A case of adrenal infarction in a patient with COVID 19 infection
Parotitis	Aug2020	1. Capaccio P	Italy	Acute parotitis: possible precocious clinical manifestation of SARS-CoV2
	Aug2020	2. Fisher J	USA	COVID19 associated parotitis: case report
	Dec2020	3. Chern A	USA	Sialadenitis: possible early manifestation of COVID19
	Dec2020	4. Afsal AS	India	Inflammation of papillae of Wharton's duct in COVID – a debatable entity
Male Repro-ductive tract	Dec2020	1. Bridwell RE	USA	COVID-19 patient with bilateral orchitis: A case report
	Dec2020	2. Shoar S	USA	Late COVID-19 Complication: Male Sexual Dysfunction
	Dec2020	3. Duarte SAC	Brazil	Prostate infarction & acute urinary retention: complication of severe COVID
Other	Dec2020	1. Dixit NM	USA	Sudden Cardiac Arrest in a Patient With Myxedema Coma and COVID-19

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 6

Gastrointestinal System (for Liver see Annex 9; for Pancreatitis see Annex 5)

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Gastrointestinal Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Tian Y	China	GI features in COVID-19 and the possibility of faecal transmission
	May2020	2. Lee IC	China	GI and liver manifestations in patients with COVID-19
	May2020	3. Patel KP	China/USA	Gastrointestinal, hepatobiliary and pancreatic manifestations of COVID-19
	Aug2020	4. Cha MH	Taiwan	GI and hepatic manifestations of COVID-19: a comprehensive review
	Aug2020	5. D'Amico F	China	Diarrhea with COVID19: Pathogenesis, epidemiology, prevention, mgmt
	Dec2020	6. Amorin Dos Santos	Brazil	Oral manifestations in COVID-19: a living systematic review
	Aug2021	7. Silva FAFD	Brazil	COVID-19 gastrointestinal complications
	Aug2021	8. Ye L	China	Digestive system manifestations and clinical significance of COVID-19
	Aug2021	9. Keshavarz P	Iran/US/Georg	Ischemic GI complications of COVID-19: imaging presentation
2. Meta-Analyses	May2020	1. Cheung KS	China	GI manifestations of COVID-19 & fecal virus load
	Aug2020	2. Mao R	CHina	Manifestations and prognosis of GI & liver involvement
	Aug2020	3. Kumar VCS	USA	Novelty in the gut: a syst rev and meta-anal of GI manifestations of COVID-19
	Aug2020	4. Rokkas T	Greece	GI involvement in COVID-19: syst review and meta-analysis
	Aug2020	5. Tariq R	USA	Prevalence and mortality for COVID-19 patients with GI symptoms
	Aug2021	6. Maslennikov R	Russia	Diarrhoea in adults with COVID – beyond incidence and mortality.
3. Pathogenesis / hypothesis*	May2020	1. Liang W	China	Diarrhoea may be underestimated: a missing link in COVID-19
	Aug2020	2. Kopel J	USA	Clinical insights into the GI manifestations of COVID-19
	Dec2020	3. Galanopoulos M	Greece	COVID-19 pandemic: pathophysiology and manifestations from the GI tract
4. Guidelines*				
5. Studies*	May2020	1. Jin X	China	Epidemiologic, clinical, virologic characteristics of 74 cases with GI symptoms
	May2020	2. Lin L	China	GI symptoms of 95 cases
	May2020	3. Wei XS	China	Diarrhea is associated with prolonged symptoms and viral carriage
	May2020	4. Hajifathalian K	USA	GI and hepatic manifestations of COVID-19 in large Ney York cohort
	Aug2020	5. Kaafarani HMA	USA	GI complications in critically ill patients with COVID-19

	Aug2020	6. Ferm S	USA	Analysis of GI and Hepatic Manifestations: 892 patients in Queens NY
	Dec2020	7. Laszkowska M	USA	Course/outcomes of COVID-19 among hospitalized patients with GI symp/signs
	Dec2020	8. El Moheb M	USA	GI complications in critically ill patients with and without COVID-19
	Dec2020	9. Elmunzer BJ	USA	Digestive manifestations in patients hospitalized with COVID-19
6. Case Reports/Series*				
Hematochezia	May2020	1. Guotao L	China	SARS-CoV-2 presenting with hematochezia
	May2020	2. Li G	China	SARS-CoV-2 infection presenting with hematochezia
Enteritis/ Colitis	Aug2020	1. Sattar T	USA	Three cases of COVID-19 disease with colonic manifestations
	Aug2020	2. Amarpurkar AD	India	Haemorrhagic enteritis and COVID-19: causality or coincidence
	Aug2020	3. Carnevale S	Italy	Direct endothelial damage & vasculitis due to SARS-CoV-2 in small bowel
	Aug2020	4. Carvalho A	USA	COVID GI infection causing hemorrhagic colitis
	Aug2020	5. Chan KH	USA	COVID-19 and ischemic colitis: an under-recognized complication
	Aug2020	6. Rehman M	USA	Neutropenic enterocolitis & rapid spontaneous resolution of portal venous gas
	Dec2020	7. Gonzalez Lazaro P	Spain	Ischemic colitis and short bowel disease due to COVID-19
	Dec2020	8. Brunet E	Spain	Ileitis as the exclusive manifestation of COVID-19
	Dec2020	9. Paul T	Qatar	Ischemic colitis in severe COVID-19 pneumonia
	Dec2020	10. Jaijakul S	USA	Colitis as a sole presentation of SARS-CoV-2
Ischemia	Aug2020	1. Farina D	Italy	Bowel ischemia in a suspected COVID-19 patient
	Aug2020	2. Ignat M	France	Small bowel ischemia and SARS-CoV2 infection: underdiagnosed
	Aug2020	3. Norsa L	Italy	Intestinal ischemia in the COVID-19 era
	Aug2020	4. Mitchell JM	USA	Ischemic enteritis secondary to superior mesenteric artery thrombosis
	Aug2020	5. Norsa L	Italy	Poor outcome of intestinal ischemic manifestations of COVID-19
	Aug2020	6. Bruni A	Italy	Histopathologic findings in COVID with ischemic gangrenous cholecystitis
	Aug2020	7. English WJ	UK	Coagulopathy and mesenteric ischaemia in severe COVID
	Aug2020	8. Ofosu A	USA	Portal vein thrombosis in a patient with COVID-19
	Aug2020	9. Cheung S	USA	Superior mesenteric artery thrombosis and acute intestinal ischemia
	Dec2020	10. Low SW	USA	Gastric ischemia and portal vein thrombosis in a COVID-19 patient
	Dec2020	11. Khesrani LS	Algeria	Intestinal ischemia secondary to COVID-19
	Dec2020	12. Sehhat S	Iran	Acute mesenteric ischemia in a patient with COVID-19
	Dec2020	13. Thuluva SK	India	29 year old male from India with isolated superior mesenteric vein thrombosis
	Dec2020	14. Singh B	USA	Acute intestinal ischemia in a patient with COVID-19 infection

	Dec2020	15. Chiu CY	USA	COVID-19 related ischemic bowel disease
	Dec2020	16. Almeida Vargas A	Spain	Severe colon ischemia in patients with severe COVID-19
Acute abdomen	Aug2020	1. De nardi P	Italy	Bowel perforation in a COVID19 patient: case report
	Aug2020	2. Cabrero-HernandezM	Spain	SARS-CoV-2 infection in children with suspected acute abdomen
	Aug2020	3. Alsuwailem AB	Saudi Arabia	Complicated appendicitis in a pediatric patient with COVID-19
	Aug2020	4. Ahmed AOE	Qatar	COVID-19 masquerading as an acute surgical abdomen
Cholecystitis	Aug2020	1. Ying M	China	COVID19 with acute cholecystitis: case report
	Dec2020	2. Mattone E	Italy	Acute acalculous cholecystitis in a COVID-19 patient
	Dec2020	3. Cirillo B	Italy	Acalculous hemorrhagic cholecystitis
Oral lesions	Aug2020	1. Ansari R	Iran	Oral cavity lesions as a manifestation of COVID-19
	Aug2020	2. Kahraman FC	Turkey	Mucosal involvement in a COVID-19 positive patient
	Dec2020	3. Riad A	Czech	Manifestation of oral mucositis in COVID-19 patients: case series
	Dec2020	4. Riad A	Czech	Angular cheilitis of COVID-19 patients: case series and literature review
	Dec2020	5. Riad A	Czech	Tongue ulcers associated with SARS-CoV-2 infection: case series
Other	Aug2020	1. Ekbatani MS	Iran	Atypical and novel presentations of COVID-19: 3 children
	Dec2020	2. Ibrahim YS	Qatar	Paralytic ileus: potential extrapulmonary manifestation of severe COVID-19
	Dec2020	3. Moazzam Z	Pakistan	Intussusception in an infant as a manifestation of COVID-19
	Dec2020	4. Mobayen M	Iran	Presentation of spontaneous splenic rupture in a COVID-19 patient
	Dec2020	5. Karki S	Nepal	Spontaneous hemoperitoneum in COVID-19 patient
	Dec2020	6. Bolia R	India	Recognising the gastrointestinal manifestations of pediatric COVID-19

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 7

Hematologic System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021',Hematologic Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews*	May2020	1. Giannis D	USA + more	Coagulation disorders in coronavirus infected patients (COVID/SARS/MERS)
	Aug2020	2. Agbuduwe C	UK	Hematologic manifestations of COVID-19: from cytopenia to coagulopathy
	Aug2020	3. Mina A	USA	Hematologic manifestations of COVID-19
	Aug2020	4. Slomka A	Poland/Neth	COVID-19 hematologic manifestations
	Aug2020	5. Terpos E	Greece/Fr/Rus	Hematologic findings and complications of COVID-19
	Aug2020	6. Zhou M	China	Thrombocytopenia in three types of coronavirus infection
	Dec2020	7. Asakura H	Japan	COVID-19 associated coagulopathy and disseminated intravascular coagulation
	Dec2020	8. Iba T	USA	The coagulopathy, endotheliopathy and vasculitis of COVID-19
	Dec2020	9. Bhattacharjee S	India	Immune thrombocytopenia due to COVID-19
	Dec2020	10. Medicherla CB	USA	Cerebral venous sinus thrombosis in COVID-19 pandemic
	Aug2021	11. Servante J	UK/Ir/Aust/Can	Haemostatic and thrombo-embolic complications in pregnant women with COVID
	Aug2021	12. Tu TM	Singapore	Cerebral venous thrombosis in patients with COVID-19
	Aug2021	13. Parra-Medina R	Columbia	Microthrombi in COVID-19 autopsies
	May2020 Thru Aug2021	Number of additional Reviews Focused on: 12 Coagulopathy 17 stroke 13 thrombosis 13 thromboembolism 3 pulmonary embolism 2 endothelial dysfunction		Author, country and title of reviews focused on already identified AESIs are not specified but can all be found in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', hematologic tab; filter on subgrp1 =specified Focus area, and subgrp2=review
2. Meta-Analyses*	May2020	1. Lippi G	Italy	Thrombocytopenia
	May2020	2. Xiong M	China	Changes in blood coagulation
	Aug2020	3. Jin S	China	Prevalence and impact of coagulation dysfunction in COVID-19 in China
	Aug2020	4. Lin J	China	COVID-19 and coagulation dysfunction in adults

	Aug2020	5. Zhu J	China	Coagulation dysfunction is associated with severity of COVID-19
	Aug2020	6. Liao SC	Taiwan	Incidence and mortality of pulmonary embolism in COVID-19
	Aug2020	7. Tan YK	Singapore	COVID-19 and ischemic stroke
	Aug2020	8. Wang Y	China	Pooled prevalence of deep vein thromboses among COVID-19 patients
	Dec2020	9. Roncon L	It/Switz/Gre	Incidence of acute pulmonary embolism in COVID1-19 patients
	Dec 2020	10. Yamakawa M	USA/Isra/Jap	Clinical characteristics of stroke with COVID-19
	Dec2020	11. Lee KW	Malaysia	Stroke and novel coronavirus infection in humans
	Dec2020	12. Nannoni S	UK,Nether.	Stroke in COVID-19
	Dec2020	13. Siepmann T	Germany	Increased risk of acute stroke among patients with COVID-19
	Dec2020	14. Zong X	China	Thrombocyopenia is associated with COVID-19 severity and outcome
	Dec2020	15. DiMinno A	Italy	COVID-19 and VTE
	Dec2020	16. Kunutsor SK	UK,Finland	Incidence of venous and arterial thromboembolic complications in COVID-19
	Dec2020	17. Porfidia A	Italy	VTE in patients with COVID-19
	Dec2020	18. Zhang C	China, USA	Incidence of VTE in hospitalized COVID-19 patients
	Dec2020	19. Kefale B	Ethiopia	Prevalence and risk factors of thromboembolism among patients with COVID-19
	Dec2020	20. Nopp S	Austria,Russia	Risk of VTE in patients with COVID-19
	Dec2020	21. Sridharan GK	USA	VTE in hospitalized COVID-19 patients
	Aug2021	22. Bansal A	USA/India	Association of D-dimers with mortality, ICU admission or ARDS in COVID-19
	Aug2021	23. Suh YJ	SKor/UK/It/Fra	Pulmonary embolism and DVT in COVID-19
	Aug2021	24. UaprasertN	Thailand	Systemic coagulopathy in hospitalized patients with COVID-19
	Aug2021	25. Zhang X	China	Coagulopathy in patients with COVID-19
	Aug2021	26. Zhou X	China	Incidence and impact of DIC in COVID-19
	Aug2021	27. Mitra S	Singapore	Severe COVID-19 and coagulopathy
	Aug2021	28. Polimeni A	Italy	Diff in coagulopathy indices in patients with severe vs non-severe COVID-19
	Aug2021	29. Syahrul S	Indonesia	Hemorrhagic and Ischemic stroke in patients with COVID-19
	Aug2021	30. Mohamed MFH	Qatar/USA	Prevalence of VTE in critically ill COVID-19 patients
	Aug2021	31. Zhang R	China	Prevalence of VTE events in COVID-19 patients
	Aug2021	32. Wu T	China	VTE in patients with COVID-19
	Aug2021	33. Mai V	Canada/Fran	VTE in COVID vs non-COVID cohorts
	Aug2021	34. Loomba RS	USA	Factors associated with DVT in COVID-19 patients
	Aug2021	35. Lu YF	China	Incidence of VTE and impact of anticoagulation on mortality in COVID-19 patients
	Aug2021	36. Gabbai-Armelin PR	Brazil	COVID-19 infection and thrombotic conditions

3 Pathogenesis / hypothesis*	May2020 May2020 Aug2020 Dec2020	1. Gavrillaki E 2. Xu P 38 new publications 31 new publications	Greece/US China Multiple Multiple	COVID and thrombotic microangiopathy Mechanism of thrombocytopenia in COVID19 patients For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup2=pathogenesis)
4. Guidelines*	May2020 May2020 May2020 Aug2020 Dec2020	1. Bikdeli B 2. Castelli R 3. Zhai Z No new publications No new publications	Multiple Italy China	COVID19 thromboembolic disease: implications_prevention_therapy_follow-up Abnormal hemostatic parameters/risk of TE Prevention/treatment of TE: Consensus statement
5. Studies*	May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Cui S 2. Fogarty H 3. Klok FA 4. Han H 5. Helms J 6. Llitjos JF 7. Lodigiani C 8. MiddledorpS 9. Panigada M 10. Ranucci M 11. Spiezia L 12. Tang N 13. Yang X 14. Zou Y 15. Thomas W 16. Wichmann D 17. Yaghi S 18. Tejada Meza H 42 new studies 104 new studies	China Ireland Holland China France France Italy Holland Italy ItalyUSA(2) Italy China China China UK Germany USA Spain Multiple Multiple	Prevalence of venous Thromboembolism Coagulopathy in Caucasian patients Incidence of thrombotic complications in critically ill ICU patients Prominent changes in blood coagulation Multicentre prospective cohort: High risk of thrombosis High incidence of venous thromboembolic events in anticoagulated patients Venous & arterial thromboembolic complications Incidence of venous thromboembolism in hospitalized Hypercoagulability of COVID19 patients in ICU Procoagulant pattern of patients with ARDS Severe hypercoagulability in ICU pts with respiratory failure Anticoagulant therapy associated with decreased mortality Thrombocytopenia association with mortality Analysis of coagulation parameters Thrombotic complications of patients admitted to ICU with COVID-19 Autopsy findings and venous thromboembolism in patients with COVID-19 SARS-CoV-2 and Stroke in New York healthcare system Ischaemic stroke in the time of COVID-19 For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup2=Study)

6. Case Reports/Series *				
Coagulopathy /Microvascular Injury	May2020 May2020 Aug2020 Dec2020	1. Zhang Y 2. Magro C 7 new case reports 10 new case reports	China USA Multiple Multiple	Coagulopathy and antiphospholipid antibodies Complement associated microvascular injury and thrombosis For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = coagulopathy; Subgroup2=case reports)
Stroke	May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Avula A 2. Beyrouti R 3. Oxley TJ 4. Viguier A 5. Bruggemann R 6. Hughes C 7. Zhou B 8. Tunc A 9. Zayet S 10. Gunasekaran K 11. Morassi M 40 new case reports 56 new case reports	USA UK USA France Netherlands UK China Turkey France USA Italy Multiple Multiple	COVID-19 presenting as stroke (4 cases) Characteristics of ischemic stroke (6 cases) Large-vessel stroke as presenting feature in the young Acute ischemic stroke complicating common carotid artery thrombosis Arterial and venous thromboembolic disease in a patient with COVID-19 Cerebral venous sinus thrombosis as a presentation of COVID-19 Acute Cerebral Infarction and deep vein thrombosis concomitant with COVID-19 Coexistence of COVID-19 & acute ischemic stroke – 4 cases Acute cerebral stroke with multiple infarctions & COVID-19 Stroke in a young COVID-19 patient Stroke in patients with SARS-CoV-2 infection: case series (6) For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = stroke; Subgroup2=case reports)
Pulmonary Embolus (PE)	May2020 May2020 May2020 Aug2020 Dec2020	1. Fabre O 2. Poissy J 3. Polat V 32 new case reports 26 new case reports	France France Turkey Multiple Multiple	Severe acute proximal PE Increased prevalence of PE in COVID19 patients Sudden death due to acute PE in a young woman with COVID-19 For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = PE; Subgroup2=case reports)
Other Thrombotic Disease	May2020 May2020 May2020 May2020 May2020 May2020 Aug2020	1. Griffin DO 2. Beccara A 3. Besutti G 4. Poggiali E 5. Schultz K 6. Bellosta R 44 new case reports	USA Italy Italy Italy USA Italy Multiple	Arterial thromboembolic complications in prophylaxed low risk patients Arterial Mesenteric Thrombosis as a complication of SARS-CoV-2 Abdominal Visceral Infarction in 3 patients with COVID-19 Deep Vein Thrombosis and Pulmonary Embolism: 2 complications of COVID-19 Digital Ischemia in COVID-19 patients Acute limb ischemia in patients with COVID-19 pneumonia (20 cases)

	Dec2020	71 new case reports	Multiple	For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = thrombosis OR TE OR ischemia; Subgroup2=case reports)
Thrombo-cytopenia / ITP	May2020 May2020 Aug2020 Dec2020	1. Ahmed MZ 2. Zulfiqar AA 20 new case reports 15 new case reports	UK France Multiple Multiple	Thrombocytopenia as an initial manifestation (3 cases) Idiopathic thrombocytopenic purpura (ITP) For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = tcp; Subgroup2=case reports)
Autoimmune hemolytic anemia	May2020 May2020 Aug2020 Dec2020	1. Lopez C 2. Lazarian G 5 new case reports 1 new case report	USA France Multiple	Simultaneous onset of COVID 19 and AHA AHA associated with COVID19 For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Hematologic tab (Subgroup 1 = AHA, Subgroup2=case reports)
Other	May2020 May2020 Dec2020 Dec2020	1. Mitra A 2. Li G 3. Jensen CE 4. Faisal H	USA China USA USA	Leukoerythroblastic reaction in patient with COVID19 Covid-19 presenting with hematochezia Cold agglutinin syndrome as a complication of COVID-19 in two cases Unexplained methemoglobinemia in COVID-19: a case report

* The August 2021 search excluded these types of articles: Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor

Annex 8

Kidney

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Kidney Injury Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	Aug2020	1. Chan VW	China	Syst Rev: COVID-19 urological manifestations and viral RNA detection
	Aug2020	2. Moitinho MS	Brazil	AKI in patients with COVID-19: integrative review
	Aug2020	3. Qian JY	China	AKI in 2019 Novel coronavirus disease
	Dec2020	4. Kellum JA	USA	Targeting AKI in COVID-19
	Dec2020	5. Nogueira SAR	Brazil	Renal changes and AKI in Covid-19: a systematic review
	Dec2020	6. Prasad N	India	COVID-19 and AKI
	Dec2020	7. Ostermann M	England	What every intensivist should know about COVID-19 associated AKI
	Dec2020	8. Parmar MS	Canada	AKI assoc with COVID19-cumulative evidence & rationale against direct injury
	Dec2020	9. Mallhi TH	Saudi Arabia	Stratification of AKI in COVID19
	Dec2020	10. Nadim MK	US/Europe	COVID19 assoc AKI: Consensus report-25th Acute disease quality initiative WG
	Aug2021	11. Xu Z	China	Incidence of AKI in patients with COVID-19
	Aug2021	12. Raina R	USA	Incidence and outcomes of AKI in COVID-19
2. Meta-Analyses	May2020	1. Ali H	Egypt	Survival rate in AKI in COVID-19 patients: systematic review & meta-analysis
	May2020	2. Ng JJ	Singapore	AKI in hospitalized patients with COVID-19
	Aug2020	3. Wang Y	China	AKI associated with mortality of COVID-19
	Aug2020	4. Brienza N	Italy	AKI in COVID-19 infected: a Meta-analytic study
	Aug2020	5. Chen YT	Taiwan	Incidence of AKI in COVID-19
	Aug2020	6. Gabarre P	France	AKI in critically ill patients with COVID-19
	Aug2020	7. Yang X	China	Prevalence and impact of acute renal impairment on COVID-19
	Aug2020	8. Chen YT	Taiwan	Mortality rate of AKI in SARS, MERS and COVID-19 infection
	Aug2020	9. Hansrivijit P	USA	Incidence of AKI and its association with mortality in COVID-19
	Aug2020	10. Kunutsor SK	Finland	Renal complications in COVID-19
	Aug2020	11. Shao M	China	AKI is associated with severe infection and fatality in patients with COVID-19
	Dec2020	12. Oliveira CB	Brazil	High burden of AKI in COVID-19 pandemic
	Dec2020	13. Pan XW	China	AKI during the COVID-19 outbreak

	Dec2020	14. Robbins-Juarez	USA	Outcomes for patients with COVID-19 and AKI
	Dec2020	15. Ouyang L	China	Association of AKI with severity & mortality of SARS-CoV-2: meta-analysis
	Aug2021	16. Jafari-Oori M	Iran/Ital/Braz	AKI and COVID-19
	Aug2021	17. Liu YF	China	Chronic kidney disease and AKI involvement in COVID-19 pandemic
	Aug2021	18. Wang B	China	Involvement of Chronic kidney disease and AKI in disease severity and mortality
	Aug2021	19. Zhou Y	China	Chronic kidney diseases and AKI in patients with COVID-19
	Aug2021	20. Nasiri N	Iran/Canada	Kidney complications of Covid-19
	Aug2021	21. Lee SA	S Korea	Increased risk of AKI in COVID patients with ARS blockade use
3. Pathogenesis / hypothesis	May2020	1. Soleimani M	USA	AKI in SARS-CoV2: Direct effect of virus on kidney proximal tubule cells
	Aug2020	2. Pan XW	China	Identification of potential mechanism of AKI: single-cell transcriptome analysis
	Aug2020	3. Batlle D	USA	AKI in COVID-19: Emerging Evidence of a distinct pathophysiology
	Dec2020	4. Braun F	Germany	SARS-CoV-2 renal tropism associates with AKI
	Dec2020	5. Izzedine H	France	AKI in patients with COVID-19: an update on the pathophysiology
	Dec2020	6. Chueh TI	China	Novel evidence of AKI in COVID-19
4. Guidelines	Aug2020	1. Selby NM	England	COVID-19 and AKI in hospital: summary of NICE guidelines
5. Studies	May2020	1. Wang L	China	COVID-19 doesn't result in AKI: 116 hospitalized patients-Wuhan
	May2020	2. Su H	China	Renal histopathological analysis of 26 postmortem findings
	May2020	3. Cheng Y	China	Kidney disease is associated with in-hospital death of COVID19 patients
	Aug2020	4. Gaetano A	Italy	Incidence, risk factors, mortality: single centre observational study
	Aug2020	5. Chan L	USA	AKI in hospitalized patients with COVID-19
	Aug2020	6. Hirsch JS	USA	AKI in patients hospitalized with COVID-19
	Aug2020	7. Lim JH	S Korea	Fatal outcomes of COVID-19 in patients with severe AKI
	Aug2020	8. Sun DQ	China	Subclinical AKI in Covid-19 patients: Retrospective cohort study
	Aug2020	9. Dudoignon E	France	Activation of the renin-angiotensin-aldosterone system associated with AKI
	Aug2020	10. Pelayo J	USA	Clinical characteristics & Outcomes of community and hospital acquired AKI
	Aug2020	11. Stewart DJ	England	Renal dysfunction in hospitalized children with COVID-19
	Aug2020	12. Golmai P	USA	Histopathologic and Ultrastructural findings in pm kidney biopsy material (n-12)
	Aug2020	13. Na KR	S Korea	AKI and kidney damage in COVID-19 patients
	Aug2020	14. Sharma P	USA	COVID-19 associated kidney injury: case series of kidney biopsy findings
	Aug2020	15. Cui X	China	AKI in patients with COVID-19: multicenter study
	Aug2020	16. Hong D	China	Kidney manifestations of mild/mod/severe COVID-19: retro cohort study

	Aug2020	17. Husain-Syed F	Germany	AKI and urinary biomarkers in hospitalized patients with COVID-19
	Aug2020	18. Kormann R	France	COVID-19: acute Fanconi syndrome precedes AKI
	Aug2020	19. Rubin S	France	Characterization of AKI in critically ill patients with severe COVID-19
	Aug2020	20. Santoriello D	USA	Postmortem kidney pathology findings in patients with COVID-19.
	Dec2020	21. Frithiof R	Sweden	Presence of SARS-CoV-2 in urine is rare and not associated with AKI in critically ill
	Dec2020	22. Lee JR	USA	AKI in hospitalized COVID-19 patients in an urban academic center
	Dec2020	23. Naar L	USA	AKI in Critically ill COVID patients; single center experience-206 consecutive pts
	Dec2020	24. Ng JH	USA	Outcomes among patients hospitalized with COVID-19 and AKI
	Dec2020	25. Russo E	Italy	Kidney disease & all-cause mortality in COVID patients hospitalized in Genoa
	Dec2020	26. Zahid U	USA	AKI in COVID-19: inner city hospital experience and policy implications
	Dec2020	27. Zheng X	China	Prevalence of AKI and associations with critical illness and death
	Dec2020	28. Chaibi K	France	Severe AKI in COVID-19 patients with ARDS
	Dec2020	29. Joseph A	France	AKI in patients with SARS-CoV02 infection
	Dec2020	30. Liu L	China	Potential proximal tubular dysfunction in hospitalized patients
	Dec2020	31. Nimkar A	USA	Incidence and risk factors for AKI and effect on mortality
	Dec2020	32. Portoles J	Spain	Chronic kidney disease and AKI in COVID-19 Spanish outbreak
	Dec2020	33. Taher A	Bahrain	AKI in COVID-19 pneumonia: single-center experience in Bahrain
	Dec2020	34. Wang J	China	Risk factors of COVID-19 related AKI: single center retro cohort study
	Dec2020	35. Watchorn J	England	Critically ill patients with AKI have reduced renal blood flow and perfusion
	Dec2020	36. Werion A	Belgium	SARS-CoV02 causes a specific dysfunction of the Kidney proximal tubule
	Dec2020	37. Xia P	China	Clinicopath features/outcomes of AKI in critically ill: retrosp cohort
	Dec2020	38. Chaudhri I	USA	Proteinuria & hematuria with AKI and mortality in hospitalized patients
	Dec2020	39. Bjornstad EC	USA	AKI in critically ill children: Multicenter cross-sectional analysis
	Dec2020	40. Hamilton P	UK	Characteristics & Outcomes of hospitalized with AKI & COVID19
	Dec2020	41. Kolhe NV	UK	AKI associated with COVID19: retrospective cohort study
	Dec2020	42. Akilesh S	USA	Multicenter clinicopath correlation of kidney biopsies in COVID AKI or proteinuria
6. Case Reports/Series				
Acute kidney injury	May2020	1. Gopalakrishnan	USA	Fulminant acute kidney injury in a young patient with COVID-19
	Aug2020	2. Post A	Netherlands	Kidney infarction in patients with COVID19
	Aug2020	3. Rossi GM	Italy	Kidney biopsy findings: case against SARS CoV2 nephropathy
	Aug2020	4. Chenna A	USA	AKI in Case Series-Role of ACE2 and RAS blockade
	Aug2020	5. Wang Y	China	AKI in 2 patients with pre-existing chronic renal disease

	Aug2020 Dec2020 Dec2020 Dec2020	6. Zhu D 7. DiMauro M 8. Patel N 9. Ammous A	China Italy USA USA	Progressive renal impairment in an older patient AKI in COVID-19: a case report COVID-19 associated AKI: a case series Renal infarction in a COVID19 patient
Hematuria	May2020	1. Almeida FJ	Brazil	Hematuria associated with SARS-CoV-2 infection in a child
Virus in tissue	Aug2020	1. Ren JG	China	Positive RT-PCR in urine from asymptomatic patient
Collapsing Glomerulo-pathy	Dec2020 Dec2020	1. Nlandu YM 2. Tancredi T	DRCongo USA	1st case of COVID-19 assoc collapsing glomerulopathy in Sub-Saharan Africa Renal US findings in COVID related collapsing focal segmental glomerulosclerosis
Vasculitis	Dec2020 Dec2020	1. Suso AS 2. Uppal NN	Spain USA	IgA vasculitis with nephritis (HSP) in a COVID patient De Novo ANCA-associated vasculitis with glomerulonephritis in COVID-19
Hyper-natremia	Dec2020	1. Zimmer MA	Germany	Hypernatremia: A manifestation of COVID-19 – a case series

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 9

Liver

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Liver Injury Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Li J	China	Characteristics & Mechanism of Liver injury in COVID-19
	May2020	2. Lee IC	Taiwan	GI & Liver manifestations in COVID-19
	May2020	3. Xu L	China	Liver injury during highly pathogenic human coronavirus infections
	May2020	4. Zhang C	China	Liver injury in COVID-19: management and challenges
	Aug2020	5. Alqahtani SA	Saudi Arabia	Liver injury in COVID-19: the current evidence
	Aug2020	6. Cha MH	USA	GI and hepatic manifestations of COVID-19: a comprehensive review.
	Aug2020	7. Debes JD	Poland	Systematic analysis of acute liver injury during SARS-CoV-2 infection
	Aug2020	8. Kukla M	USA	COVID-19, MERS and SARS with concomitant liver injury-Systematic Review
	Aug2020	9. Reddy KR	USA	SARS0CoiV02 and the liver: considerations in Hepatitis B and Hepatitis C infections
	Aug2020	10. Ali N	Bangladesh	Liver injury in severe COVID-19 infection: current insights and challenges
	Dec2020	11. Ali N	Bangladesh	Relationship between COVID-19 infection and liver injury: a Review of Recent Data
	Dec2020	12. Garland V	USA	GI & Hepatic manifestations of COVID-19: evolving recognition re vulnerable popns
	Dec2020	13. Ghoda A	India	Liver injury in COVID-19 infection: a systematic review
	Dec2020	14. Papadopoulos	Greece	COVID-19 and liver injury: where do we stand
	Dec2020	15. Zhou YH	China	Abnormal liver enzymes in children and infants
	Dec2020	16. Cheong J	USA	GI and liver manifestations of COVID-19
	Dec2020	17. Farshidpour M	USA	A brief review of liver injury in patients with COVID-19
	Dec2020	18. Zhong P	China	COVID19 associated GI and liver injury: clinical features & potential mechanisms
	Dec2020	19. Bin Arif T	Pakistan	Incidence, patterns, risk factors and histopathology of liver injury in COVID19
	Dec2020	20. Zhao JN	China	Liver injury in COVID-19: a minireview
2. Meta-Analyses	May2020	1. Parohan M	Iran	Liver injury associated with severe COVID19: systematic review and meta-analysis
	Aug2020	2. Kunutsor SK	England	Markers of liver injury and clinical outcomes in COVID-19 patients: Syst rev & MA
	Aug2020	3. Mao R	China	Manifestations and prognosis of GI and liver involvement: syst rev & meta-analysis
	Aug2020	4. Wang H	China	Liver injury and GI symptoms in COVID19: syst review and meta-analysis
	Aug2020	5. Youssef M	Egypt	COVID-19 and liver dysfunction: syst rev and meta-analysis of retrospective studies

	Aug2020	6. Kumar MP	India	COVID-19 and the liver: a comprehensive syst rev and meta-analysis
	Aug2020	7. Kunutsor SK	England	Hepatic manifestations and complications of COVID-19: syst rev and meta-anal
	Aug2020	8. Samidoust P	Iran	Risk of hepatic failure in COVID-19 patients. A systematic review & meta-analysis
	Aug2020	9. Xin S	China	Abnormal LFTs with COVID-29 in mainland China: Syst review & meta-analysis
	Aug2020	10. Kulkarni AV	India	Systematic review with meta-analysis: liver manifestations & outcomes in COVID19
	Aug2020	11. Wijarnpreecha K	USA	COVID-19 and liver injury: a meta-analysis
	Dec2020	12. Ahmed J	Pakistan	COVID-19 and liver injury: a systematic review and meta-analysis
	Dec2020	13. Labenz C	Germany	Liver injury in patients with SARS-CoV-2: a systematic review and meta-analysis
	Dec2020	14. Wong YJ	Singapore	A systematic review and meta-analysis of the COVID-19 associated liver injury
	Dec2020	15. Kumar A	India	GI and hepatic manifestations of COVID-19 and their relationship to severe course
	Dec2020	16. Liu C	China	Liver injury could be associated with severe disease in COVID-19 patients
	Dec2020	17. Wu ZH	China	A meta-analysis of the impact of COVID-19 on liver dysfunction
	Dec2020	18. Merola E	Italy	Prevalence of live injury in patients with COVID19: syst rev & meta-analysis
	Aug2021	19. Del Zompo F	Italy	Prevalence of liver injury & correlation with clinical outcomes in patients with COVID-19
	Aug2021	20. Zhao X	China	Impact of COVID-19 on liver injury in China
	Aug2021	21. Diaz LA	Chile	High prevalence of hepatic steatosis and vascular thrombosis in COVID-19
	Aug2021	22. Ampuero J	Spain	Impact of liver injury on severity of COVID-19
	Aug2021	23. Shehab M	Kuw/US/Can	Gastroenterological and hepatic manifestations of patients with COVID-19
3. Pathogenesis*	May2020	1. Li Y	China	Hepatic involvement in COVID-19: pathology, pathogenesis, clinical implications
4. Guideline*	May2020	1. Musa S	Egypt	Hepatic and GI involvement in COVID-19: what do we know till now?
	May2020	2. Su TH	Taiwan	Clinical manifestations & management of COVID-19 related liver injury
	May2020	3. Sun J	China, Italy	COVID-19 and liver disease
5. Studies*	May2020	1. Xie H	China	Clinical characteristics of non-ICU hospitalized patients with COVID-19 liver injury
	May2020	2. Zhang Y	China	Liver impairment in COVID-19 patients: 115 cases from single centre in Wuhan
	May2020	3. Hajifathalian K	USA	GI and hepatic manifestations of COVID19 in large Ney York cohort
	Aug2020	4. Huang H	China	The association between markers of liver injury and clinical outcomes COVID-Wuhan
	Aug2020	5. Phipps MM	USA	Acute liver injury in COVID19: prevalence and outcomes in large US cohort
	Aug2020	6. Wang Q	China	Patterns of liver injury in adult patients with COVID19: retrospective analysis–105 cases
	Aug2020	7. Schattenberg JM	Germany	Patterns of liver injury in COVID19 – a German case series
	Aug2020	8. Jiang S	China	Liver injury in critically & non-critically ill COVID-patients: multicenter observational study
	Aug2020	9. Yip TC	China	Liver injury is independently associated with adverse clinical outcomes

	Dec2020	10. Anastasiou OE	Germany	Mild vs severe liver injury in SARS-CoV-2 infection
	Dec2020	11. Bernal-Monterde V	Spain	SARS-CoV-2 infection induces a dual response in LFTs: association with mortality
	Dec2020	12. Effenberger M	Austria	Systemic inflammation as fuel for acute live injury in COVID-19
	Dec2020	13. Lei P	China	Liver injury in COVID-19: clinical profiles, CT findings, correlation with severity
	Dec2020	14. Uchida Y	Japan	Significance of live dysfunction in Japanese patients with severe COVID19
	Dec2020	15. Zhang H	China	Clinical characteristics and risk factors for liver injury in COVID – in Wuhan
	Dec2020	16. Abe K	Japan	Clinical features and liver injury in patients with COVID19: in Japanese population
	Dec2020	17. Brito CA	Brazil	Mechanisms and consequences of COVID-19 associated liver injury: what can we affirm
	Dec2020	18. Chen VL	USA	Hepatic steatosis I associated with increased disease severity and injury
	Dec2020	19. Guo H	China	Analysis of live injury factors in 332 patients with COVID-19 in Shanghai
	Dec2020	20. Suresh Kumar VCS	USA	Transaminitis is an indicator of mortality in patients with COVID19
	Dec2020	21. Wang M	China	Clinical characteristics/risk factors of liver injury in COVID19: retrospect Wuhan cohort
	Dec2020	22. Wang J	China	Risk factors of liver injury in COVID19 in Jiangsu, China: retrospective multictr study
	Dec2020	23. Kaneko S	Japan	Liver injury with COVID-19 based on GI symptoms and pneumonia severity
	Dec2020	24. Sikkema BJB	Netherlands	No association between COVID19 related liver injury and course of disease
	Dec2020	25. Schmit G	Belgium	The liver in COVID19 related death: protagonist or innocent bystander
	Dec2020	26. Fu L	China	Liver dysfunction and its association with the risk of death in COVID19 pts
	Dec2020	27. Chen F	China	Clinical features & risk factors of COVID19 associated liver injury & function: 830 cases
	Dec2020	28. Tsutsumi T	Japan	Association of coagulopathy with liver dysfunction in patients with COVID19
6. Case Reports/Series*				
Acute liver injury	May2020	1. Cardoso FS	Portugal	Liver injury in critically ill patients with COVID-19: case series
	Aug2020	2. Li X	China	Severe COVID-19 patients with liver injury: a seven case series
	Aug2020	3. Kudaravalli P	USA	Case series and review of liver dysfunction in COVID-19 patients
	Dec2020	4. Makarem J	Iran	Case Report of progressive liver failure inappropriate to decompensated Heart failure
Acute hepatitis	May2020	1. Lagana SM	USA	COVID-19 associated hepatitis complicating living donor liver transplantations
	May2020	2. Wander P	USA	COVID-19 presenting as acute hepatitis
	Aug2020	3. Aldhaleei WA	Abu Dhabi	COVID-19 induced Hepatitis B virus reactivation: novel case from United Arab Emirates
	Aug2020	4. Fraga M	Swiss	Hepatocellular type II Fibrinogen inclusions in patient with severe COVID-19 & hepatitis
	Dec2020	5. Bongiovannni M	Italy	Acute hepatitis caused by asymptomatic COVID-19 infection
	Dec2020	6. Melquist S	USA	COVID-19 presenting as fulminant hepatic failure: Case report
	Dec2020	7. Haji E Memar EHE	Iran	Fulminant hepatic failure: rare and devastating manifestation of COVID19 in 11yo boy

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 10

COVID-19 chronic complications (including those on long COVID which is addressed in detail in Part 1 of this deliverable)

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Long COVID Tab

Body System	Review Period	Author	Country	Focus
Systemic				
Reviews	Aug2021	1. Bektas A	USA	Do hyper-inflammatory syndromes accelerate short- and long-term inflammaging?
	Aug2021	2. Wang F	USA	Long-Term Respiratory and Neurological Sequelae of COVID-19
	Aug2021	3. McClafferty B	USA	Critical illness myopathy and polyneuropathy in older SARS-CoV-2 patients
	Aug2021	4. Riederer P	Den/Ger	Coronaviruses: a call for extended human postmortem brain analyses
	Aug2021	5. Schirinzi T	Italy	COVID-19: dealing with a potential risk factor for chronic neurological disorders
	Aug2021	6. Nami M	Multiple	Interrelation of COVID19 Neurological & Psychological Symptoms: Risks & Remedies
	Aug2021	7. Shaw B	Italy	Update on long term pulmonary consequences of COVID-19
	Aug2021	8. Alwan NA	UK	Defining long COIVD: going back to the start
	Aug2021	9. Becker RC	USA	COVID-19 and its sequelae: a platform for optimal patient care, discovery, training
	Aug2021	10. Berger Z	USA/UK	Long COVID and health inequalitites: The role of primary care
	Aug2021	11. Brussow H	Belg/Ger	COVID-19: long covid and its societal consequences
	Aug2021	12. Cabrera M	Brazil	Frequency, signs, symptoms and criteria adopted for long COVID-19
	Aug2021	13. Chilazi M	USA	COVID and Cardiovascular disease: What we know in 2021
	Aug2021	14. Dixit NM	USA	Post-acute COVID-19 syndrome and the cardiovascular system. What is known?
	Aug2021	15. Fernandez-de-Las-Penas C	Spain	Definite Post-COVID symptoms (Post-acute/Long/Persistent-post- COVID
	Aug2021	16. Garg M	India	The conundrum of 'Long-COVID-19'
	Aug2021	17. Gutenbrunner C	Germany	Phase-adapted rehab for acute COVID-19 patients and those with long sequelae
	Aug2021	18. Iwu CJ	SAfrica	Occurrence of long COVID
	Aug2021	19. Korompoki E	Greec/US	Epidemiology and organ specific sequelae of post-acute COVID-19
	Aug2021	20. Mendelson M	SAfrica	Long-COVID: an evolving problem with an extensive impact
	Aug2021	21. Oghimi N	USA/Italy	Neurological manifestations of Post-Acute Sequelae of SARS-CoV-2 infection
	Aug2021	22. Naeije R	Belg/Ital	Phenotyping Long COVID
	Aug2021	23. Nalbandian A	USA	Post-acute COVID-19 syndrome
	Aug2021	24. Raj SR	USA/Can	Long-COVID postural tachycardia syndrome: an Amer Autonomic Society statement

	Aug2021	25. Rando HM	USA	Defining Long COVID: differences across literature, e-health records, patient reports
	Aug2021	26. Raveendran AV	India	Long COVID
	Aug2021	27. Sarfreaz Z	US/Pk/Mx/Ec	Cardio-pulmonary sequelae in recovered COVID-19 patients
	Aug2021	28. Siso-Almirall A	Spain	Long COVID-19: proposed primary care clinical guidelines re Diagnosis & Management
	Aug2021	29. Soriano V	Spain	Unveiling long COVID-19 disease
	Aug2021	30. Stefano GB	Czech	Historical insight re infections/disorders with neuro&pscyh sequelae like long COVID
	Aug2021	31. Vehar S	USA	Post-acute sequelae of SARS-CoV-2 infection: caring for the 'long-haulers'
	Aug2021	32. Wong TL	USA	Long COVID and Myalgic Encephalomyelitis/Chronic Fatigue syndrome
	Aug2021	33. Yelin D	Isr/Swed	Long COVID-19: it's not over until?
	Aug2021	34. Yong SJ	Malaysia	Long COVID or post-COVID-19 syndrome: pathophysiology, risk factors, treatments
Meta-analyses	Aug2021	1. Cares-Marambio K	Chile/Spain	Prevalence of potential respiratory symptoms in survivors of COVID-19 hospitalization
Patho-genesis	Dec2020	1. Tavassoly O	Can/USA	Brain Protein Aggregation by SARS-CoV-2 as a Possible Long-Term Complication
	Dec2020	2. Alpert O	USA	Cytokine storm induced new onset depression in patients with COVID-19.
	Dec2020	3. Mohammadi	Iran	Immunologic Characteristics/Mechanisms of Neuro Manifestations of SARS-CoV-2
	Dec2020D	4. Shiers S	USA	ACE2 & SCARF expression in human DRG nociceptors & COVID CNS effects
	ec2020	5. Wijeratne T	Australia	Post-COVID 19 Neurological Syndrome (PCNS); novel syndrome & global challenges
	Aug2021	6. Swain O	USA	SARS-CoV-2 neuronal invasion and complications
Guideline	Aug2021	1. Raveendran AV	India	Long COVID-19: challenges in the diagnosis and proposed diagnostic criteria
Studies	Aug2021	1. Ramani C	USA	Post-Intensive Care Unit COVID-19 Outcomes-a Case Series
	Aug2021	2. Tolba M	Egypt	Assessment and Characterization of Post-COVID-19 manifestations
	Aug2021	3. Sollini M	Italy	Vasculitis changes in COVID-19 survivors with persistent symptoms (PET/CT scan)
	Aug2021	4. Barizien N	France	Clinical characterization of dysautonomia in long COVID-19 patients
	Aug2021	5. Bellan M	Italy	Resp and Psychophysical sequelae 4 months after Hospital discharge for COVID-19
	Aug2021	6. Bende F	Romania	Presence of Hepatic and Cardiac abnormalities in Patients with post-acute COVID-19
	Aug2021	7. Bierle DM	USA	Central sensitization phenotypes in post acute sequelae of SARS-CoV-2 infection
	Aug2021	8. Blomberg B	Norway	Long COVID in a prospective cohort of home-isolated patients
	Aug2021	9. Brackel CLH	Netherlands	Pediatric long COVID: an overlooked phenomenon?
	Aug2021	10. Buonsenso D	Italy	Preliminary evidence on long COVID in children
	Aug2021	11. Busatto GF	Brazil	Post-acute sequalae of SARS-CoV-2 infection: protocol for multidiscp prosp evaluation

	Aug2021	12. Cheng D	UK	Clinical characteristics and outcomes of adult patients with COVID-19 in E London
	Aug2021	13. Chopra N	India	Clinical predictors of long COVID-19 and phenotypes of mild COVID at a 3° care ctr
	Aug2021	14. Delbressine JM	Netherlands	Impact of post-COVID-19 syndrome on self reported physical activity
	Aug2021	15. Dennnis A	UK	Mutiorgan impairment in low risk people with post-COVID-19 syndrome-Comm.study
	Aug2021	16. Doykov I	UK	'The long tail of post-COVID-19' – detection of prolonged inflammatory response
	Aug2021	17. El Sayed S	Egypt	Post-COVID-19 fatigue and anhedonia: cross-sectional study
	Aug2021	18. Estrir H	USA	Evolving phenotypes of non-hospitalized patients that indicate long COVID
	Aug2021	19. Gold JE	USA	Investigation of long COVID prevalence and relationship to EBV reactivation
	Aug2021	20. Graham EL	USA	Persistent neuro symptoms and cognitive dysfunction in non-hospitalized COVID-19
	Aug2021	21. Guedj E	France	(18)F-FDG brain PET hypometabolism after SARS-CoV-2: substrate for persistence?
	Aug2021	22. Guedj E	France	(18)F-FDG brain PET hypometabolism in patients with Long COVID
	Aug2021	23. Holmes E	Aust/UK/Mal	Incomplete systemic recovery/metabolic phenoreversion in nonhosp COVID-19 pts
	Aug2021	24. Huang C	China	6 month consequences of COV ID-19 in patients discharged from hospital
	Aug2021	25. Kashif A	Pakistan/UK	Follow-up of COVID-19 recovered patients with mild disease
	Aug2021	26. Kingstone T	UK	Finding the 'right' GP: qualitative experiences of people with long COVID
	Aug2021	27. Ladds E	UK	Persistent symptoms after COVID-19: qualitative study of 114 'long COVID'
	Aug2021	28. Lui DTW	China	Long COVID in pts with mild-mod disease: thyroid function & autoimmunity
	Aug2021	29. Mandal S	UK	Long-COVID: X-sect study: persist. symptoms, biomarker/imaging abnorm
	Aug2021	30. Moreno-Perez O	Spain	Post-acute COVID-19 syndrome. Incidence/risk factors–Mediterranean cohort
	Aug2021	31. Naidu SB	UK	High mental health burden of LONG-COVID & assoc with physical symptoms
	Aug2021	32. Orru G	Italy	Long-COVID syndrome? Persistence of neuro_psych_physiologic symptoms
	Aug2021	33. Ortona E	Italy	Long COVID: an estrogen-associated autoimmune disease?
	Aug2021	34. Osikomaiya B	Nigeria	Long COVID: persistent symptoms in survivors managed in Lagos, Nigeria
	Aug2021	35. Osmanov IM	US/EurMulti	Risk factors for long COVID in previously hosp children: ISARIC global prot.
	Aug2021	36. Peluso MJ	USA	Rapid implementation of cohort for study of Post-acute sequelae of COVID-19
	Aug2021	37. Petersen MS	Denm/Faroe	Long COVID in the Faroe Islands: longitudinal study among non-hosp pts
	Aug2021	38. Scherlinger M	France	Multimodal evaluation of Pts with long-term symptoms attributed to SARS
	Aug2021	39. Shouman K	USA	Autonomic dysfunction following COVID-19 infection
	Aug2021	40. Sollini M	Italy	Long COVID hallmarks on [18F]FDG-PET/CT: case control study
	Aug2021	41. Sudre CH	US/EurMulti	Attributes and predictors of long COVID
	Aug2021	42. Sykes DL	UK	Post-COVID-19 Symptom Burden: What is Long COVID?
	Aug2021	43. Taboada M	Spain	Quality fo life, functional status and persistent symptoms after ICU for COVID

	Aug2021A	44. Townsend L	Ireland	Persistent poor health after COVID-19: not assoc with resp comps/severity
	ug2021	45. Tran VT	France	Development and validation of Long COVID symptom and impact tools
	Aug2021	46. Vaes AW	Neth/Ger/Au	Recovery from COVID-19: a sprint or marathon? 6 month follow up data
	Aug2021	47. Wise J	UK	COVID-19: long COVID cases are underreported in GP records
Case reports	Dec2020	1. Novak P	USA	Orthostatic cerebral hypoperfusion syndrome & small fiber neuropathy
	Dec2020	2. Faber I	Brazil	Covid-19 and Parkinsonism: A non-post-encephalitic case
	Dec2020	3. Scelfo C	Italy	Early Lung Fibrosis Following COVID-19 Pneumonia - Case Reports
	Aug2021	4. Agarwala SR	India	Avascular necrosis as a part of Long COVID-19
	Aug2021	5. Hugon J	France	Long COVID: cognitive complaints (brain fog) and dysfunction of the cingulate cortex
	Aug2021	6. Mayer KP	USA	Physical therapy Management of an individual with Long COVID syndrome
	Aug2021	7. Younger DS	USA	Post-acute sequelae of SARS2 (PASC): peripheral, autonomic and central NS features
Comment	Aug2021	1. Al-Jahdhami I	Oman	The Post-acute COVID-19 Syndrome (Long COVID)
	Aug2021	2. Altmann DM	UK	Decoding the unknowns in long covid
	Aug2021	3. Amin-Chowdhury Z	UK	Causation or confounding: why controls are critical for characterizing long COVID
	Aug2021	4. Atherton H	UK	Long COVID and the importance of the doctor-patient relationship
	Aug2021	5. Baratta Jm	USA	Postacute Sequelae of COVID-19 Infection & Development of a Recovery Clinic
	Aug2021	6. Bhopal SS	UK	Vaccinating children to prevent long covid? caution needed in interpreting epi data
	Aug2021	7. Buonsenso D	Italy	Long COVID in children: Family_Pediatrician Partnerships a priority for better care
	Aug2021	8. Burke MJ	USA/Can	Long COVID has exposed medicine's blind-spot
	Aug2021	9. Callard F	UK	How and why patients made Long Covid
	Aug2021	10. Carson G	UK	Research priorities for Long Covid: refined via international multi-stakeholder forum
	Aug2021	11. Decary S	Can/UK	Humility & Acceptance: Working Within Our Limits With Long COVID and ME/CFS
	Aug2021	12. Gandotra S	USA	Is "Long COVID" More Than Slow Resolution of the Acute Disease?
	Aug2021	13. Gorna R	UK	Long COVID guidelines need to reflect lived experience
	Aug2021	14. Hageman JR	USA	Post-Acute Sequelae of SARS-CoV-2 Infection in Children/Adolescents/Young Adults
	Aug2021	15. Hoffer EP	USA	Long Covid: does it exist? What is it? We can we do for sufferers?
	Aug2021	16. Horn M	France	Somatic symptom disorders and long COVID: A critical but overlooked topic
	Aug2021	17. Khunti K	UK/Ger/US	Long COVID - metabolic risk factors and novel therapeutic management
	Aug2021	18. Kondratiuk AL	UK	Conceptual framework to accelerate clinical impact of research into long COVID
	Aug2021	19. LePage M	UK	Getting to grips with long covid
	Aug2021	20. Llach CD	Spain	Mind long COVID: Psychiatric sequelae of SARS-CoV-2 infection
	Aug2021	21. Lokugamage AU	UK	How power imbalances in Long COVID narratives/research/publications can harm pts

	Aug2021	22. Mahase E	UK	Covid-19: What do we know about "long covid"?
	Aug2021	23. Marshall M	USA	The four most urgent questions about long COVID
	Aug2021	24. Martelletti P	Italy	Long-COVID Headache
	Aug2021	25. Marx V	USA	Scientists set out to connect the dots on long COVID
	Aug2021	26. Meagher T	Canada	Long COVID - An Early Perspective
	Aug2021	27. Montani D	France	Multidisciplinary approach for post-acute COVID-19 syndrome
	Aug2021	28. Munblit D	UK/Ireland	Legacy of child COVID-19 infection: long-COVID_lifelong health/economic impact
	Aug2021	29. Murray T	Canada	Unpacking "long COVID"
	Aug2021	30. Nabavi N	UK	Long covid: How to define it and how to manage it
	Aug2021	31. Nath A	USA	Long-Haul COVID
	Aug2021	32. Newman M	UK	Chronic fatigue syndrome and long covid: moving beyond the controversy
	Aug2021	33. Norton A	UK/Can	Long COVID: tackling a multifaceted condition requires a multidisciplinary approach
	Aug2021	34. Parums DV	USA	Editorial: Long COVID, or Post-COVID Syndrome, and the Global Impact on Health Care
	Aug2021	35. Phillips S	USA	Confronting Our Next National Health Disaster - Long-Haul Covid
	Aug2021	36. Rello J	France	Post-acute COVID-19 Syndrome (PACS): A public health emergency
	Aug2021	37. Sancak B	Turkey	Long COVID and Its Psychiatric Aspects
	Aug2021	38. Sancak B	Turkey	A Psychiatrist's Own Experience of Long Covid: Beyond the Psychosomatic Perspective
	Aug2021	39. Sathish T	Can/India	New-onset diabetes in "long COVID"
	Aug2021	40. Simpson F	UK	Long COVID in children: the perspectives of parents and children need to be heard
	Aug2021	41. Sivan M	UK	Fresh evidence of the scale and scope of long covid
	Aug2021	42. Stewart-Patterson C	Can/USA	Keeping Patients with Post-Acute Sequelae of SARS-CoV-2 Infection Engaged in Work
	Aug2021	43. Subbaraman N	USA	US health agency will invest $1 billion to investigate 'long COVID'
	Aug2021	44. Tammaro A	Italy/Austral	Cutaneous long COVID
	Aug2021	45. The Lancet Neurology	UK	Long COVID: understanding the neurological effects
	Aug2021	46. Thomson H	UK	Children with long covid
	Aug2021	47. Venkatesan P	UK	NICE guideline on long COVID
	Aug2021	48. Wise J	UK	Long covid: doctors call for research and surveillance to capture disease
	Aug2021	49. Wise J	UK	Long covid: WHO calls on countries to offer patients more rehabilitation
	Aug2021	50.	USA	Meeting the challenge of long COVID

Annex 11

Multisystem Inflammatory Syndromes

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', MIS_Child&Adult Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Zhang Y	China	New understanding of the damage of SARS-CoV-2 infections outside the respiratory system.
	Aug2020	2. Gomez-Pastora	USA	Hyperferritinemia in critically ill COVID-19 patients: product of inflammation or mediator?
	Aug2020	3. Soy M	Turkey	Hemophagocytic lymphohistiocytosis: a review inspired by COVID-19 pandemic
	Aug2020	4. Singh-Grewal D	Aust/NZ	Update on COVID-19 MIS-C
	Dec2020	5. Upadhyay J	India	Role of inflammatory markers in COVID-19 patients
	Dec2020	6. Santos BSD	Brazil	Clinical-epidemiological relation between SARS-CoV-2 and Kawasaki disease
	Dec2020	7. Abrams JY	USA	MIS-C associated with SARS-CoV-2: systematic review
	Dec2020	8. Sperotto F	USA	Cardiac manifestations in SARS-CoV02 associated MIS-C
	Dec2020	9. Loomba RS	USA	COVID-19 and MIS-C: Kawasaki disease with macrophage activation syndrome in disguise?
	Dec2020	10. Sims JT	US/UK/Italy	Characterization of the cytokine storm reflects hyperinflammatory endothelial dysfunction
	Dec2020	11. Goncalves LF	Brazil	Kawasaki and COVID-19 disease in children
	Dec2020	12. Rife E	USA	Kawasaki disease: an update
	Dec2020	13. Simon Jr H	Brazil	MIS associated with COVID-19 from pediatric emergency physician's point of view
	Dec2020	14. Kaushik A	USA/India	Systematic review of MIS-C
	Dec2020	15. Aronoff SC	USA	Natural history of SARS-CoV-2 related MIS-C: systematic review
	Dec2020	16. Lami F	Italy	"Perfect storm": current evidence on MIS-C during SARS-CoV-2 pandemic
	Dec2020	17. Sarzaeim M	Iran	Kawaski disease and MIS-C
	Dec2020	18. Bustos BR	Chile/Colum	MIS-C associated with SARS-CoV-2: case series quantitative systematic review.
	Dec2020	19. Berardicurti O	Italy	Wide spectrum of Kawasaki-like disease associated with SARS-CoV-2 infection.
	Dec2020	20. Lawrensia S	Indonesia	MIS-C associated with SARS-CoV-2
	Dec2020	21. Carter MJ	UK	MIS-C temporally-associated with SARS-CoV-2 infection: overview
	Dec2020	22. Cavallo F	Italy	An outbreak of Kawasaki-like Disease in children during SARS-CoV-2: no surprise?
	Aug2021	23. Medaglia AA	Italy	Kawasaki disease recurrence in the COVID-19 era
	Aug2021	24. Novellli L	Italy/USA	The JANUS of chronic inflammatory and autoimmune diseases onset during COVID-19
	Aug2021	25. Akca UK	Turkey	Kawasaki-like disease in children with COVID-19

	Aug2021	26. Mardi P	Iran	Characteristics of children with Kawasaki disease-like signs in COVID-19
	Aug2021	27. Keshavarz P	Iran/Georgia	COVID-19: review of 133 children presenting with Kawasaki like MIS
	Aug2021	28. Murphy Jones L	USA	MIS in children: a microcosm of challenges and opportunities for translational bioinformatics
2. Meta-Analyses	Aug2020	1. Feng X	China	Immune-inflammatory parameters in COVID-19 cases: Systematic review & meta-analysis
	Dec2020	2. Jiang L	Canada	COVID-19 and MIS-C
	Dec2020	3. Leisman DE	USA	Cytokine elevation in severe, critical COVID-19: rapid systematic review & meta-analysis
	Aug2021	4. Zou H	China	Characteristics of MIS-C in COVID-19
	Aug2021	5. Hoste L	Belgiuim	MIS-C related to COVID-19
	Aug2021	6. Toraih EA	USA	MIS in pediatric COVID-19 patients
	Aug2021	7. Zhao Y	China	Inflammatory markers of MIS-C and adolescents associated with COVID-19
	Aug2021	8. Dhar D	India	Systemic inflammatory syndrome in COVID-19 – SISCoV study
	Aug2021	9. Baradaran A	Iran	COVID-19 associated MIS
3. Patho-genesis / hypothesis *	May2020	1. Colafrancesco S	Italy	COVID19 gone bad: New character in the spectrum of hyperferritinemic syndrome?
	May2020	2. Calabrese LH	USA	Cytokine storm and prospects for immunotherapy with COVID-19.
	May2020	3. McGonagle D	UK	COVID-19 induced pneumonia and macrophage activation syndrome-like disease.
	May2020	4. Ruscitti P	Italy	Cytokine storm syndrome in severe COVID-19.
	May2020	5. Amiral J	France	COVID-19 induced activation of hemostasis & immune reactions: Auto-immune reaction?
	May2020	6. Alunno A	Italy	Storm, typhoon, cyclone or hurricane in COVID-19? Beware_same storm_different origin.
	May2020	7. Li H	China	SARS-CoV-2 and viral sepsis: observations and hypotheses.
	Aug2020	22 new publications	Multiple	For Aug20/Dec20 additions see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', 'Multisystem Inflammatory Synd' tab; (Subgroup 2 = pathogenesis)
	Dec2020	20 new publications	Multiple	
4. Guidelines*	May2020	1. ECDC	Europe	Pediatric inflammatory multisystem syndrome & SARS-CoV-2: rapid risk assessment
	May2020	2. RCPCH	UK	Pediatric multisystem inflammatory syndrome temporally associated with COVID-19
	May2020	3. WHO	Global	Multisystem inflammatory syndrome in children and adolescents with COVID-19
	May2020	4. CDCP	USA	Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with COVID-19
5. Studies*	May2020	1. Verdoni L	Italy	Outbreak of severe Kawasaki-like disease at Italian COVID epicenter: observational cohort
	May2020	2. Belhadjer Z	France	Acute heart failure in multisystem inflammatory syndrome in children
	Aug2020	3. Grimaud M	France	Acute myocarditis and MIS-C following SARS-CoV-2 infection
	Aug2020	4. Toubiana J	France	Kawasaki-like MIS-C during covid-19 pandemic in Paris: prospective observational study
	Aug2020	5. Belot A	France	SARS-CoV-2-related MIS-C: an epidemiological study, France
	Aug2020	6. Pouletty M	France	MIS-C mimicking Kawasaki disease (Kawa-COVID-19): a multicentre cohort.
	Aug2020	7. Kaushik S	USA	MIS-C: A Multi-institutional Study from New York City.

	Aug2020	8. Capone CA	USA	Characteristics, Cardiac involvement, and Outcomes of MIS-C
	Aug2020	9. Perez-Toledo	UK	Serology confirms SARS-CoV-2 infection in PCR-negative MIS-C
	Aug2020	10. McElvaney OJ	Ireland	Characterization of Inflammatory Response to Severe COVID-19 Illness.
	Aug2020	11. Wang W	China	Definition & Risks of Cytokine Release Syndrome in 11 Critically Ill Patients with Pneumonia:
	Aug2020	12. Chen TH	Taiwan/USA	Gastrointestinal involvements in children with MIS-C
	Aug2020	13. Ouldali N	France	Emergence of Kawasaki disease related to SARS-CoV-2: a time-series analysis France.
	Aug2020	14. Prilutskiy A	USA	SARS-CoV-2 Infection-Associated Hemophagocytic Lymphohistiocytosis
	Aug2020	15. Fraser DD	USA	Inflammation Profiling of Critically Ill COVID-19 Patients
	Aug2020	16. Dufort EM	USA	MIS-C in New York State
	Aug2020	17. Feldstein LR	USA	MIS-C in U.S. Children and Adolescents
	Aug2020	18. Bhandari S	India	Inflammatory Markers in COVID-19
	Aug2020	19. Diorio C	USA	MIS-C & COVID-19 are distinct presentations of SARS-CoV-2
	Aug2020	20. Blumfield E	USA	Imaging Findings in MIS-C
	Dec2020	21. Losocco GG	Italy	HScore for secondary HLH, calculated without marrow biopsy is low in COVID-19
	Dec2020	22. Choe SA	S Korea	No temporal association: human coronavirus & Kawasaki disease: South Korea
	Dec2020	23. Lio K	Japan	Kawasaki or Kawasaki-like disease: influence of SARS-CoV-2 infections in Japan
	Dec2020	24. Theocharis P	UK	Multimodality cardiac evaluation MIS-C
	Dec2020	25. Carter MJ	UK	Peripheral immunophenotypes in MIS-C
	Dec2020	26. Davies P	UK	Intensive care admissions for MIS-C in UK: a multicentre observational study
	Dec2020	27. De Farias ECF	Brazil	MIS-C: Multi-centered Study - Brazil
	Dec2020	28. Dhanalakshmi	India	Epidemiological & Clinical Profile of MIS-C in Indian Children
	Dec2020	29. Godfred-Cato	USA	MIS-C: United States, March-July 2020
	Dec2020	30. Jain S	India	MIS-C: Mumbai, India
	Dec2020	31. Mamishi S	Iran	MIS-C in 45 Children: 1st Report from Iran
	Dec2020	32. Matsubara D	USA	Echocardiographic Findings in MIS-C in the United States
	Dec2020	33. Rostad CA	USA	Quantitative SARS-CoV-2 Serology in Children With MIS-C
	Dec2020	34. Sadiq M	Pakistan	MIS-C: Pakistan
	Dec2020	35. Torres JP	Chile	MIS-C: clinical & epidemiological characteristics Santiago de Chile
	Dec2020	36. Pereira MFB	Brazil	Severe clinical spectrum with high mortality in MIS-C
	Dec2020	37. Webb Bj	USA	Clinical criteria for COVID-19-associated hyperinflammatory syndrome: a cohort study
	Dec2020	38. Hutchings SD	UK	Microcirculatory/Endothelial/Inflammatory Responses: COVID-19 vs Septic Shock
	Dec2020	39. Minocha PK	USA	Cardiac Findings in MIS-C

	Dec2020	40. Zeichner SL	USA	MIS-C and SARS-CoV-2 Serology
	Dec2020	41. Bordet J	France	MIS-C: filling the gap between myocarditis and Kawasaki?
	Dec2020	42. Grazioli S	Switzerland	Immunological assessment of MIS-C
	Dec2020	43. Valverdi I	Europe	Acute Cardiovascular manifestations in 286 European children with MIS-C
	Dec2020	44. Garcia-Salido	Spain	CD64, CD11a and CD18 leukocytes expression: MIS-C vs Kawasaki disease
	Dec2020	45. Caro-Paton GL	Spain	Shock and Myocardial Injury in Children With MIS-C: case series & review
	Dec2020	46. Sethuraman U	USA	MIS-C in Michigan
	Dec2020	47. Antunez-Montes	Multiple	MIS-C in Latin American Children: A Multinational Study
	Dec2020	48. OkarskaNapierat	Poland	MIS-C in Poland during Months with Low COVID-19 Prevalence: Registry
	Dec2020	49. Deep A	UK	Acute Kidney Injury in MIS-C: United Kingdom experience
	Dec2020	50. Dionne A	USA	Atrioventricular Block in MIS-C
	Dec2020	51. Clark KEN	UK	Assessment of HLH HScore in COVID-19 patients
	Dec2020	52. Corwin DJ	USA	Distinguishing MISC from Kawasaki Disease and benign inflammatory illnesses
	Dec2020	53. Ece I	Turkey	Assessment of cardiac arrhythmic risk in children with CO VID-19
	Dec2020	54. Gaitonde M	USA	COVID-19 related MISC affects LVent function & global strain compared with Kawasaki
	Dec2020	55. Hakim NN	USA	Secondary HLH versus cytokine release syndrome in severe COVID-19
	Dec2020	56. Pang J	UK	SARS-CoV-2 polymorphisms and MIS-C
6. Case Reports/Series*				
MIS-C (Children)	May2020	1. Licciardi F	Italy	SARS-CoV-2 induced Kawasaki-like hyperinflammatory Syndrome: novel child phenotype
	May2020	2. Acharyya	India	Novel Coronavirus mimicking KD in an infant.
	May2020	3. Patel PA	USA	Severe pediatric COVID-19 presenting with respiratory failure and severe thrombocytopenia
	May2020	4. Riphagen S	UK	Hyperinflammatory shock in children during COVID-19 pandemic
	May2020	5. Chiotos K	USA	MIS-C in children during COVID-19 pandemic: case series
	Aug2020	39 new case reports	Multiple	For Q1/Dec2020 see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021',
	Dec2020	43 new case reports	Multiple	'Multisystem Inflammatory Synd' tab; (Subgroup 1=pediatric, Subgroup2=case reports))
MIS-A (Adult)	Aug2020	1. Wang C	China	Alveolar macrophage dysfunction and cytokine storm in two fatal COVID-19 cases
	Aug2020	2. Chhetri S	Oman	Fatal COVID-19: metabolic acidosis followed by cytokine storm
	Aug2020	3. Haberman R	USA	COVID-19 in immune mediated inflammatory diseases: New York case series
	Aug2020	4. Bonnet M	France	Endomyocardial biopsy findings in Kawasaki-like disease associated with SARS-CoV-2
	Aug2020	5. Moghadam P	France	MIS-A with particular cutaneous lesions
	Dec2020	6. Chowdhary A	UK	MIS in an adult with SARS-CoV-2 infection
	Dec2020	7. Cogan E	Belgium	MIS-A With Complete Kawasaki Disease Features

	Dec2020	8. Feng Y	USA	Novel case of an adult with toxic shock syndrome following COVID-19 infection
	Dec2020	9. Lidder AK	USA	An adult with COVID-19 Kawasaki-like syndrome and ocular manifestations
	Dec2020	10. Lolachi S	Switzerland	Macrophage activation syndrome: A case report
	Dec2020	11. Chau VQ	USA	Cardiogenic Shock and Hyperinflammatory Syndrome in Young Males with COVID-19
	Dec2020	12. Morris SB	UK	Case Series of MIS-A: UK and USA March-August 2020
	Dec2020	13. Kofman AD	USA	MIS-A: a case report
	Dec2020	14. Abdollahi A	Iran	Possibility of hemophagocytic lymphohistiocytosis in COVID-19 patients
	Dec2020	15. Othenin-Girard A	Switzerland	MIS-A with refractory cardiogenic shock, acute myocarditis & mononeuritis multiplex
	Dec2020	16. Burgi Vieira C	Portugal	Kawasaki-like Syndrome as an Emerging Complication in Young Adults
	Dec2020	17. Nicol M	France	Delayed acute myocarditis and COVID-19-related MIS
	Dec2020	18. Hekimian G	France	COVID-19 acute myocarditis and MIS in Adult intensive and cardiac care units
Kawasaki Disease & Kawasaki-like syndromes	May2020	1. Jones VG	USA	COVID-19 and Kawasaki Disease: novel virus and novel case
	May2020	2. Rivera-Figueroa	USA	Incomplete Kawasaki Disease in a child with COVID-19.
	Aug2020	3. Charif MY	USA	COVID-19 related Kawasaki-like disease in an adult
	Dec2020	4. To KK	China	False positive SARS-CoV-2 serology in 3 children with Kawasaki disease
	Dec2020	5. Rehman S	Saudi Arabia	Syndrome resembling Kawasaki disease in COVID-19 asymptomatic children
HLH	Aug2020	1. Radmanesh F	USA	Severe cerebral involvement in adult-onset hemophagocytic lymphohistiocytosis (HLH)
	Aug2020	2. Dewaele K	Belgium	HLH in SARS-CoV-2 infection
	Aug2020	3. Ruscitti P	Italy	Lung involvement in macrophage activation syndrome and severe COVID-19
	Dec2020	4. VonderThusen J	Netherlands	Fatal combination of HLH with extensive pulmonary microvascular damage in COVID-19
	Dec2020	5. Amaral LTQ	Brazil	Hemophagocytic syndrome: a potential COVID-19 complication

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 12

Musculoskeletal System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Musculoskeletal Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	Aug2020 Aug2020 Aug2020	Cipollaro L Schett G Disser NP	Italy Germany USA	Musculoskeletal symptoms in COVID-19 patients COVID-19 revisiting inflammatory pathways of arthritis Musculoskeletal consequences of COVID-19
2. Meta-Analyses				
3. Pathogenesis*				
4. Guidelines*				
5. Studies*				
6. Case Reports/Series*				
Myositis	May2020 Aug2020 Dec2020 Dec2020 Dec2020	1. Beydon M 2. Zhang H 3. Mehan WA 4. Almadani M 5. Ishkanian A	France USA USA USA USA	Myositis as a manifestation of SARS-CoV-2 COVID-19 associated myositis with severe proximal and bulbar weakness Paraspinal myositis in patients with COVID-19 Compartment syndrome secondary to viral myositis as initial COVID-19 presentation Clinical conundrum: Dysphagia in patient with COVID-19 & progressive muscle weakness
Rhabdomyolysis	May2020 May2020 Aug2020 Aug2020 Aug2020 Aug2020 Aug2020 Aug2020 Aug2020 Aug2020	1. Jin M 2. Suwanwongse K 3. Chan KH 4. Gefen AM 5. Borku Uysal B 6. Rivas Garcia S 7. Valente-Acosta B 8. Zhang Q 9. Chedid NR 10. Mukherjee A	China USA USA USA Turkey Spain Mexico USA USA USA	Rhabdomyolysis as potential late complications associated with COVID-19 Rhabdomyolysis as a presentation of COVID-19 Weakness & elevated creatinine kinase as initial presentation of COVID-19 Pediatric COVID-19-associated rhabdomyolysis: a case report A COVID-19 Patient Presenting with Mild Rhabdomyolysis. Rhabdomyolysis as the main manifestation of COVID-19 Rhabdomyolysis as an initial presentation of COVID-19. COVID-19 Induced Viral Myositis & Subsequent Rhabdomyolysis. COVID-19 and Rhabdomyolysis Rhabdomyolysis in a Patient With COVID-19

	Aug2020	11. Samies NL	USA	Rhabdomyolysis and Acute Renal Failure in an Adolescent with COVID-19
	Aug2020	12. Husain R	USA	Rhabdomyolysis as a manifestation of a severe case of COVID-19
	Dec2020	13. Alrubaye R	USA	Severe Rhabdomyolysis in a 35-Year-old Woman with COVID-19
	Dec2020	14. He YC	China	Rhabdomyolysis as Potential Late Complication Associated with COVID-19
	Dec2020	15. Taxbro K	Sweden	Rhabdomyolysis and acute kidney injury in severe COVID-19 infection
	Dec2020	16. Chong WH	USA	SARS-CoV-2 with Rhabdomyolysis and Acute Kidney Injury
	Dec2020	17. Meegada S	USA	Coronavirus Disease 2019-Induced Rhabdomyolysis
	Dec2020	18. Singh B	USA	Rhabdomyolysis in COVID-19: Report of Four Cases
	Dec2020	19. Tram N	Belgium	Rhabdomyolysis & Acute Kidney Injury as COVID-19 Presentation in an Adolescent
	Dec2020	20. Murillo F	Peru	SARS-CoV-2 Infection Rhabdomyolysis and Probable Myocarditis
	Dec2020	21. Shanbhag A	USA	COVID-19 Presenting as Severe Rhabdomyolysis With Normal Renal Function
	Dec2020	22. Buckholz AP	USA	Clinical Characteristics/Diagnosis/Outcomes of 6 Patients With COVID-19 Rhabdomyolysis
	Dec2020	23. Anklesaria Z	USA	Fatal Rhabdomyolysis in a COVID-19 Patient on Rosuvastatin
	Dec2020	24. Gilpin S	USA	Rhabdomyolysis as the Initial Presentation of SARS-CoV-2 in an Adolescent
Arthritis +/or Arthralgia	May2020	1. Joob B	Thailand	Arthralgia as an initial presentation of COVID-19
	Aug2020	2. Lopez-Gonzailez	Spain	Case series of acute arthritis during COVID-19 admission
	Aug2020	3. Alivernini S	Italy	Comparative analysis of synovial inflammation after SARS-CoV-2 infection
	Aug2020	4. De Stefano L	Italy	Transient monoarthritis and psoriatic skin lesions following COVID-19
Other	Dec2020	1. Van Aerde N	Belgium	Intensive care unit acquired muscle weakness in COVID-19 patients

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 13

Neurologic System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Neurologic Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Asadi-Pooya AA	Iran, USA	CNS manifestations of COVID-19: a systematic review
	May2020	2. Troyer EA	USA	Neuropsychiatric sequelae of COVID-19 – potential immunologic mechanisms
	May2020	3. Wu Y	China	CNS involvement after infection with COVID19 and other coronaviruses
	May2020	4. Li H	China	Involvement of the Nervous System in SARS-CoV-2
	May2020	5. Daou BJ	USA	Neurologic implications of COVID19: lessons learned from prior epidemics
	May2020	6. Liu K	China	Neurologic manifestations of SARS-CoV-2
	May2020	7. Finsterer J	Austria	Update on the neurology of COVID-19
	Aug2020	8. Acharya A	USA	SARS-CoV-2 infection leads to neurologic dysfunction
	Aug2020	9. Ahmad I	Pakistan	Neurologic manifestations and complications of COVID-19
	Aug2020	10. Gklinos P	Greece	Neurologic manifestations of COVID-19
	Aug2020	11. Montalvan V	USA/Hondur	Neurologic manifestations of COVID-19 and other coronavirus infections
	Aug2020	12. Munhoz RP	Braz/US/Can	Neurological complications in patients with SARS-CoV-2
	Aug2020	13. Roman GC	Global	Neurology of COVID-19 revisited
	Aug2020	14. Romoli M	Europe-mult	Neurologic manifestations of SARS-CoV-2: the devil is hidden in the details
	Aug2020	15. Sheraton M	USA	Neurologic complications of COVID-19
	Aug2020	16. Vonck K	Belgium	Neurologic manifestations of SARS-CoV-2
	Aug2020	17. Whittaker A	UK	Neurological manifestations of COVID-19
	Aug2020	18. Zubair AS	USA	Neuropathogenesis and neurologic manifestations of COVID-19
	Aug2020	19. Ahmed MU	Pakistan	Neurologic manifestations of COVID-19
	Aug2020	20. Azim D	Pakistan/US	Neurologic consequences of 2019-nCoV infection
	Aug2020	21. Ellul MA	UK/India	Neurological associations of COVID-19
	Aug2020	22. Ghannam M	USA	Neurologic involvement of COVID-19
	Aug2020	23. Verstrepen K	Belgium	Neurologic manifestations of COVID-19, SARS and MERS
	Aug2020	24. Koralnik IJ	USA	COVID-19: a global threat to the nervous system
	Aug2020	25. Payus AO	Malaysia	SARS-CoV-2 infection of the nervous system

	Aug2020	26. Rahman J	USA	Neurologic and psychological effects of COVID-19
	Aug2020	27. Tsai ST	Taiwan	Neurologic manifestations of COVID-19 pandemic
	Aug2020	28. Tsivoulis G	Europe-mult	Neurological manifestations and implications of COVID-19
	Aug2020	29. Fiani B	US/Mex/Can	Neurological sequelae of COVID-19
	Aug2020	30. Nepal G	US/Ch/Nepal	Neurological manifestations of COVID-19
	Aug2020	31. Yavarpour-Bali H	Iran	Update on neurological manifestations of COVID-19
	Aug2020	32. Chen X	China/Germ	Neurological symptoms and complications of COVID-19
	Aug2020	33. Silva MTT	Brazil	SARS-CoV-2: should we be concerned about the nervous system
	Aug2020	34. DiCarlo DT	Italy	Exploring clinical association between neuro symptoms & COVID-19 pandemic
	Aug2020	35. Almufarrij I	UK/SaudiAra	Does coronavirus affect the audio-vestibular system?
	Aug2020	36. Harenberg	Germ/Italy	Liaison between sudden sensorineural hearing loss and SARS-CoV-2
	Aug2020	37. Gupta I	Italy	Atypical neurological manifestations of COVID-19
	Aug2020	38. Espindola OM	Brazil	COVID-19 pts with neuro manifestations show undetectable SARS-CoV-2 RNA in CSF
	Aug2020	39. Sepehrinezhad A	Iran	COVID-19 may have neuroinvasive potential and cause neuro complications
	Dec2020	40. Adamczyk-Sowa M	Poland	Neurologic symptoms as clinical manifestations of COVID-19
	Dec2020	41. Agarwal A	USA	Neurologic emergencies associated with COVID-19
	Dec2020	42. Almqvist J	Sweden	Neurologic manifestations of coronavirus infections
	Dec2020	43. Alomari SO	Lebanon	COVID-19 and the nervous system
	Dec2020	44. Azizi SA	USA	Neurological injuries in COVID-19 patients
	Dec2020	45. Finsterer J	Austria/Braz	Infectious/parainfectious, nonvascular, nonhypoxic CNS disease in 48 COVID-19 pts
	Dec2020	46. Hassett CE	USA	Neurologic complications of Covid-19
	Dec2020	47. Morgello S	USA	Coronaviruses and the CNS
	Dec2020	48. Msigwa SS	Tanzania/Chi	Neurologic insights of the emerging coronaviruses
	Dec2020	49. Najjar S	USA	CNS complications associated with SARS-CoV-2 infection
	Dec2020	50. Pezzini A	Italy	Lifting the mask on neurologic manifestations
	Dec2020	51. Sultana S	India	COVID-19 and its impact on neurologic manifestations and mental health
	Dec2020	52. De Assis GG	Poland	Possible mechanisms of neurologic implications
	Dec2020	53. Desforges M	Canada	Human coronaviruses and other respiratory viruses
	Dec2020	54. Jarrahi A	USA	Neurologic consequences of Covid-19
	Dec2020	55. Orru g	Italy	Neurologic complications of cOVid-19 and possible neuroinvasive pathways
	Dec2020	56. Puccioni-Sohler M	Brazil	Current evidence of neurologic features
	Dec2020	57. Rahman A	Sri Lanka	Neurologic manifestations in COVID-19

	Dec2020	58. Zangbar S	Iran	Neurologic manifestations of COVID-19 infection
	Dec2020	59. Wenting A	Netherlands	COVID-19 neurologic manifestations and underlying mechanisms
	Dec2020	60. Goldberg MF	USA	Neuroradiologic manifestations of COVID-19
	Dec2020	61. Alshebri MS	SaudiArabia	Neurologic complications of SARS-CoV, MERS-CoV and COVID-19
	Dec2020	62. Cagnazzo F	France	Neurologic manifestations of patients infected with SARS-CoV-2
	Dec2020	63. Divani AA	USA	CNS manifestations associated with COVID-19
	Dec2020	64. Goh GX	Singapore	Neuroimaging in Zoonotic outbreaks affecting the CNS
	Dec2020	65. Ibrahim W	Egypt	Neurologic manifestations in COVID-19 patients
	Dec2020	66. Katyal N	USA	Neuromuscular complications with SARS-CoV-2 infection
	Dec2020	67. Kumar M	India	Neurologic manifestations and comorbidity associated with COVID-19
	Dec2020	68. Parsamanesh N	Iran	Neurologic manifestations of COVID infections: role of ACE2 in COVID-19
	Dec2020	69. Parsons N	Australia	Modelling the anatomical distribution of neurologic events in COVID-19 patients
	Dec2020	70. Pergolizzi JV	USA	Potential neurologic manifestations of COVID-19
	Dec2020	71. Satarker S	India	Involvement of the nervous system in COVID-19
	Dec2020	72. Valiuddin HM	USA	Update on neurologic manifestations of SARS-CoV-2
	Aug2021	73. Guerrero JI	Columbia	CNS and PNS involvement by COVID-19
	Aug2021	74. Parsons N	Australia	Modelling the anatomic distribution of neurologic events in patients with COVID-19
	Aug2021	75. Prakash A	India	nCOV-2019 infection induced neurological outcome and manifestation
	Aug2021	76. Tandon M	India/USA	CSF analysis that defines neurologic manifestations of COVID-19
	Aug2021	77. Yadav R	India	CNS involvement and its manifestations in SARS-CoV2 patients
	Aug2021	78. Gupta S	India	Bell's Palsy as the only major neurological manifestations in COVID-19 patients
	Aug2021	79. Mondal R	India/Spain	COVID-19 and emerging spinal cord complications
	Aug2021	80. Elbini Dhouib I	Tunisia	Does coronavirus induce neurodegenerative diseases?
	Aug2021	81. Leonardi M	Italy/USA	Neurologic manifestations associated with COVID-19
	Aug2021	82. Slyk S	Poland	Neurologic manifestations of SARS-CoV-2
	Aug2021	83. Taherifard E	Iran	Neurologic complications of COVID-19
	May2020 Thru Aug2021	No. Reviews Focused on: 30 Smell/Taste 13 GBS 5 Seizure 3 encephalitis/opathy 1 CNS bleed		Author, country and title of reviews focused on already identified AESIs are not specified but can all be found in excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab; filter on subgrp1 =specified Focus area, and subgrp2=review

2. Meta-Analyses	May2020	1. Tong JY	USA	Prevalence of olfactory & gustatory dysfunction in COVID19: SystRev/Meta-Analysis
	May2020	2. Aziz	USA	Taste Changes (Dysgeusia) in COVID-19: Systematic review/Meta-analysis.
	Aug2020	3. Wang L	China	Clinical manifestations and evidence of neurological involvement in COVID-19
	Aug2020	4. Pinzon RT	Indonesia	Neurologic characteristics in COVID-19
	Aug2020	5. Collantes MEV	Phillipines	Neurologic manifestations in COVID-19 infection
	Aug2020	6. Abdullahi A	Nigeria/+mul	Neurological and Musculoskeletal features of COVID-19
	Aug2020	7. Borsetto D	t	Self-reported alteration of sense of smell or taste in patients with COVID-19
	Aug2020	8. Hoang MP	UK	Olfactory and gustatory dysfunctions in COVID-19 patients
	Aug2020	9. Rocke J	Thai/VietNa	Is loss of sense of smell a diagnostic marker in COVID-19
	Aug2020	10. Agyeman AA	m	Smell and taste dysfunction in patients with COVID-19
	Dec2020	11. Madani Naishaboori	UK	CNS complications in COVID-19 patients
	Dec2020	12. Chua Th	Aust/Denmk	Neurological manifestations in COVID-19
	Dec2020	13. Favas TT	Iran/Iraq	Neurologic manifestations of COVID-19
	Dec2020	14. Hasan I	Indonesia	GBS associated with SARS-CoV-2 infection
	Dec2020	15. Chi H	India	1/7th of patients with COVID-19 had smell/taste abnormalities as initial symptoms
	Dec2020	16. Hajikhani B	Bang/Jap/Ne	Smell and Taste dysfunction in COVID-19 patients
	Dec2020	17. Ibekwe TS	t	Smell and taste disorders in COVID-19
	Dec2020	18. Pang KW	Taiwan	Frequency and clinical utility of smell dysfunction in COVID-19
	Aug2021	19. Nazari S	Iran/US	CNS manifestations in COVID-19 patients
	Aug2021	20. Soltani S	Nigeria	COVID-19 associated CNS manifestations, mental and neurological symptoms
	Aug2021	21. Yassin A	Singapore	Neurologic manifestations and complications of COVID-19
	Aug2021	22. Vakili K	Iran	Neurological symptoms, comorbidities and complications of COVID-19
	Aug2021	23. Aziz M	Iran	The association of “loss of smell” to COVID-19
	Aug2021	24. Hannum ME	Jordan	Objective sensory testing methods reveal a higher prevalence of Olfactory loss
	Aug2021	25. Kim JW	Iran	Regional & Chronological variation of chemosensory dysfunction in COVID-19
	Aug2021	26. Saniasiaya J	USA	Prevalence of Smell dysfunction in COVID-19: meta-analysis of 27,492 patients
	Aug2021	27. Saniasiaya J	USA	Prevalence &characteristics of taste disorders in COVID-19: meta-anal of 29,349 pts
	Aug2021	28. Mutiawati E	S Korea	Ansomia & dysgeusia in SARS-CoV-2 infection: incidence, effects on COVID severity
	Aug2021	29. Tan RQ	Malaysia	Clinical characteristics and epidemiologic features of smell dysfunction in COVID-19
			Malaysia	
			US/India/Ind	
			0	

			China	
3. Pathogenesis / hypothesis*	May2020 May2020 May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Baig AM 2. De Felice FG 3. Gandhi S 4. Li Z 5. Paniz-Mondolfi P 6. Steardo L 7. Vaira LA 23 new publications 45 new publications	Pakistan Brazil, Canada India China, UK USA Italy Multiple Multiple	Tissue Distribution, Host-Virus interaction & proposed neurotropic mechanisms SARS-CoV-2 and the CNS Is collapse of brain respiratory centre responsible for COVID resp breakdown Potential routes of SARS-CoV-2 neuroinvasion from periphery to the brain CNS involvement by SARS-CoV-2 Neuroinfection may contribute to pathophysiology/clinical manifestations Potential pathogenesis of ageusia and anosmia For Aug20/Dec20 updates see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup2=pathogenesis)
4. Guidelines / Registries*	May2020 May2020 May2020 Aug2020 Dec2020	1. Lao wP 2. Needham EJ 3. Soler ZM 4 new publications 1 new publication	USA UK, USA USA Multiple Multiple	Anosmia, hyposmia & dysgeusia as indicators for positive SARS-CoV-2 infection Neurological implications of COVID-19 infections A primer on viral-associated olfactory loss in the era of COVID19 For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup2=Guideline)
5. Studies*	May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020	1. Kandemirli SG 2. Beltran-Corbellini 3. Giacomelli A 4. Hopkins C 5. Hopkins C 6. Jitaroon K 7. Klopfenstein T 8. Luers JC 9. Mao L 10. Moein ST 11. Spinato G 12. Yan CH 13. De Maria A 14. Lee Y 15. Lu L	Turkey Spain Italy UK UK Thailand, USA France Germany China Iran, USA Italy, UK USA Italy Korea	Brain MRI findings in ICU patients with COVID-19 Acute-onset smell & taste disorders: pilot multicenter PCR based case-ctl study Self-reported olfactory & taste disorders in SARS-CoV-2: cross-sectional study Presentation of new anosmia during COVID-19 pandemic Early recovery following new onset anosmia: observational cohort study Evaluation of Incidence of other cranial neuropathies in patients with anosmia Features of anosmia in COVID-19 Olfactory & gustatory dysfunction in COVID-19 Neurologic manifestations of hospitalized patients with COVID-19 Smell dysfunction: a biomarker for COVID-19 Alterations in smell or taste in mildly symptomatic outpatients with SARS-CoV-2 Association of chemosensory dysfunction and COVID19 in patients with ILI High prevalence of olfactory and taste disorder during ARS-CoV-2 in outpatients Prevalence & Duration of acute loss of smell or Taste in COVID-19 patients New onset acute symptomatic seizure and risk factors in COVID-19

	May2020 May2020 Aug2020 Dec2020	16. Vaira LA 17. Kaye R 80 new studies 81 new studies	China Italy Multiple Multiple	Validation of a self-administered olfactory & gustatory test Anosmia reporting tool: initial findings For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup2=Study)
6. Case Reports/Series*				
Encephalitis	May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Duong L 2. Huang YH 3. Moriguchi T 4. Ye M 5. Bernard-Valnet R 26 new case reports 22 new case reports	USA USA Japan China Switzerland Multiple Multiple	Meningoencephalitis without respiratory failure in young female patient Update to Duong L(1 above): Detection of SARS-CoV-2 in CSF by PCR A first case of meningitis / encephalitis associated with SARS-CoV-2 Encephalitis as a clinical manifestation of COVID-19 Meningo-encephalitis concomitant to SARS-CoV-2 For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=encephalitis; subgroup2=case reports)
Encephalo-pathy	Aug2020 Dec2020	21 new case reports 26 new case reports	Multiple Multiple	For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=encephalopathy; subgroup2=case reports)
Generalized convulstion	Aug2020 Dec2020	12 new case reports 8 new case reports	Multiple Multiple	For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=seizure; subgroup2=case reports)
GBS	May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Scheidl E 2. Alberti P 3. Camedssanche JP 4. Gutierrez-Ortiz C 5. El Otmani H 6. Sedaghat Z 7. Toscano G 8. Virani A 9. Zhao H 10. Coen M 11. Ottoviani D 12. Pfefferkorn 34 new case reports 22 new case reports	Germany Italy France Spain Morocco Iran Italy USA China Switzerland Italy Germany Multiple Multiple	GBS during SARS-CoV-2: case report and review of recent literature GBS related to COVID-19 infection COVID-19 may induce GBS Miller Fisher syndrome and polyneuritis cranialis in COVID-19 (2 cases) COVID-19 and GBS: more than a coincidence GBS associated with COVID19 infection: a case report GBS associated with SARS-CoV-2 – 5 cases reported GBS associated with SARS-CoV-2 infection GBS associated with SARS-CoV-2 infection: causality or coincidence Fatal GBS after infection with SARS-CoV-2 GBS in COVID-19: a case report Acute polyradiculoneuritis with locked-in syndrome in a patient with COVID-19 For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=GBS; subgroup2=case reports)

ADEM	Aug2020 Dec2020	7 new case reports 3 new case reports	Multiple Multiple	For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=ADEM; subgroup2=case reports)
Myelitis	Aug2020 Dec2020	4 new case reports 12 new case reports	Multiple Multiple	For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=myelitis; subgroup2=case reports)
CNS bleed	May2020 May2020 May2020 Aug2020 Dec2020	1. Sharifi-Razavi A 2. Poyiadii N 3. Muhammad S 12 new case reports 11 new case reports	Iran USA Germany Multiple Multiple	COVID-19 and intracerebral haemorrhage: causative or coincidental COVID-19 associated Acute Hemorrhagic Necrotizing Encephalopathy Severe brain haemorrhage and concomitant COVID-19 For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021' neurologic tab (subgroup 1=CNS bleed; subgroup2=case reports)
Anosmia/ Ageusia	May2020 May2020 May2020 May2020 May2020 Aug2020 Dec2020	1. Gane SB 2. Galougahi MK 3. Oilarves-Carrerro 4. Gilani S 5. Hjelmesaeth J 15 new case reports 11 new case reports	UK Iran Spain Iran Norway Multiple Multiple	Isolated sudden onset anosmia in COVID-19 infection: A novel síndrome? Olfactory Bulb MRI in SARS-CoV02 induced anosmia: the first report Anosmia in a healcare worker with COVID-19 in Madrid Spain COVID-19 and anosmia in Tehran, Iran Loss of smell or taste as the only symptom of COVID-19 For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=smell/taste; subgroup2=case reports)
Other Cranial Nerve abnormalities	May2020 May2020 Aug2020 Dec2020	1. Dinkin M 2. Kaya Y 8 new case reports 17 new case reports	USA Turkey Multiple Multiple	COVID-19 infection presenting with ophthalmoparesis from cranial nerve palsy Transient cortical blindness in COVID-19 pneumonia For Aug20/Dec20 updates: see excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', neurologic tab (subgroup 1=cranial nerve-other; subgroup2=case reports)
Peripheral neuropathy	May2020 Dec2020	Abdelnour L Denes E	UK France	COVID-19 infection presenting as a motor peripheral neuropathy Temporal+Spatial concomitance of exanthema and dysesthesia in pt with COVID-19
Meningitis	Aug2020 Dec2020 Dec2020 Dec2020 Dec2020	Cebrian J Naz S Yousefi K Khodamoradi Z De Oliveira FAA	Spain Pakistan Iran Iran Brazil	Headache and impaired consciousness level associated with SARS-CoV-2 in CSF Meningitis as an Initial Presentation of COVID-19: A Case Report Viral meningitis associated with covid-19 in a 9-year-old child COVID-19 meningitis with positive cerebrospinal fluid PCR Headache and pleocytosis in CSF associated with COVID-19
Myoclonus	Aug2020 Dec2020 Dec2020	Rabano-Suarez Schellekens Borroni B	Spain Netherlands Italy	Generalized myoclonus in COVID-19 Reversible Myoclonus-Ataxia as a Postinfectious Manifestation of COVID-19 Diaphragmatic myoclonus due to SARS-CoV-2 infection

	Dec2020	Anand P	USA	Myoclonus in Patients With Coronavirus Disease 2019: A Multicenter Case Series
	Dec2020	Dijkstra F	Belgium	Myoclonus and cerebellar ataxia following Coronavirus Disease 2019 (COVID-19)
	Dec2020	Muccioli L	Italy	Subcortical myoclonus in COVID-19: comprehensive evaluation of a patient
	Dec2020	Ros-Castella V	Spain	Post-hypoxic myoclonus after COVID-19 infection recovery
	Dec2020	Shah PB	India	Opsoclonus myoclonus ataxia syndrome (OMAS) in the setting of COVID-19 infection
	Dec2020	Sanguinetti S	USA	Opsoclonus Myoclonus Ataxia Syndrome Related to COVID-19
SIADH	May2020	Yousaf Z	Qatar	COVID-19 associated SIADH: a clue in the times of pandemic
	Aug2020	Habib MB	Qatar	Acute symptomatic hyponatremia in setting of SIADH
	Aug2020	Ho KS	USA	SIADH as the initial presentation of COVID-19
CNS Vasculitis	Aug2020	Hanafi R	France	COVID-19 Neurologic Complication with CNS Vasculitis-Like Pattern.
	Aug2020	Pinto AA	UK	CNS inflammatory vasculopathy with anti-myelin oligodendrocyte glycoprotein
	Aug2020	Brun G	France	White matter & globus pallidum lesions: Demyelination or small-vessel vasculitis?
	Dec2020	De Sousa G	Brazil	Vasculitis-related stroke as a presenting feature
	Dec2020	Vaschetto R	Italy	CNS vasculitis in a COVID-19 patient with pneumonia
	Dec2020	Chia KX	UK	Possible affective cognitive cerebellar syndrome with CNS vasculopathy and stroke
Other	May2020	Zanin L	Italy	SARS-CoV-2 can induce brain and spine demyelinating lesions
	Aug2020	Noro F	Brazil	Benign intracranial hypertension: A case report
	Aug2020	Chaumont H	France	Mixed central and peripheral nervous system disorders
	Aug2020	Coolen T	Belgium	Early postmortem brain MRI findings in COVID-19 non-survivors.
	Aug2020	Diezma-Marten	Spain	Tremor and ataxia in COVID-19.
	Aug2020	Vitale JA	Italy	Is disruption of sleep quality a consequence of severe Covid-19 infection?
	Aug2020	Allard N	France	Acute hypothermia in Covid 19
	Aug2020	Eshak N	USA	Dysautonomia in a Critically ill COVID-19 Patient
	Dec2020	Dorgalaleh A	Iran	Persistent hiccups in a patient with mild congenital factor V deficiency
	Dec2020	Saleh AO	France	Urinary Retention and Severe Hyponatremia
	Dec2020	Cunha P	Qatar	Movement disorders as a new neurological clinical picture in severe SARS-CoV-2
	Dec2020	Sia J	Canada	Dizziness can be an early sole clinical manifestation for COVID-19 infection
	Dec2020	Tony AA	Egypt	COVID-19-associated sleep disorders: A case report
	Dec2020	Klein S	USA	COVID 19 Presenting with Tremors and Gait Disturbance

* The August 2021 search excluded these types of articles: Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor

Annex 14

Ocular System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Ocular Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	May2020	1. Hu K	USA	Ophthalmic manifestations of COVID-19
	May2020	2. Seah I	Singapore	Can COVID-19 affect the eyes
	Aug2020	3. Douglas KAA	US/Greece	Ocular Manifestations of COVID-19: Critical Review of Current Literature
	Aug2020	4. Ho D	Singapore	COVID-19 and the Ocular Surface: Review of Transmission/Manifestations
	Dec2020	5. Torres BRS	Brazil	Ocular manifestations of COVID-19: a literature review
	Dec2020	6. Bertoli F	Italy	Ocular Findings in COVID-19: Review of Direct Manifestations & Indirect Effects
	Dec2020	7. Tisdale AK	USA	Neuro-ophthalmic manifestations of COVID-19
	Dec2020	8. Sanghi P	UK	Ocular Complications in the Prone Position in the Critical Care Setting
	Dec2020	9. Luis ME	Portugal	Review of Neuro-Ophthalmological Manifestations of Human Coronavirus Infection
2. Meta-Analyses*	May2020	1. Ulhaq ZS	Indonesia	Prevalence of ophthalmic manifestations in COVID-19; diagnostic value of ocular fluid
	Dec2020	2. Aggarwal K	India/Sing	Ocular Surface manifestations of COVID-19: systematic review and meta-analysis
	Dec2020	3. Ling XC	Taiwan	Ocular manifestations/comorbidities and detection of SARS-CoV-2 in conjunctiva
3. Pathogenesis/ hypothesis*				
4. Guidelines*	May2020	1. Siedlecki J	Germany	Ophthalmological aspects of the SARS-CoV-2 global pandemic
5. Studies*	May2020	1. Wu P	China	Characteristics of ocular findings of patients with COVID-19
	Aug2020	2. Chen L	China	Ocular manifestations/clinical characteristics: 535 cases in Wuhan, China
	Aug2020	3. Bostanci CB	Turkey	Ocular manifestations of COVID-19
	Aug2020	4. Valente P	Italy	Ocular manifestations & viral shedding in tears of pediatric patients with COVID-19
	Aug2020	5. Abrishami M	Iran	Ocular Manifestations of Hospitalized Patients with COVID-19 in Northeast of Iran.
	Aug2020	6. Landecho MF	Spain	COVID-19 retinal microangiopathy as an in vivo biomarker of systemic vascular disease?
	Dec2020	7. Lee YH	Korea	Ocular Manifestations of Patients with COVID-19 in Daegu Province, Korea
	Dec2020	8. Ma N	China	Ocular Manifestations & Clinical Characteristics of Children With Confirmed COVID-19

	Dec2020	9. Sawant OB	USA	Prevalence of SARS-CoV-2 in human post-mortem ocular tissues
6. Case Reports/Series*				
Conjunctivitis	May2020	1. Cheema M	Canada	Keratoconjunctivitis as initial presentation of COVID-19
	May2020	2. Chen L	China	Ocular manifestations of a hospitalized patient with confirmed COVID-19
	Aug2020	3. Guo D	China	Relapsing viral keratoconjunctivitis in COVID-19
	Aug2020	4. Ozturker ZK	Turkey	Conjunctivitis as sole symptom of COVID-19: case report and review of literature
	Dec2020	5. Lim LW	Singapore	Acute onset of bilateral follicular conjunctivitis in two patients
Uveitis and/or retinitis	Aug2020	1. Virgo J	UK	Paracentral acute maculopathy & acute macular neuroretinopathy after COVID-19
	Aug2020	2. Bettach E	Israel	Bilateral anterior uveitis as part of a COVID-19 multisystem inflammatory syndrome
	Aug2020	3. QuintanaCastanedo	Spain	Concurrent chilblains and retinal vasculitis in a child with COVID-19.
	Dec2020	4. Benito-Pascual	Spain	Panuveitis and Optic Neuritis as Possible Initial Presentation of COVID-19
	Dec2020	5. Gascon P	France	Covid-19-Associated Retinopathy: A Case Report
	Dec2020	6. Ortiz-Seller A	Spain	Ophthalmic & Neuro-ophthalmic Manifestations of COVID-19
Other	Aug2020	1. Stevens DV	USA	Complications of Orbital Emphysema in a COVID-19 Patient
	Aug2020	2. Mendez Mangana C	Spain	Episcleritis as an ocular manifestation in a patient with COVID-19
	Aug2020	3. Ruiy W	Taiwan	COVID-19 mimicking dengue fever with retro-orbital pain
	Aug2020	4. Insausti-Garcia A	Spain	Papillophlebitis in a COVID-19 patient: Inflammation and hypercoagulable state
	Dec2020	5. Khan AW	Pakistan	Ischemic stroke leading to bilateral vision loss in COVID-19 patient
	Dec2020	6. Otaif W	SaudiArab	Episcleritis as a possible presenting sign of the novel coronavirus disease
	Dec2020	7. D'Aloisio R	Italy	Bilateral macular hemorrhage in a patient with COVID-19
	Dec2020	8. Sriwastava S	US/India	New onset ocular myasthenia gravis in COVID-19: novel case report & literature review

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 15

Population: Adults

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Populations_Adult Tab

Type of Reference	Review Period	Author	Country	Focus
Reviews	Aug2020	1. Behzad S	Iran/USA	Extrapulmonary manifestations of COVID-19: radiologic and clinical overview
	Aug2020	2. Lai CC	Taiwan	Extra-respiratory manifestations of COV ID-19
	Aug2020	3. Gulati A	USA	A comprehensive review of manifestations of novel coronaviruses in COVID-19 pandemic
	Aug2020	4. Harb JG	Lebanon	SARS, MERS, COVID-19: clinical manifestations and organ-system complications
	Aug2020	5. Gupta A	USA	Extrapulmonary manifestations of COVID-19
	Aug2020	6. Jamwal S	US/India/Ital	An updated insight into the molecular pathogenesis, secondary complications of COVID
	Aug2020	7. Zheng KI	Chin/Ital/UK	Extra-pulmonary complications of COVID-19: a multi-system disease?
	Aug2020	8. Gavriatopoulou M	Greece	Organ-specific manifestations of COVID-19 infection.
	Aug2020	9. Machhi J	USA	Natural history, pathobiology and clinical manifestations of SARS-CoV-2 infections
	Aug2020	10. Sacco G	France/Can.	Symptoms of COVID-19 among older adults. (article in French)
	Dec2020	11. Kordzadeh-Kermani E	Iran	Pathogenesis, clinical manifestations and complications of COVID-19
	Dec2020	12. Johnson KD	USA	Pulmonary and extra-pulmonary clinical manifestations of COVID-19
	Dec2020	13. Revzin MV	USA	COVID-19 Multisystem imaging 1: Pathogenesis, Pulmonary/vascular complications
	Dec2020	14. Sarkesh A	Iran	Extrapulmonary clinical manifestations of COVID-19 patients
	Dec2020	15. Rosen HR	USA	Extrapulmonary manifestations of SARS-CoV-2 infection
	Dec2020	16. Cates J	USA	Risk for in-hospital complications with COVID-19 and Influenza
	Aug2021	17. Sousa Neto AR	Brazil	Symptomatic manifestations of the disease caused by COVID-19 in adults.
	Aug2021	18. Da Rosa M	Brazil	Clinical manifestations of COVID-19 in the general population.
	Aug2021	19. Sessa	Italy	Autopsy tool in unknown diseases: Experience with SARS-CoV, MERS-CoV, SARS-CoV-2
Meta-Analyses	Aug2020	1. Cao Y	China	Imaging and clinical features of patients with SARSo-CoV-2
	Aug2020	2. Fu L	China	Clinical characteristics of COVID-19 in China
	Aug2020	3. Rafiq D	India	Three months of COVID-19
	Aug2020	4. Zhu J	China	Clinicopathological characteristics of 8697 patients with COVID-19 in CHINA
	Aug2020	5. Grant MC	UK	The prevalence of symptoms in 24,410 adults infected by SARS-CoV02
	Aug2020	6. Huang D	China	Clinical features of severe patients infected with COVID-19

	Aug2020	7. Koh J	Singapore	Epidemiological & Clinical characteristics of cases during early phases of COVID pandemic
	Aug2020	8. Sun P	China	Clinical characteristics of hospitalized patients with SARS-CoV-2 infection
	Dec2020	9. Wu T	China	Multi-organ dysfunction in patients with COVID-19
	Dec 2020	10. Vakili K	Iran	Critical complications of COVID-19
	Aug2021	11. Satturwar S	USA/Italy	Postmortem findings associated with SARS-CoV-2
	Aug2021	12. Liu X	China	East-West differences in clinical manifestations of COVID-19 patients.
	Aug2021	13. Tiruneh SA	Ethiopia	The effect of age on the incidence of COVID-19 complications
	Aug2021	14. Thakur B	USA	Geographic differences in comorbidities and associated severity and mortality
Studies (1st 5 China studies describing COVID-19)	May2020	1. Huang C	China	Clinical features of 41 Wuhan COVID patients
	May2020	2. Chen N	China	Epidemiology and clinical features of 99 Wuhan COVID patients
	May2020	3. Wang D	China	Description of 138 Wuhan hospitalized patients comparing 36 ICU & 102 non-ICU cases
	May2020	4. Guan W	China	Clinical manifestations of 1099 Chinese COVID patients
	May2020	5. Novel COVID epi team	China	Epidemiological characteristics of COVID-19 outbreak including 44,672 confirmed cases

Annex 16

Populations: Children including infants and neonates

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Populations_pediatric Tab

Type of Reference	Review Period	Author	Country	Focus
Reviews General	Aug2020	1. Castagnoli R	Italy	SARS-CoV-2 infection in Children and Adolescents
	Aug2020	2. De Souza Th	Brazil	Clinical manifestations of Children with COVID-19
	Aug2020	3. Liguoro I	Italy	SARS-CoV-2 infection in children and adolescents
	Aug2020	4. Panahi L	Iran	Clinical characteristics of COVID-19 infection in newborns and pediatrics
	Aug2020	5. Henry BM	USA	Laboratory abnormalities in children with mild and severe COVID-19
	Aug2020	6. Patel NA	USA	Pediatric COVID-19
	Aug2020	7. Raba AA	Ireland/UK	Novel COVID-19 in children younger than one year
	Aug2020	8. Saleem H	USA	COVID-19 in Children: Vulnerable or spared?
	Aug2020	9. Yu Y	China	COVID-19 in neonates and children from China
	Aug2020	10. Di Nardo M	Italy/Qatar	SARS-CoV-2 infection in neonates and children.
	Aug2020	11. De Bernardo G	Italy	Clinical course of SARS-CoV-2 positive neonates
	Dec2020	12. Jahangir M	Pakistan33	Clinical manifestations and outcomes of COVID-19 in the pediatric population
	Dec2020	13. Pousa PA	Brazil	Extrapulmonary manifestations of COVID-19 in children
	Dec2020	14. Chi H	Taiwan	Clinical features of neonates born to mothers with COVID-19
	Dec2020	15. Dhir SK	India	Clinical features and outcome of SARS0CoV-2 infection in neonates
	Dec2020	16. Green J	UK/Austral.	COVID-19 in babies – knowledge for neonatal care
	Dec2020	17. Nayak M	India	COVID-19 in neonates – what is known and what needs to be known?
	Dec2020	18. Trevisanuto D	Italy	Coronavirus infection in neonates
	Dec2020	19. Raschetti R	France	Synthesis and systematic review of reported neonatal SARS-CoV-2 infections
	Aug2021	20. Kitano T	Canada/Jap	Differential impact of Pediatric COVID-19 between HICs and LMICs
Reviews Body System Specific	Aug2020	1. Erdede O	Turkey	An overview of smell and taste problems in pediatric COVID-19 patients
	Aug2020	2. Siracusa	Italy	Neurological complications in pediatric patients with SARS-CoV-2 infection
	Dec2020	3. Panda PK	India	Neurological complications of SARS-CoV-2 infection in children
	Dec2020	4. Stafstrom CE	USA	Neurologic considerations in neonates and children

	Dec2020	5. Zhou YH	China	Abnormal liver enzymes in children and infants with COVID-19
	Dec2020	6. Kosmeri C	Greece	Hematologic manifestations of SARS-CoV-2 in children
	Aug2020	7. Shelmerdine SC	UK/Sp/Sw/Se	COVID-19 in children: imaging findings
Meta-Analyses General	Aug 2020	1. Ma X	China	Clinical characteristics of pediatric inpatients with SARS-CoV-2 infections
	Aug 2020	2. Meena J	India	Clinical features and outcome of SARS-CoV-2 infection in children
	Dec2020	3. Kachru S	India	COVID-19 manifestations in children
Meta-analyses Body System Specific	Aug2021	1. Nepal G	Nepal/US/NZ	Neurological manifestations of COVID-19 associated MIS-C
	Aug2021	2. Akobeng AK	UK/Qatar	GI manifestations of COVID-19 in children
	Aug2021	3. Bolia R	India	GI manifestations of pediatric COVID and relationship with severe clinical course
Studies*	Aug2020	1. Oualha M	France	Severe and fatal forms of COVID-19 in children
	Aug2020	2. Zhang C	China	Clinical and epidemiological characteristics of Pediatric SARS-CoV-2 infections in China
	Aug2020	3. Derespina KR	USA	Clinical manifestations and outcomes of critically ill Children and adolescents in NYC
	Aug2020	4. Qiu C	China	Smell and Taste dysfunction as an early identifier of COVID-19 in adults and children
	Aug2020	5. Stewart DJ	UK	Renal dysfunction in hospitalized children with COVID-19
	Dec2020	6. Zeng L	China	Neonatal early-onset infection with SARS-COV-2 in 33 neonates of Wuhan mothers
	Dec2020	7. Kanburoglu MK	Turkey	Multicentre study on epidem/clinical characteristics of 37 neonates with COVID19
	Dec2020	8. Kalamdani P	India	Clinical profile of COVID infected neonates in Mumbai India
	Dec2020	9. Gale C	UK	Characteristics and outcomes of neonatal infection in UK
	Dec2020	10. Morrone KA	USA	Acute chest syndrome in the setting of SARS-CoV-2 = Bronx case series
	Dec2020	11. Olivar-Lopez V	Mexico	Clinical risk profile of COVID infection and complications in pediatric emergency room
	Dec2020	12. Smarrazzo A	Italy	Threefold increase in admissions for pediatric febrile convulsions during COVID19
Case Reports: classified by system*				
General, Pediatric	Aug2020	1. Feld L	USA	COVID-19 in 3 febrile infants in New York
	Dec2020	2. Cai J	China	Case series of children with COVID-19: clinical and epidemiological features
	Dec2020	3. Chan JF	China	Case series of children with COVID-19: what have we learned?
	Dec2020	4. Dinkelbach L	Germany	COVID-19 in a child with known immunodeficiency, cardiomyopathy, chronic lung disease
	Dec2020	5. Heydari H	Iran	COVID-19 in a 2 month old male infant
	Dec2020	6. Soumana A	Niger	Fatal case of COVID-19 in an infant with severe acute malnutrition
	Dec2020	7. Loron G	France	COVID-19 associated with life-threatening apnea in a prematurely born infant
General, Neonatal	Aug2020	1. Piersigilli F	Belgium	COVID-19 in a 26 week preterm neonate
	Aug2020	2. White A	USA	Neonates hospitalized with community acquired SARS-COV-2

	Aug2020	3. Wardell H	USA	SARS-CoV-2 infection in Febrile neonates
	Aug2020	4. Xiong Y	China	Clinical and imaging features of COVID-19 in a neonate
	Aug2020	5. Eghbalian F	Iran	COVID-19 virus in a 6 day old girl neonate
	Dec2020	6. Dima M	Romania	First neonates with SARS-CoV-2 infection in Romania: 3 case reports
	Dec2020	7. Di Nicola P	Italy	Concomitant SARS-CoV-2 infection and severe neurologic involvement
	Dec2020	8. Sagheb S	Iran	Two seriously ill neonates born to mothers with COVID-19 pneumonia
	Dec2020	9. Lenoci G	Italy	SARS-CoV-2 isolation from a 10 day old newborn in Italy
	Dec2020	10. Trieu C	USA	Severe neonatal COVID-19 presenting as ARDS
	Dec2020	11. Saha S	Bangladesh	Direct and Indirect impact of SARS-CoV-2 infection on neonates: series of 26 cases
	Dec2020	12. Mukhopadhyay K	India	SARS-CoV-2 infection in a term neonate presenting with respiratory failure on day 3 of life
Cardiac	Dec2020	1. Santi AD	USA	Atrial fibrillation in a child with COVID-19 infection
Dermatologic				
Endocrine	Dec2020	1. Samies NL	USA	Pancreatitis in Pediatric patients with COVID-19
Gastro-intestinal	Aug2020	1. Ekbatani MS	Iran	Atypical and novel presentations of COVID19: three pediatric cases (all GI)
	Aug2020	2. Alsuwailem AB	Saudi Arabia	Complicated appendicitis in a pediatric patient with COVID-19
	Dec2020	3. Moazzam Z	Pakistan	Intussusception in an infant as a manifestation of COVID-19
	Dec2020	4. Bolia R	India	Recognizing the GI manifestation of Pediatric COVID-19
Hematologic	Dec2020	1. Al-Ghafry M	USA	Are children with SARS-CoV-2 infection at high risk for thrombosis?
Kidney	May2020	1. Almeida FJ	Brazil	Hematuria associated with SARS-CoV-2 in a child
Liver	Dec2020	1. HajiEsmaeil Memar	Iran	Fulminant hepatic failure: rare & devastating COVID19 manifestations in an 11 year old boy
Musculo-skeletal	Aug2020	1. Gefen AM	USA	Pediatric COVID-19 associated rhabdomyolysis
	Aug2020	2. Samies NL	USA	Rhabdomyolysis and Acute renal failure in an adolescent with COVID-19
	Dec2020	3. Tram N	Belgium	Rhabdomyolysis and AKI as leading COVID-19 presentation in an adolescent
	Dec2020	4. Gilpin S	USA	Rhabdomyolysis as the initial presentation of SARS-CoV-2 in an adolescent
Neurologic	Aug2020	1. McAbee N	USA	Encephalitis associated with COVID-19 in an 11. Year old child
	Dec2020	2. Arango Ferreira C	Columbia	Acute meningoencephalitis as initial presentation of COVID-19 in a child
	Dec2020	3. Yousefi K	Iran	Viral meningitis associated with COVID-19 in a 9 year old boy
	Dec2020	4. Roussel A	France	Cranial polyneuropathy as the first manifestation of a severe COVID-19 in a child
	Dec2020	5. Hatipoglu N	Turkey	Olfactory bulb MRI in SARS-CoV-2 induced anosmia in pediatric cases
	Dec2020	6. Kaur H	USA	Transverse myelitis in a child with COVID-19

	Aug2020	7. Khalifa M	Egypt	GBS associated with COVID-19 infection in a child
	Dec2020	8. Curtis M	USA	GBS in a child with COVID-19 infection
	Aug2020	9. Farley M	USA	COVID-19 precipitating status epilepticus in a pediatric patient
	Aug2020	10. Bhatta S	USA	New-onset seizure as the only presentation in a child with COVID-19
	Dec2020	11. Garcia Howard M	Spain	Benign infantile seizures temporally associated with COVID-19
	Dec2020	12. Saeed A	Iran	Status epilepticus as a first presentation of COVID-19 in a 3 year old boy
	Dec2020	13. Chegondi M	USA	COVID-19 associated with febrile Status epilepticus in a child
	Aug2020	14. Dugue R	USA	Neurologic manifestations in an infant with COVID-19
	Aug2020	15. Mak PQ	China	Anosmia and Ageusia: not an uncommon presentation of COVID-19 infection in children
Ocular				
Respiratory	Aug2020	1. Nyholm S	Sweden	Invasive mechanical ventilation in a former preterm infant with COVID-19
	Dec2020	2. Kalyanaraman M	USA	ARDS in an ex-premature infant with BPD and COVID-19
	Dec2020	3. Venn AMR	USA	A case series of pediatric croup with COVID-19

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).

Annex 17

Populations: Pregnant, Foetal, Neonatal

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Populations_Pregnancy_Perinatal Tab

Body System	Review Period	Author	Country	Focus
Reviews	Aug2020	1. Della Gatta AN	Italy	COVID-19 during pregnancy
	Aug2020	2. Muhidin S	Australia	Analysis of maternal coronavirus infections and neonates born to mothers with 2019-nCoV
	Aug2020	3. Trocado V	Portugal	Pregnancy and COVID-19: maternal, obstetric and neonatal outcomes
	Aug2020	4. Yang Z	China	COVID-19 and pregnancy
	Aug2020	5. Smith V	Australia	Maternal and neonatal outcomes associated with COVID-19 infection
	Aug2020	6. Zaigham M	Sweden	Maternal and perinatal outcomes with COVID-19: 108 pregnancies
	Aug2021	7. Makvandi S	Iran	2019 novel coronavirus disease in pregnancy
	Aug2020	8. Telos Abrao Trad A	USA	Complications and outcomes of SARS-CoV-2 in pregnancy: where and what is the evidence?
	Aug2020	9. Ashraf M	Iran	COVID-19 in pregnancy and possibility of vertical transmission
	Aug2020	10. Duran P	Uruguay	COVID-19 and newborn health
	Aug2020	11. Chi J	China	Clinical characteristics and outcomes of pregnant women with COVID-19
	Aug2020	12. Trippella G	Italy	COVID-19 in pregnant women and neonates
	Aug2020	13. Elshafeey F	Egypt	Systematic scoping review of COVID-19 during pregnancy and childbirth.
	Aug2020	14. Juan J	China	Effects of COVID-19 on maternal, perinatal and neonatal outcomes.
	Aug2021	15. Islam MM	Taiwan	Clinical characteristics and neonatal outcomes of pregnant patients with COVID-19
	Aug2020	16. Yang Z	China	Vertical transmission of SARS-CoV-2
	Aug2020	17. Yoon SH	Korea	Clinical outcomes of 201 neonates born to mothers with COVID-19
	Aug2020	18. Galang RR	USA	Severe coronavirus infections in pregnancy
	Aug2021	19. Novoa RH	Peru	Maternal clinical characteristics and perinatal outcomes among pregnant women with COVID
	Aug2020	20. Huntley BJF	USA	Rates of maternal and perinatal mortality and vertical transmission in COVID pregnancies
	Dec2020	21. Abou Ghayda R	USA	COVID-19 and adverse pregnancy outcome: a systematic review of 104 cases
	Aug2020	22. Walker KF	UK	Maternal transmission of SARS-CoV-2 to the neonate and possible routes for transmission
	Aug2020	23. Gordon M	UK	Rapid systematic review of neonatal COVID-19 including a case of presumed vertical transm.
	Aug2020	24. Vigil de Gracia P	Panama	Perinatal transmission with SARS-CoV-2 and route of pregnancy termination

	Dec2020	25. Bwire GM	Tanzania	Possible vertical transmission and antibodies vs SARS-CoV-2 among infants of COVID + moms
	Aug2021	26. Karimi L	Iran	571 pregnancies affected by COVID-19
	Aug2020	27. Akhtar H	UK	COVID-19 infection in pregnancy
	Dec2020	28. Pettirosso E	Australia	COVID19 and pregnancy: clinical characteristics, obstetric outcomes, vertical transmission
	Aug2020	29. Lopes de Sousa AF	Portugal	Effects of COVID-19 infection during pregnancy and neonatal prognosis
	Dec2020	30. Areia AL	Portugal	Can immunity during pregnancy influence SARS-CoV-2 infection?
	Aug2020	31. Deniz M	Turkey	Vertical transmission of SARS-CoV-2
	Aug2020	32. Auriti C	Italy	Vertical transmission of SARS-COV-2: are hypotheses more than evidence?
	Aug2021	33. Kim CNH	Canada	Maternal outcome of pregnant women admitted to ICUs for COVID-19
	Dec2020	34. Singh B	USA	SARS-CoV-2 and its effect on gametogenesis and early pregnancy
	Dec2020	35. Han Y	China	Clinical manifestation, outcomes in pregnant women with COVID-19 + possible vert transm
	Dec2020	36. Oliveira LV	Brazil	Current evidence of SARS-CoV-2 vertical transmission
	Aug2020	37. Sheth S	USA	Outcomes in COVID-19 positive neonates and possibility of viral vertical transmission
	Aug2021	38. Rodrigues C	Portugal	Pregnancy and breastfeeding during COVID-19 pandemic
	Aug2020	39. Nakamura Pereira M	Brazil	Worldwide maternal deaths due to COVID-19
	Dec2020	40. Hessami K	Iran	COVID-19 and maternal, fetal and neonatal mortality
	Dec2020	41. Figueiro Filho EA	Canada	COVID-19 during pregnancy: clinical & outcomes: 10,996 cases, 15 countries
	Dec2020	42. Sharps MC	UK	Placental morphology and histopathological lesions associated with SARS-CoV-2 infection
	Dec2020	43. Chamseddine RS	Qatar	Pregnancy and neonatal outcomes in SARS-CoV-2 infection
	Dec2020	44. Boushra MN	USA	COVID-19 in pregnancy and the puerperium: a review for emergency physicians
	Aug2021	45. Barcelos IDES	Brazil	Vertical transmission of SARS-CoV-2
	Aug2021	46. Ciapponi A	Argentina	COVID-19 and pregnancy: clinical presentation, vertical transmission, outcomes
	Aug2021	47. Dube R	UAE	COVID-19 in pregnancy: the foetal perspective
	Aug2021	48. Mirbeyk M	Iran	Pregnant women with COVID-19 and their neonates
	Aug2021	49. Oliveira KF	Brazil	Vertical transmission and COVID-19
	Aug2021	50. Oshay RR	USA	COVID-19 in pregnancy:chest CT findings and associated clinical features in 427 patients
	Aug2021	51. Tolu LB	Ethiopia	Vertical transmission of SARS-CoV-2
Reviews of Reviews	Aug2021	1. Ang XL	Singapore	Problems with early systematic reviews: The case of COVID-19 in pregnancy
	Aug2021	2. Papapanou M	Greece	Maternal/neonatal characteristics + outcomes of COVID-19 in pregnancy: overview of reviews
Meta-Analyses	Aug2020	1. Di Mascio D	Spain	Outcome of Coronavirus spectrum infections (SARS, MERS,COVID-19) during pregnancy
	Aug2020	2. Kasraeian M	Iran	COVID-19 pneumonia and pregnancy
	Aug2020	3. Capobianco G	Italy	COVID-19 in pregnant women

	Aug2020	4. Gao YJ	China	Clinical features and outcomes of pregnant women with COVID-19
	Dec2020	5. Allotey J	UK	Clinical manifestations, risk factors and perinatal outcomes of COVID-19 in pregnancy
	Dec2020	6. Diriba K	Ethiopia	Effect of coronavirus infection (SARS, MERS, COVID-19) during pregnancy
	Aug2020	7. Matar R	USA	Clinical presentation and outcomes of pregnant women with COVID-19
	Aug2020	8. Melo GC	Brazil	COVID-19 in pregnant women, preterm delivery, birthwt, vertical transmission
	Dec2020	9. Khalil A	UK	SARS-CoV02 infection in pregnancy
	Dec2020	10. Di Toro F	Italy	Impact of COVID-19 on maternal and neonatal outcomes
	Aug2020	11. Goh XL	Singapore	Incidence of SARS-CoV-2 vertical transmission
	Aug2020	12. Kotlyar AM	USA	Vertical transmission of COVID-19
	Aug2021	13. Bellos I	Greece	Maternal and perinatal outcomes in pregnant women infected by SARS-CoV-2
	Aug2021	14. Neef V	Germany	Characterization of neonates born to mothers with SARS-CoV-2 infection
	Dec2020	15. Dubey P	USA	Maternal and neonatal characteristics and outcomes among COVID-19 infected women
	Dec2020	16. Yee J	SKorea	Clinical manifestations and perinatal outcomes of pregnant women with COVID-19
	Aug2021	17. Chmielewska B	UK	Effects of the COVID-19 pandemic on maternal and perinatal outcomes.
	Aug2021	18. Huntley BJF	USA	Adverse pregnancy outcomes among individuals with and without SARS-CoV-2 infection
	Aug2021	19. Karimi L	Iran	Effect of COVID-19 on mortality of pregnant and postpartum women
	Aug2021	20. La Verde M	Italy	Maternal death related to COVID-19
	Aug2021	21. Lassi ZS	Australia	Pregnant women with confirmed COVID-19: clinical presentation and pregnancy outcomes
	Aug2021	22. Wei SQ	Canada	The impact of COVID-19 on pregnancy outcomes

Annex 18

Key Findings from Meta-analyses & Systematic Reviews on Maternal, Foetal and Neonatal Outcomes Associated with COVID-19

Key findings of each meta–analysis or review by maternal, foetal or neonatal outcome. The full citation for each study can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Tab named Populations_Pregnancy_Perinatal. The characteristics of each meta-analysis and systematic review are profiled in the adjacent tab named Pregnancy_Rev_MetaAn_Summaries. A third tab, names "Pregnancy_Studies by Reviews lists all studies included by any of the meta-analyses or systematic reviews and cross-tabulates each across all meta-analyses and reviews in terms of which studies were included in each meta-analysis and systematic review.

Study ID	Lead author - country	Maternal	Foetal	Neonatal
M01	Daniele Di Mascio – Spain	79 hospitalized women were eligible for this systematic review: 41 pregnancies (51.9%) affected by COVID-19, 12 (15.2%) by MERS, and 26 (32.9%) by SARS. An overt diagnosis of pneumonia was made in 91.8%, and the most common symptoms were fever (82.6%), cough (57.1%), and dyspnea (27.0%).	For all coronavirus infections, the pooled proportion of miscarriage was 64.7% (8/12; 95% confidence interval, 37.9-87.3), although reported only for women affected by SARS in two studies with no control group; the pooled proportion of perinatal death was 11.1% (5/60; 95% confidence interval, 84.8e19.6); When focusing on COVID-19, the pooled proportion of perinatal death was 7.0% (2/41; 95% confidence interval, 1.4e16.3).	The pooled proportion of preterm birth <37 weeks was 24.3% (14/56; 95% confidence interval, 12.5e38.6); premature pre-labor rupture of membranes occurred in 20.7% (6/34; 95% confidence interval, 9.5e34.9), preeclampsia in 16.2% (2/19; 95% confidence interval, 4.2e34.1), and fetal growth restriction in 11.7% (2/29; 95% confidence interval, 3.2e24.4), although reported only for women affected by SARS; 84% (50/58) were delivered by cesarean; 57.2% of newborns (3/12; 95% confidence interval, 3.6e99.8) were admitted to the neonatal intensive care unit. When focusing on COVID-19, the most common adverse pregnancy outcome was preterm birth <37 weeks, occurring in 41.1% of cases (14/32; 95% confidence interval, 25.6e57.6). None of the 41 newborns assessed showed clinical signs of vertical transmission.

M02	Maryam Kasraeian – Iran	87 SARS-CoV-2 positive pregnant women. Almost 65% of the patients reported a history of exposure to an infected person, 78% suffered from mild or moderate COVID-19, 99.9% had successful termination, 86% had cough, and 68%had fever (p¼.022 and p<.001); The confounding role of history of underlying diseases with an estimated overall proportion of 33% (p¼.03) resulted in further investigations due to sample size limitation. A natural history of COVID-19 pneumonia in the adult population was presented, as well.	The overall proportions of still birth and neonatal death were 0.002 and 0.002, respectively (p¼.86 and p¼.89, respectively).	The overall proportions of vertical transmission were zero (p¼1); The means of the first- and fifth-minute Apgar scores were 8.86 and 9, respectively (p<.001 for both).
M03	Giampiero Capobianco – Italy	The mean (SD) age and gestational age of pregnant women were 30.3 (1.5) years and 35.9 (2.9) weeks, respectively. The mean (SD) duration from the first symptoms to the hospital admission and to labor were 5.5 (2.0) and 9.5 (8.7) days, respectively. Patients mainly complained of fever and cough (pooled(95%CI) proportions were 76.0% (57.0%–90.0%) and 38.0 (28.0%–47.0%), respectively). Several antibiotics, antivirals, and corticosteroids were prescribed in different combinations. The pooled prevalence of maternal complications and of caesarean section were 45.0% (95%CI:24.0%–67.0%) and 88.0%(95%CI:82.0%–94.0%). A proportion of pregnant women less than 20% were admitted to ICU.		The pooled proportion of preterm infants was 23.0% (95%CI:11.0%–39.0%). The most frequent neonatal complications were pneumonia and respiratory distress syndrome. The pooled percentage of infected neonates was 6.0% (95%CI:2.0%–12.0%).
M04	Yi-jie Gao – China	Positive CT findings (71%; 95% CI, 0.49–0.93), caesarean section (65%; 95% CI, 0.42–0.87), fever (51%; 95% CI, 0.35–0.67), lymphopenia (49%; 95% CI, 0.29–0.70), coexisting disorders (33%; 95% CI, 0.21–0.44), cough (31%; 95% CI, 0.23–0.39), preterm labor (23%; 95% CI, 0.14–0.32), and severe	Fetal distress (29%; 95% CI, 0.08–0.49)	

		case or death (12%; 95%CI, 0.03–0.20). The subgroup analysis showed that compared with non-pregnant patients, pregnant women withCOVID-19 had significantly lower incidences of fever (pregnant women, 51%; non-pregnant patients, 91%; P<0.00001) and cough (pregnant women, 31%; non-pregnant patients, 67%; P<0.0001).		
M05	John Allotey – UK	Overall, 10% (95% confidence interval 7% to 12%; 73 studies, 67 271 women) of pregnant and recently pregnant women attending or admitted to hospital for any reason were diagnosed as having suspected or confirmed covid-19. The most common clinical manifestations of covid-19 in pregnancy were fever (40%) and cough (41%). Compared with non-pregnant women of reproductive age, pregnant and recently pregnant women with covid-19 were less likely to have symptoms (odds ratio 0.28, 95% confidence interval 0.13 to 0.62; I2=42.9%) or report symptoms of fever (0.49, 0.38 to 0.63; I2=40.8%), dyspnea (0.76, 0.67 to 0.85; I2=4.4%) and myalgia (0.53, 0.36 to 0.78; I2=59.4%). The odds of admission to an intensive care unit (odds ratio 2.13, 1.53 to 2.95; I2=71.2%), invasive ventilation (2.59, 2.28 to 2.94; I2=0%) and need for extra corporeal membrane oxygenation (2.02, 1.22 to 3.34; I2=0%) were higher in pregnant and recently pregnant than non-pregnant reproductive aged women. Overall, 339 pregnant women (0.02%, 59 studies, 41 664 women) with confirmed covid-19 died from any cause. Increased maternal age (odds ratio 1.83, 1.27 to 2.63; I2=43.4%), high body mass index (2.37, 1.83 to 3.07; I2=0%), any pre-existing maternal		The odds of admission to the neonatal intensive care unit (4.89, 1.87 to 12.81, I2=96.2%) were higher in babies born to mothers with covid-19 versus those without covid-19.

		comorbidity (1.81, 1.49 to 2.20; I2=0%), chronic hypertension (2.0, 1.14 to 3.48; I2=0%), pre-existing diabetes (2.12, 1.62 to 2.78; I2=0%), and pre-eclampsia (4.21, 1.27 to 14.0; I2=0%) were associated with severe covid-19 in pregnancy. In pregnant women with covid-19, increased maternal age, high body mass index, non-white ethnicity, any pre-existing maternal comorbidity including chronic hypertension and diabetes, and pre-eclampsia were associated with serious complications such as admission to an intensive care unit, invasive ventilation and maternal death. Compared to pregnant women without covid-19, those with the disease had increased odds of maternal death (odds ratio 2.85, 1.08 to 7.52; I2=0%), of needing admission to the intensive care unit (18.58, 7.53 to 45.82; I2=0%), and of preterm birth (1.47, 1.14 to 1.91; I2=18.6%).		
M06	Kuma Diriba – Ethiopia	The most common clinical features were fever, cough, and myalgia with prevalence ranging from 30 to 97%, while lymphocytopenia and C-reactive protein were the most common abnormal laboratory findings (55–100%). Pneumonia was the most diagnosed clinical symptom of COVID-19 and non-COVID-19 infection with prevalence ranged from 71 to 89%. Bilateral pneumonia (57.9%) and ground-glass opacity (65.8%) were the most common CT imaging reported. The most common treatment options used were hydroxychloroquine (79.7%), ribavirin (65.2%), and oxygen therapy (78.8%). Regarding maternal outcome, the rate of preterm birth < 37 weeks of gestation was 14.3%,	Mis-carriage (14.5%, preterm premature rupture of membranes (9.2%) and fetal growth restriction (2.8%). Fetal distress rated (26.5%).	Neonatal asphyxia rated (1.4%). Only, 1.2% of neonates had Apgar score < 7 at 5 min. Neonate admitted to ICU was rated 11.3%, while the rate of perinatal death was 2.2%. In the current review, none of the studies reported transmission of CoV from the mother to the fetus in utero during the study period.

		preeclampsia (5.9%). From the total coronavirus infected pregnant women, 56.9% delivered by cesarean, 31.3% admitted to ICU, while 2.7% were died.		
M07	Reem Matar – USA	The most common symptoms were fever (62.9%) and cough (36.8%). Laboratory findings included elevated C-reactive protein (57%) and lymphocytopenia (50%). Ground-glass opacity was the most common radiological finding (81.7%). Preterm birth rate was 37.7% and cesarean delivery rate was 76%. There was 1 maternal death.	There were 2 fetal COVID-19 cases.	
M08	Géssyca Cavalcante de Melo – Brazil	The meta-analysis showed no significant association between COVID-19 and preterm delivery (OR = 2.25; 95%CI: 0.96, 5.31; p = 0.06; I^2 = 0%).		No significant relationship was found between birth weight and COVID-19 (MD = -124.16; 95%CI: -260.54, 12.22; p = 0.07; I^2 = 0%). Among 432 newborns, 10 were reported with positive results for early SARS-CoV-2.
M09	Asma Khalil – UK	Most women (73.9%) were in the third trimester; 52.4% have delivered, half by caesarean section (48.3%). The proportion of Black, Asian or minority ethnic group membership (50.8%); obesity (38.2%), and chronic co-morbidities (32.5%) were high. The most commonly reported clinical symptoms were fever (63.3%), cough (71.4%) and dyspnea (34.4%). The commonest laboratory abnormalities were raised CRP or procalcitonin (54.0%), lymphopenia (34.2%) and elevated transaminases (16.0%). Preterm birth before 37 weeks' gestation was common (21.8%), usually medically-indicated (18.4%). Maternal intensive care unit admission was required in 7.0%, with intubation in 3.4%. Maternal mortality was uncommon (~1%). Maternal intensive care admission was higher in cohorts with higher		Neonatal nasopharyngeal swab RT-PCR was positive in 1.4%.

		rates of co-morbidities (beta=0.007, p<0.05) and maternal age over 35 years (beta=0.007, p<0.01). Maternal mortality was higher in cohorts with higher rates of antiviral drug use (beta=0.03, p<0.001), likely due to residual confounding.		
M10	Francesca Di Toro – Italy	The pooled prevalence of pneumonia was 89% (95%CI 70e100), while the prevalence of women admitted to the intensive care unit was 8% (95%CI 1e20). Five maternal deaths were reported. A pooled prevalence of 85% (95%CI 72e94) was observed for caesarean deliveries.	Three stillbirths were reported.	There were three neonatal deaths. The prevalence of COVID-19-related admission to the neonatal intensive care unit was2% (95%CI 0e6). Nineteen out of 444 neonates had a positive nasopharyngeal swab; one out of five neonates had elevated concentrations of serum IgM and IgG, but a negative swab.
M11	Xin Lei Goh – Singapore			Nine of 330 newborns tested positive for SARS-CoV-2. The average pooled incidence of vertical transmission was 16 per 1000 newborns (95%CI 3.40 to 73.11, figure1) Therefore, current evidence shows that the risk of vertical transmission of SARS-CoV-2 is low. One of the nine newborns had elevated IgM antibodies and was symptomatic at birth which suggested intrauterine infection. This is supported by reports of SARS-CoV-2 in amniotic fluid and fetal side of the placenta.
M12	Alexander M Kotlyar – USA			Our quantitative synthesis revealed that of 936 neonates from mothers with coronavirus disease 2019, 27 neonates had a positive result for severe acute respiratory syndrome coronavirus 2 viral RNA test using nasopharyngeal swab, indicating a pooled proportion of 3.2% (95% confidence interval, 2.2e4.3) for vertical transmission. Of note, the pooled proportion of severe acute respiratory syndrome coronavirus 2 positivity in neonates by nasopharyngeal swab in studies from China was

				2.0% (8/397), which was similar to the pooled proportion of 2.7% (14/517) in studies from outside of China. Severe acute respiratory syndrome coronavirus 2 viral RNA testing in neonatal cord blood was positive in 2.9% of samples (1/34), 7.7% of placenta samples (2/26), 0% of amniotic fluid (0/51), 0% of urine samples (0/17), and 9.7% of fecal or rectal swabs (3/31). Neonatal serology was positive in 3 of 82 samples (3.7%) (based on the presence of immunoglobulin M).
M13	Ioannis Bellos – Greece	Fever was the most frequent maternal symptom, followed by cough and shortness of breath, while about 15% of infected were asymptomatic. Severe disease was estimated to occur in 11% of women in case reports/series and in 7%(95%CI:4%–10%) in observational studies. Two maternal deaths were reported.	Still birth occurred in 3 cases.	2 neonatal deaths were observed. Vertical transmission was suspected in 4 cases. Fever was the most common neonatal symptom (40%), followed by shortness of breath (28%) and vomiting (24%), while 20% of neonates were totally asymptomatic. The rate of neonatal transmission did not differ between women with and without severe disease (OR:1.94,95%CI:0.50–7.60). Preterm birth occurred in 29.7% and 16% (95%CI:11%–21%).
M14	Vanessa Neef – Germany			Most neonates born to infected mothers did not show any clinical abnormalities (80.4%). Clinical features were dyspnea in 11 (42.3%) and fever in 9 newborns (19.1%). Of 261neonates, 120 neonates were tested for infection, of whom 12 (10.0%) tested positive. Swabs from placenta, cord blood and vaginal secretion were negative. Neonates are mostly not affected by the mother's SARS-CoV-2 infection. The risk of vertical transmission is low.
M15	Pallavi Dubey – USA			The rates of C-section, premature birth, low birth weight, and adverse pregnancy events were

				estimated as 72%, 23%, 7%, and 27% respectively. In the heterogeneity analysis, the rate of C-section was substantially higher in Chinese studies (91%) compared to the US (40%) or European (38%) studies. The rates of preterm birth and adverse pregnancy events were also lowest in the US studies (12%, 15%) compared to Chinese (17%, 21%), and European studies (19%, 19%). In case reports, the rates of C-section, preterm birth, and low birthweight were estimated as 69%, 56%, and 35%, respectively. Adverse pregnancy outcomes were associated with infection acquired at early gestational ages, more symptomatic presentation, myalgia symptom at presentation, and use of oxygen support therapy.
M16	Jeong Yee – Korea	Among the pregnant patients infected by severe acute respiratory coronavirus 2 (SARS-CoV-2), fatigue was the most prevalent symptoms (54.5%), followed by cough (50.1%) and fever (27.6%). Other common symptoms such as dyspnea, myalgia, and sore throat were observed in about 21%, 16%, and 11% of pregnant women with COVID-19, respectively. The prevalence of diarrhea was less than 10%. In terms of laboratory findings, approximately 48%, 43% and 36% of infected pregnant women had elevated CRP, lymphopenia, and leukocytosis, respectively. The prevalence of hypertension (including pregnancy-induced hypertension) and diabetes (including gestational diabetes) was 3.7 and 4.2%, respectively, whereas 4.7% of pregnant women with COVID-19 had	Premature rupture of membranes and fetal distress were observed in about 2%. Fetal death was observed in about 2%.	The mean birth weight was 2855.9 g (95% CI 2634.9–3076.9 g) and the prevalence of small-for-gestational-age births was estimated as 17.4% (95% CI 0–56.0%). Mean Apgar scores at 1 min and 5 min were 8.8 (95% CI 8.6–9.0) and 9.2 (95% CI 8.3–10.1), respectively. Neonatal death was found to be 0.4%.

		asthma. Around 30% of pregnant women with COVID-19 experienced preterm delivery		
M17	Barbara Chmielewska – UK	We identified significant increases in maternal death (1·37 [1·22–1·53; I^2=0%, two studies [both from low-income and middle-income countries], 1237018 and 2224859 pregnancies) during versus before the pandemic. Mean Edinburgh Postnatal Depression Scale scores were higher, indicating poorer mental health, during versus before the pandemic (pooled mean difference 0·42 [95% CI 0·02–0·81; three studies, 2330 and 6517 pregnancies). Surgically managed ectopic pregnancies were increased during the pandemic (OR 5·81 [2·16–15·6]; I^2=26%; three studies, 37 and 272 pregnancies). No overall significant effects were identified for other outcomes included in the quantitative analysis: maternal gestational diabetes; hypertensive disorders of pregnancy; preterm birth before 34 weeks', 32 weeks', or 28 weeks' gestation; iatrogenic preterm birth; labor induction; modes of delivery (spontaneous vaginal delivery, caesarean section, or instrumental delivery); post-partum hemorrhage.	We identified significant increases in stillbirth (pooled OR 1·28 [95% CI 1·07–1·54]; I^2=63%; 12 studies, 168 295 pregnancies during and 198 993 before the pandemic)	Preterm births before 37 weeks' gestation were not significantly changed overall (0·94 [0·87–1·02]; I^2=75%; 15 studies, 170640 and 656423 pregnancies) but were decreased in high-income countries (0·91 [0·84–0·99]; I^2=63%; 12 studies, 159987 and 635118 pregnancies), where spontaneous preterm birth was also decreased (0·81 [0·67–0·97]; two studies, 4204 and 6818 pregnancies). No overall significant effects were identified for other outcomes included in the quantitative analysis: neonatal death; low birthweight (<2500 g); neonatal intensive care unit admission; or Apgar score less than 7 at 5 min.
M18	Benjamin J F Huntley – USA	Our analysis included 728 deliveries to patients who tested positive for SARS-CoV-2 and 3,836 contemporaneous deliveries to patients who tested negative. Preterm birth occurred in 95 of 714 (13.3%) patients who tested positive and 446 of 3,759 (11.9%) who tested negative. Maternal death occurred in 3 of 559 (0.5%) patients who tested positive and 8 of 3,155 (0.3%) who tested negative.	Intra-uterine fetal death occurred in 8 of 728 (1.1%) patients who tested positive and 44 of 3,836 (1.1%) who tested negative.	Neonatal death occurred in 0 of 432 (0.0%) patients who tested positive and 5 of 2,400 (0.2%) who tested negative.
M19	Leila Karimi – Iran	117 studies with a total of 11758 pregnant women were included. The age ranged between 15 and 48		

		years. Most subjects were infected with SARS-CoV-2 in the third trimester. Disease severity was not reported in 1125 subjects. Maternal mortality was 1.3%. In 100% of fatal cases with adequate data, fever alone or with cough was one of the presenting symptoms. Also, dyspnea (58.3%) and myalgia (50%) were the most common symptoms. Sore throat (8.3%) and gastrointestinal symptoms (anorexia, nausea) (8.3%) were rare. The rate of comorbidities was 20% amongCOVID-19 deaths. The majority of COVID-19-infected women who died had cesarean section (58.3%), 25% had a vaginal delivery, and 16.7% of patients were not full term.		
M20	Marco La Verde – Italy	Thirteen studies with 154 deceased patients were included. Obesity doubled the risk of death (relative risk [RR] 2.48, 95% confidence interval [CI] 1.41–4.36, I2 = 0%). No differences were found for gestational diabetes (RR 5.71; 95% CI 0 . 7 7 – 4 2 . 4 4 , I2 = 94%) or asthma (RR 2.05, 95% CI 0.81–5.15, I2 = 0%). Overall, at least one severe co- morbidity showed a twofold increased risk of death (RR 2.26, 95% CI 1.77– 2.89, I2 = 76%). Admission to intensive care was related to a fivefold increased risk of death (RR 5.09, 95% CI 2.00–12.98, I2 = 56%), with no difference in need for respiratory support (RR 0.53, 95% CI 0.23–1.48, I2 = 95%) or mechanical ventilation (RR 4.34, 95% CI 0.96–19.60, I2 = 58%).		
M21	Zohra S Lassi – Australia	31016 pregnant women from 62 studies were included. Women were an average of 30.9 years of age, most (77.7%) were in the third trimester, and 16.4% developed severe COVID-19. Nearly half were		Among newborns, 23.4% were preterm (<37 weeks), 16.6% were low birth weight, and 23.7% were admitted to neonatal ICU. A total of 21 stillbirths (1.6%) and 24 neonatal deaths (1.6%)

		asymptomatic, while the most commonly reported symptoms were cough, fever, fatigue, and anosmia/ageusia. About 7% were admitted to the intensive care unit (ICU), 8% required mechanical ventilation, and 2% of the women died. Almost 80% of women delivered; 48.4% had cesarean births. Studies comparing pregnant women with severe and non-severe COVID-19 showed that women with severe COVID-19 were 3.7 years older and the risk of severe COVID-19 was 1.5 times higher among women >35 years. The risk of severe COVID-19 was significantly higher among women who were obese, had smoked, diabetic, and had pre-eclampsia. The risk of preterm birth was almost 2.4 folds among women with severe COVID-19.		were recorded, while 50 babies (3.5%) were COVID-19 positive.
M22	Shu Qin Wei – Canada	We included 42 studies involving 438,548 people who were pregnant. Compared with no SARS-CoV-2 infection in pregnancy, COVID-19 was associated with preeclampsia (OR 1.33, 95% CI 1.03 to 1.73), preterm birth (OR 1.82, 95% CI 1.38 to 2.39). Compared with mild COVID-19, severe COVID-19 was strongly associated with preeclampsia (OR 4.16, 95% CI 1.55 to 11.15), preterm birth (OR 4.29, 95% CI 2.41 to 7.63), gestational diabetes (OR 1.99, 95% CI 1.09 to 3.64).	Compared with no SARS-CoV-2 infection in pregnancy, COVID-19 was associated with stillbirth (OR 2.11, 95% CI 1.14 to 3.90)	Compared with no SARS-CoV-2 infection in pregnancy, COVID-19 was associated with low birth weight (OR 1.89, 95% CI 1.14 to 3.12)
R01	Anna Nunzia Della Gatta – Italy	48 pregnant women, 46 gave birth by cesarean delivery, and 2 gave birth vaginally	1 stillbirth	1 neonatal death
R02	Salut Muhidin – Australia	The characteristics of 89 pregnant women and their neonates were studied. Results revealed that low-grade fever and cough were the principal symptoms in all patients. The main reported laboratory findings	Fetal distress, premature rupture of membranes and preterm labor were the	No fetal infection through intrauterine vertical transmission was reported.

		were lymphopenia, elevated C-Reactive Protein (CRP), Amino alanine transferase (ALT), and Aspartate amino transferase (AST). In all symptomatic cases, chest Computerized Tomography (CT) scans were abnormal. Two women needed intensive care unit admission and mechanical ventilation, one of whom developed multi-organ dysfunction and was on Extra-corporeal Membrane Oxygenation (ECMO). No case of maternal death was reported up to the time the studies were published. 79 mothers delivered their babies by cesarean section and five women had a vaginal delivery.	main prenatal complications.	
R03	Vera Trocado – Portugal	Among 95 pregnant women, 26% had a history of epidemiological exposure to SARS-CoV-2. The most common symptoms presented were fever (55%), cough (38%) and fatigue (11%). In 50deliveries, 94% were cesarean sections and 35% were preterm births.		Of the 51 neonates, 20%had low birth weight and 1 tested positive for Sars-CoV-2. There was 1 neonatal death, not related to the viral infection, and no cases of severe neonatal asphyxia.
R04	Ziyi Yang – China	114 pregnant women were included in the review. Fever (87.5%) and cough (53.8%) were the most commonly reported symptoms, followed by fatigue (22.5%), diarrhea (8.8%), dyspnea (11.3%), sore throat (7.5%), and myalgia (16.3%). The majority of patients (91%) had cesarean delivery due to various indications.	Fetal distress (10.7%)	In terms of fetal and neonatal outcomes, stillbirth (1.2%), neonatal death (1.2%), preterm birth (21.3%), low birthweight (<2500 g, 5.3%), and neonatal asphyxia (1.2%) were reported. There are reports of neonatal infection, but no direct evidence of intrauterine vertical transmission has been found.
R05	Vinayak Smith – Australia	67.4% (62/92) of women were symptomatic at presentation. RT-PCR was inferior to CT-based diagnosis in 31.7% (26/79) of cases. Maternal mortality rate was 0% and only one patient required intensive care and ventilation. 63.8% (30/47) had preterm births, 80% (40/50) a Caesarean section.	61.1% (11/18) fetal distress	76.92% (11/13) of neonates required NICU admission and 42.8% (40/50) had a low birthweight. There was one indeterminate case of potential vertical transmission.

		Mean time-to-delivery was 4.3±3.08days (n = 12) with no difference in outcomes (p>0.05).		
R06	Mehreen Zaigham – Sweden	Eighteen articles reporting data from 108 pregnancies between 8 December 2019 and 1 April 2020 were included in the current study. Most reports described women presenting in the third trimester with fever (68%) and coughing (34%). Lymphocytopenia (59%) with elevated C-reactive protein (70%) was observed and 91% of the women were delivered by cesarean section. Three maternal intensive care unit admissions were noted but no maternal deaths.	One intrauterine death	One neonatal death
R07	Somayeh Makvandi – Iran	12 studies involving 68 women. The three most common symptoms of patients were fever, cough, and fatigue. The most common laboratory findings were an increase in C-reactive protein (CRP) and lymphopenia. The most common obstetrical complication was preterm labor (33.3%). No maternal deaths were reported. The Cesarean section rate was 83.3%. The findings showed that the clinical symptoms and laboratory measures of pregnant women affected by COVID-19 did not differ from the general population. In general, the prognosis of mothers who suffered from COVID-19 and their newborns was satisfactory. However, there is a need for further rigorous studies to confirm these findings as the pandemic progresses.		The vertical transition rate was 2.23%. The prognosis of newborns was satisfactory.
R08	Ayssa Teles Abrao Trad – USA	Maternal age ranged from 20 to 45 years with a mean of 29. The majority (150/155; 96.8%) of patients acquired the infection during the third trimester, 3.2% (5/155) in the second trimester, and none were reported in the first trimester. Maternal	One stillbirth occurred at 34 weeks' gestation by a mother with severe SARS-CoV-2 infection who deteriorated and needed	Perinatal outcome was described in 118 neonates born to 116 patients (116/155; 74.8%). Gestational age at delivery was >36 weeks in 77 neonates (77/118; 65.3%), between 32 and 36 weeks in 19 neonates (19/118; 16.1%), and <32 weeks in one

		comorbidities (pre-eclampsia- 4/122; 3.3%, gestational hypertension-5/122; 4.1% and gestational diabetes- 10/122; 8,2%) were seldom reported; 87.7% (136/155) of patients had a low-risk pregnancy until the time of publication,33 of these were still ongoing and were excluded from the cohort when looking at maternal comorbidities. Certain diseases that are typical from the third trimester such as pre-eclampsia may have been underestimated due to the rate of pre-term births (20 before 37weeks of pregnancy). The most common presenting symptoms of maternal SARS-CoV-2 infection were fever (80/139; 57.6%), followed by cough (44/139; 31.7%), dyspnea, or short-ness of breath (19/139; 13.7%), and gastrointestinal alterations (8/139; 5.8%); 20.9% (29/139) of patients were asymptomatic. Zhang et al. (6) did not report the presenting symptoms of 16 patients, which were excluded from this analysis. SARS-CoV-2 infection was diagnosed using reverse transcriptase-polymerase chain reaction (RT-PCR) SARS-CoV-2 test in all but two patients, who were deemed false-negatives after classic CT alterations were noted in conjunction with clinical presentations. CT evidence of viral pneumonia was also documented in 53.5% (82/155) of cases; with changes such as “patchy lung consolidation” with ground glasslike opacities around the border and dominant subpleural distribution (9–11). Amongst the 82 patients who had a CT, only one with confirmed PCR showed no alterations. The most reported laboratory alteration was lymphopenia	ICU admission, with multiple organ dysfunction and acute respiratory distress syndrome requiring Extracorporeal Membrane Oxygenation (15). The fetal indications were described as premature rupture of membranes and "fetal distress/compromise” (5,6,8,10,12,14–16). There was no clear indication for C-section in 3 studies (38 patients): Lui et al. (17) believed it was necessary to implement antiviral therapy, Li et al. (7) mentioned that it was based on their hospital guidelines, and Yu et al. (18) considered it necessary due to the potential impact of the antiviral medication for maternal treatment and/or the virus itself on the fetus.	neonate (1/118; 0.8%); this information was not available for 21 neonates (21/118; 17.8%) described in two studies (12,14).NICU admission was required in 24 neonates (24/118; 20.3%), although this may have been overestimated since the report by Chen et al. (14) admitted all babies born to SARS-CoV-2 positive mothers regardless of neonatal symptoms and signs. Low birthweight was reported in 14 (14/118; 11.8%) neonates and5 (5/118; 4.2%) developed pneumonia. Perinatal out-comes were favorable in all but two cases: one stillbirth and a neonatal death; the only neonatal death was a neonate born at 34 5/7 days gestation that developed shortness of breath 30 minutes after birth and subsequently died, 8 days later, from "refractory shock and multi-organ failure” (14).Placenta, amniotic fluid, umbilical cord blood, breastmilk, gastric juice, urine, and feces were all screened for SARS-CoV-2 in different studies (5,10,15,16,19) and were reported as negative, suggesting a possible lack of vertical transmission. One of the95 neonates who underwent SARS-CoV-2 PCR tested positive, 36 hours after birth with isolation from the mother (18). Additionally, one patient who tested negative for SARS-CoV-2 PCR had positive SARS CoV-2IgM and IgG (20). Hence, the possibility of vertical transmission is inconclusive at this point.

		(32/90; 35.6%); neutrophilia was present in only 8.8% (8/90) of patients. A total of 29 patients were considered asymptomatic. Eight of the 14 asymptomatic patients reported by Breslin (12) developed fever during hospital admissions well as one of the two reported by Li et al. Reported intrapartum management also varied considerably; 7.8% (9/116) of mothers delivered vaginally with the use of appropriate sterilization and personal protective equipment (PPE); 92.2% (107/116) of patients delivered by cesarean section but the indications for delivery varied amongst studies. Maternal indications included preeclampsia (5,13), prior C-section (5,6,12), and low maternal oxygen saturation (9,13). Most notable obstetric complications were PPROM (10/116; 8.6%) and preeclampsia (4/116; 3.4%) Five mothers (3.2%; 5/155) required ICU admission for severe disease; two patients, from Juusela et al. and Liu, were still in the ICU at the time of publication. The remaining mothers, who had success-fully delivered, survived to discharge and either tested negative for the virus or had resolution of clinical symptoms and CT alterations by the end of the study.		
R09	Mohammad Ali Ashraf – Iran	Overall, 21 articles were reviewed, and clinical characteristics of 90 pregnant patients were re-viewed. The most common symptoms included fever, cough, and dyspnea. The main laboratory findings included leukocytosis, lymphopenia, thrombocytopenia, and elevated C-reactive protein. One of the most commonly reported complications was preterm labor. Three mothers were admitted to	One of the most commonly reported complications was fetal distress.	Overall, 21 articles were reviewed, and clinical characteristics of 92 neonates born to mothers infected with COVID-19 were re-viewed. Overall, 86 neonates were tested for the possibility of vertical transmission and82 cases were negative in RT-PCR, while 4 were positive. Out of 92 neo-nates, one died, and one was born dead. Nineteen patients reported having no symptoms, while

		ICU and required mechanical ventilation; among them, one died, and one was on extracorporeal membrane oxygenation.		breathing problems and pneumonia were reported as the most common neonatal complications.
R10	Pablo Duran – Uruguay			Of the 222 newborns, 13 were reported as positive for SARS-CoV-2; most of the studies reported no or mild symptoms and no adverse perinatal out-comes. Two papers among those from newborns who tested positive reported moderate or severe clinical characteristics. Five studies using data on umbilical cord blood, placenta, and/or amniotic fluid reported no positive results. Nine studies reported radiographic imaging, including 5 with images of pneumonia, increased lung marking, thickened texture, or high-density nodular shadow. Minor, non-specific changes in biochemical variables were reported. Studies that tested breast milk reported negative SARS-CoV-2 results.
R11	Jianhua Chi – China	A otal of 230 women with COVID-19 (154 deliveries, 66 ongoing pregnancies, and 10 abortions) were included in this systematic review. A total of 34.62% of the pregnant patients had obstetric complications, and 59.05% of patients displayed fever. Lymphopenia was observed in 40.71% of patients. A total of 5.19% of women received mechanical ventilation. Seven women were critically ill. One mother died.		156 newborns were included in this systematic review. Two newborns died. A total of 24.74% of newborns were premature. Five newborns' throat swab tests of SARS-CoV-2 were positive, all of which were delivered by cesarean section. For eight newborns with negative throat swab tests, three had both elevated IgM and IgG against SARS-CoV-2. Nucleic acid tests of vaginal secretions, breast milk, amniotic fluid, placental blood, and placental tissues were negative.
R12	Giulia Trippella – Italy	A total of 37 studies were included, involving 275 pregnant women with COVID-19. The majority of pregnant women presented with mild to moderate	Two stillbirths were reported.	Total of 37 studies were included, involving 248 neonates. Sixteen neonates were tested positive for SARS-CoV-2 by RT-PCR, and nine of them were born from mothers infected during pregnancy.

		symptoms, only 10 were admitted in the ICU, and one died. The incidence of prematurity was 28%.		Neonatal outcomes were generally good: all the affected neonates recovered. RT-PCR for SARS-CoV-2 yielded negative results on amniotic fluid, vaginal/cervical fluids, placenta tissue, and breast milk samples. SARS-CoV-2 infection in pregnant women appeared associated with mild or moderate disease in most cases, with a low morbidity and mortality rate. The outcomes of neonates born from infected women were mainly favorable, although neonates at risk should be closely monitored.
R13	Farida Elshafeey – Egypt	We identified 33 studies reporting 385 pregnant women with COVID-19 infection: 368 (95.6%) mild; 14 (3.6%) severe; and 3 (0.8%) critical. Seventeen women were admitted to intensive care, including six who were mechanically ventilated and one maternal mortality. A total of 252 women gave birth, comprising 175 (69.4%) cesarean and 77 (30.6%) vaginal births.		Outcomes for 256 newborns included four RT-PCR positive neonates, two stillbirths, and one neonatal death.
R14	J Juan – China	A total of 324 pregnant women with COVID-19. A total of 20 pregnant patients with laboratory-confirmed COVID-19 were included in the case reports. In the combined data from the eight consecutive case series, including 211 (71.5%) cases of laboratory-confirmed and 84 (28.5%) of clinically diagnosed COVID-19, the maternal age ranged from 20 to 44 years and the gestational age on admission ranged from 5 to 41 weeks. The most common symptoms at presentation were fever, cough, dyspnea/shortness of breath, fatigue and myalgia. The rate of severe pneumonia reported amongst the case series ranged from 0 to 14%, with the majority	Only four cases of spontaneous miscarriage or abortion were reported.	The gestational age at delivery ranged from 28 to 41 weeks. Apgar scores at 1 and 5 min ranged from 7 to 10 and 7 to 10, respectively. Only eight neonates had birth weight <2500 g and nearly one-third of cases were transferred to the neonatal intensive care unit. There was one case each of neonatal asphyxia and neonatal death. In 155 neonates that had nucleic-acid testing in throat swab, all, except three cases, were negative for SARS-CoV-2. four intrauterine fetal deaths (one with twin pregnancy) and two neonatal deaths (twin pregnancy) reported in a non-consecutive case series of nine cases with severe COVID-19.

		of the cases requiring admission to the intensive care unit. Almost all cases from the case series had positive computer tomography chest findings. All six and 22 cases that had nucleic-acid testing in vaginal mucus and breast milk samples, respectively, were negative for SARS-CoV-2. In the consecutive case series, 219/295 women had delivered at the time of reporting, and the majority of these had Cesarean section. There were seven maternal deaths. From the case reports two maternal death were reported.		From the case reports one neonatal death and two cases of neonatal SARS-CoV-2 infection were reported.
R15	Md Mohaimenul Islam – Taiwan	Data is reported for 235 pregnant women with COVID-19. The age range of patients was 25–40 years. Clinical characteristics were fever [138/235 (58.72%)], cough [111/235 (47.23%)], and sore throat [21/235 (8.93%)]. One hundred fifty-six out of 235 (66.38%) pregnant women had cesarean section, and 79 (33.62%) had a vaginal delivery. All the patients showed lung abnormalities in CT scan images, and none of the patients died. Neutrophil cell count, C-reactive protein (CRP) concentration, ALT, and AST were increased but lymphocyte count and albumin levels were decreased. Amniotic fluid, neonatal throat swab, and breastmilk samples were taken to test forSARS-CoV-2 but all found negative results. Pre-eclampsia, fetal distress, PROM, pre-mature delivery were the major complications of pregnant women with COVID-19.		Gestational age ranged from 8 to 40 weeks plus 6 days. Recent published evidence showed the possibility of vertical transmission up to 30%, and neonatal death up to 2.5%.
R16	Ziyi Yang – China			In total, 22 studies comprising 83 neonates were included in this review. Among the 83 neonates, 9 had evidence of SARS-CoV-2 infection (positive RT-PCR results or elevated level of virus-specific antibodies in serum samples). Alzamora et al

				reported a pregnant woman who developed respiratory failure and underwent a cesarean delivery at 33 weeks of gestation. Neonatal isolation was implemented immediately after birth, without any physical contact with the mother. A nasopharyngeal swab collected from the neonate at16 hours after birth tested positive for SARS-CoV-2 by RT-PCR, although serum samples were negative for virus-specific immunoglobulin G (IgG) and immunoglobulin M (IgM) using automated chemiluminescence immunoassays. The RT-PCR test repeated 48 hours later for confirmation was also positive. Similarly, Li et al and Yu et al also reported neonatal infection and the implementation of neonatal isolation measures im-mediately after birth. In these two cases, the mothers wore an N95 mask during delivery and the newborns were cared for under isolation in a separate pediatric room. RT-PCR test results at 36 hours and 3 days after birth were positive. In these three cases, no amniotic fluid, placenta, or cord blood were collected for RT-PCR tests. Zeng et al and Dong et al both reported positive detection of virus-specific antibodies in serum samples drawn from the neonates following birth, although serum and throat swab samples tested negative by RT-PCR. Three of seven infants had elevated IgG and IgM levels; another three had elevated IgG levels, while IgM levels were normal. The mothers' vaginal secretions and breastmilk also tested negative by RT-PCR.

R17	S H Yoon – Korea	We included 16 case series and 12 case reports describing a total of 223 pregnant women	Fetal death was reported in two cases.	We included 16 case series and 12 case reports describing a total of 201 infants. Four newborns born to mothers affected by COVID-19 were reported to have laboratory-confirmed Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infection within 48 hours after birth. However, Reverse Transcription-Polymerase Chain Reaction tests of the breast milk, placenta, amniotic fluids, and cord blood and maternal vaginal secretions were all negative for SARS-CoV-2 in the reported cases. 48 of 185 newborns (25.9%) were born prematurely. Infants born small for gestational age and low birth weight (< 2,500 g) ac-counted for 8.3% and 15.6% of reported cases, respectively. Birth asphyxia and respiratory distress syndrome were observed in 1.8% and 6.4% of neonates, respectively. There was one neo-natal death due to intractable gastric bleeding among the SARS-CoV-2-negative infants.
R18	Romeo R Galang – USA	12 pregnant women with MERS-CoV infection, ages ranged from 26 to 31 years (median 32, interquartile range 31–38). Gestational age at time of symptom onset or diagnosis among pregnant women ranged from 4 to 38 completed weeks (median 24, interquartile range 21–33); Symptoms were reported for 11 patients (fever [n57], chills or rigors [n51], myalgia [n52], malaise [n51], cough [n58], shortness of breath [n57], chest pain[n51]); Severe illness was reported in seven pregnant women, including ICU admission (n57), mechanical ventilation (n55), renal failure (n52), and septic shock (n51) (Table 3). Among 11 women with	Among two reported stillbirths, one occurred at21 weeks of gestation (7 days after symptom onset) in a previously healthy 39-year-old woman with obstetric history of six prior full-term live births.	Among eight pregnancies known to result in the delivery of liveborn neonates, three neonates were delivered by emergency cesarean between 25 and 32weeks of gestation for critical maternal respiratory status requiring mechanical ventilation.12,13,15Oneneonate died shortly after delivery.13The other five liveborn neonates were delivered between 37 and 40weeks of gestation—one by emergency cesarean delivery for placental abruption14and four without mention of obstetric complications (Table 3).Five neonates were reported as healthy-appearing without clinical evidence of MERS-CoV infec-tion11,13,15One

		available outcome data, three died during their hospital stay after delivery (one during the second trimester of pregnancy and two during the third trimester; case fatality proportion 27%). Among the three maternal deaths, the women were 31–32 years of age and one had underlying pulmonary disease (asthma, pulmonary fibrosis, and recurrent spontaneous pneumothoraxes). Gestational age ranged from 24 to 38 completed weeks at presentation. Hospitalization occurred from 4 to 7 days after symptom onset. All three women required intubation for acute respiratory distress.		neonate received serial RT-PCR testing of serum and nasopharyngeal specimens and antibody testing (by enzyme-linked immunosorbent assay, indirect immunofluorescence testing, and plaque reduction neutralization testing), with negative results for all MERS-CoV testing.
R19	Rommy H Novoa – Peru	In 322 infected pregnant women, aged 20–45 years, the most frequent maternal comorbidity was obesity (24.2%). Forty-two (28.4%) were asymptomatic at admission. Cough (n =148,59.7%) and fever (n =147,59.3%) were the most prevalent symptoms. In the meta-analysis, fever (OR: 0.13,95% CI 0.05 to 0.36) and cough (0.26,95% CI 0.11 to 0.59) were lower in pregnant women with COVID-19 than non-pregnant women with COVID-19.195 (60.6%) delivered, and 125 (38.8%) remained pregnant during the study. Cesarean was reported in 99 (50.8%) women and vaginal delivery in 64 (32.8%). The main adverse obstetric outcome was premature birth (n =37,18.9%). Thirty patients (10.3%) with COVID-19-related com-plications required intensive care, one (0.3%) died. SARS-CoV-2 was absent in breast milk, amniotic fluid, placenta or umbilical cord blood.		

R20	Benjamin J F Huntley – USA	13 articles included 538 pregnancies complicated by SARS-CoV-2 infection, with reported outcomes on 435 (80.9%) deliveries. Maternal ICU admission occurred in 3.0% of cases (8/263, 95% CI1.6–5.9) and maternal critical disease in 1.4% (3/209, 95%CI 0.5–4.1). No maternal deaths were reported (0/348,95% CI 0.0–1.1). The preterm birth rate was 20.1% (57/284, 95% CI 15.8–25.1), the cesarean delivery rate was 84.7% (332/392, 95% CI 80.8–87.9).		The vertical transmission rate was 0.0% (0/310, 95% CI 0.0–1.2), and the neo-natal death rate was 0.3% (1/313, 95% CI 0.1–1.8).
R21	Ramy Abou Ghayda – USA	n total, 11 case series studies comprising 104 pregnant women with COVID-19 were included in our review. Fever (58.6%) and cough (30.7%) were the most common symptoms. Other symptoms included dyspnea (14.4%), chest discomfort (3.9%), sputum production (1.0%), sore throat (2.9%), and nasal obstruction (1.0%). Fifty-two patients (50.0%) eventually demonstrated abnormal chest CT, and of those with ground glass opacity (GGO),23 (22.1%) was bilateral and 10 (9.6%) were unilateral. The most common treatment for COVID-19 was administration of antibiotics (25.9%) followed by antivirals (17.3%). Cesarean section was the mode of delivery for half of the women (50.0%), although no information was available for 28.8% of the cases.	Fetal distress (13.5%), fetal death (4.8%), and abortion (2.9%) were reported.	Pre-labor rupture of membranes (9.6%), prematurity (8.7%) were reported. There are no positive results of neonatal infection by RT-PCR.
R22	K F Walker – UK	49 studies which included 655 women.		49 studies which included 666 neonates. 28/666 (4%) neonates had confirmed COVID-19 infection postnatally. Of the 291 women who delivered vaginally, 8/292 (2.7%) neonates were positive. Of the 364 women who had a Caesarean birth, 20/374 (5.3%) neonates were positive. Of the 28 neonates with confirmed COVID-19 infection, 7 were breast fed, 3 formula fed, 1 was given expressed breast

				milk and in 17 neonates the method of infant feeding was not reported.
R23	Morris Gordon – UK			The systematic review has revealed eight studies where neonates have been described to have confirmed COVID-19, with low risk of bias. Of the 10 reported cases elsewhere, only three are likely to be vertically transmitted, while seven occurred in the post perinatal period and are likely to have been postnatally acquired. All neonates had a mild course, recovered fully and were negative on retesting. Our case of COVID-19 in a 32- week premature baby from the UK was delivered by emergency caesarean section, with the mother wearing a face mask and the family having no contact with the neonate, suggesting vertical transmission. On day 33, the neonate was asymptomatic but was still RT- PCR- positive on nasopharyngeal airway swab.
R24	Paulino Vigil-De Gracia – Panama			There were found 10 articles with a total of 15 newborn infected with SARS-CoV-2 according to positive PCR at birth or in the first days of birth. Eleven newborn births by cesarean section and 4 vaginally. Of the 11 cases with cesarean section, two presented premature rupture of the membranes. Seven newborns developed pneumonia, of which two had ruptured mem-branes and one was born by vaginal delivery.
R25	George M Bwire – Tanzania			A total of 205 infants born to COVID-19 positive mothers were studied. Overall,6.3% (13/205; 95% CI: 3.0%–9.7%) of the infants tested positive for COVID-19 virus at birth. Of 33 eligible studies, six studies (18.8%) reported about immunoglobulin

				G/M (IgG/IgM) against SARS-CoV-2. IgG/IgM were detected in90% infants (10/11; 95% CI: 73.9%–107.9%) who tested negative for COVID-19 virus. The median antibody levels detected were 75.49 AU/ml (range,7.25–140.32 AU/ml) and 3.79 AU/ml (range, 0.16–45.83 AU/ml), p= .0041 for IgG and IgM, respectively.
R26	Leila Karimi – Iran	Women ranged in age from 17 to 49 years, and most were in the third trimester of pregnancy at the time the studies were carried out. The most common comorbidities were obesity, gestational diabetes mellitus, chronic hyper-tension, pulmonary conditions, asthma, diabetes mellitus, and preeclampsia/eclampsia, respectively. Common symptoms at the onset of disease in the order of prevalence were as follows: fever (65.8%), cough (61.6%), dyspnea (6.4%), fatigue (6.1%), and myalgia (3.8%). Less common symptoms included shortness of breath, anosmia, malaise, diarrhea, headache, sore throat, emesis, nasal congestion, chills, vomiting, anorexia, rhinitis, and chest discomfort. Common laboratory findings were elevated CRP levels (33.9%), lymphopenia (31.8%), increased serum levels of D-dimer (a sign of significant formation and breakdown of clot; 27.3%), leukocytosis (9.9%), and leukopenia (6.6%). A common radiological finding was patchy shadowing or ground-glass opacities (49.7%). A total of 321 Cesarean sections, 91 vaginal deliveries occurred. In 114 of the Cesarean section cases (35.5%), these were performed due to concerns related to the effects of COVID-19 infections on the mother or	20 fetal abortions occurred	The vertical transmission rate was 7.9%.

		fetus. Of the 412 deliveries, 112 were preterm (27.2%). A number of pregnant women infected with COVID-19 developed complications during treatment. More common complications were acute respiratory distress, septic shock, cardiac dysfunction, multiple organ dysfunction, cardiac arrest, myocardial injury and myocarditis, endo-carditis, need for dialysis, pericardial effusion, and pulmonary embolism. There were 55 cases of intubation (11.6%) and 13 maternal deaths (2.3%).		
R27	Hubba Akhtar – UK	Upon admission, most pregnant women underwent a low-dose radiation CT scan; the reports of which included unilateral/bilateral pneumonia in most patients. A marked lymphopenia was also noted in many patients with COVID-19. 22 studies were included, which identified 156 pregnant women with COVID-19. Premature rupture of membranes (8%).	Intrauterine/fetal distress (14%).	The neonatal clinical manifestations of COVID-19 commonly included shortness of breath (6%), gastrointestinal symptoms (4%), and fever (3%). 22 studies were included with 108 neonatal outcomes.
R28	Elicia Pettirosso – Australia	A total of 1287 confirmed SARS-CoV-2 positive pregnant cases are reported. Where universal testing was undertaken, asymptomatic infection occurred in 43.5–92% of cases. In the cohort studies, severe and critical COVID-19 illness rates approximated those of the non-pregnant population. Eight maternal deaths were reported.	Seven stillbirths and five miscarriages were reported.	Six neonatal deaths were reported. Thirteen neonates were SARS-CoV-2 positive, confirmed by reverse transcription polymerase chain reaction of nasopharyngeal swabs.
R29	Álvaro Francisco Lopes de Sousa – Portugal	A total of 755 pregnant women were assessed. More than half of pregnant women had C-sections (379/65%).		598 infants were assessed. Only 493 (82%) infants were tested for SARS-CoV-2, nine (2%) of whom tested positive. There is, however, no evidence of vertical transmission based on what has been assessed so far, considering there are knowledge gaps concerning the care provided during and after delivery, as well as a lack of suitable biological samples for testing SARS-CoV-2.

R30	Ana Luísa Areia – Portugal	Our research showed that pregnant women with COVID-19 only differ from other pregnant women in their lower WBC count. The proportion of reduced lymphocyte cases is similar in both groups, as is the case of C- reactive protein levels.		
R31	Melis Deniz – Turkey			In the 50 studies included, 17 newborns testing positive for SARS CoV-2 by RT-PCR were reported. In three neonates, SARS-CoV-2 IgG and IgM levels were elevated. Eight placental tissues testing positive for the virus were reported. Three positive RT-PCR results of test of breast milk have been reported recently. One amniotic fluid testing positive was reported.
R32	Cinzia Auriti – Italy		No autopsy reports have been published on fetuses aborted during maternal COVID-19 infection in pregnancy.	To date, it is unclear whether the vertical transmission of SARS-CoV-2 from mother to fetus occurs or not. The currently published literature describes only infants with positive nasopharyngeal swab after birth, which could be related to the horizontal transmission immediately in postpartum, by the contact with infected mothers or with positive healthcare personnel providing care at the time of delivery. The SARS-CoV-2 virus has never been found so far in the umbilical cord blood of neonates and in the amniotic fluid of most COVID-19 positive pregnant women. There are no case reports on infections contracted early in pregnancy, with teratogenic effect on the neonate. The first published data had mainly reported neonates born via caesarean section (76.8%), with CS performed to reduce the risk of vertical transmission and decrease putative risks among staff members. Many infants born via

				caesarean section could have had a decreased length of exposure to infected tissues, which might be associated with a decreased likelihood of infection. From the data of a multicentric study performed in 12 hospitals in Northern Italy (Lombardy, Veneto, and Emilia-Romagna), two neonates of the group of vaginal deliveries and one neonate of the group of elective caesarean section, performed for reasons unrelated to COVID-19 infection, tested positive while no positive neonates were observed in the group of elective caesarean sections due to COVID-19.
R33	Clara Nam Hee Kim – Canada	Of 85 reported cases, 11 women admitted to the ICU during pregnancy or within 1 week of delivery died, corresponding to a CFR of 12.9% (95% CI, 5.8e20.1). In addition, 7 of the 11 deaths were from a single report from Iran; if this study is excluded, the CFR would be 5.3% (95% CI,2.1e10.3). There was no difference in the management of the women in the latter study compared with other studies.		
R34	Bhuchitra Singh – USA	The female reproductive system is potentially at a high risk of SARS-CoV-2 infection. There are no studies that evaluate SARS-CoV-2 infection inhuman ovarian tissue and cells. The ACE2 receptor is widely expressed in the placenta [31]. Overall, there is limited evidence regarding SARS-CoV-2 and transplacental transmission, though most reviews and the American College of Obstetrics and Gynecology have stated there is no conclusive evidence of transplacental transfer of SARS-CoV-2 from infected mothers. The status of SARS COV-2 within the vaginal environment is currently		

		unknown. Many viruses have been previously isolated within vaginal fluid, such as Hepatitis C virus and Zika virus, which are both RNA viruses. At present, it is not believed that SARS-CoV-2 is able to be sexually transmitted, which is consistent with other historical coronaviruses.		
R35	Yu Han – China	The most common symptoms were found to be fever (64.78%), cough (59.81%) and shortness of breath or dyspnea (23.86%). Of this 88.73% patients demonstrated typical COVID-19 signs on chest CT or X-ray. Intubation was carried out in 35.87% of patients, and 4.95% of mothers were admitted to the intensive care unit, where the rate of maternal death was <0.01% and that of premature delivery was 25.32%.		The rate of the birth weight being <2,500 g was30.65% and that of Neonatal intensive care unit (NICU)admission was 24.41%. Positive nasopharynx swabs or sputum from newborns was <0.01%.
R36	Lisiane Vital de Oliveira – Brazil	Pregnancy can make women more susceptible to infections, especially by viral pathogens, given the various physiological and immunological changes that occur to maintain maternal-fetal balance. No difference was noticed when comparing different modes of delivery, and seems reasonable to assume that pregnant women with stable clinical conditions can be encouraged for vaginal delivery.	It is speculated that the fetus may be a possible target for COVID-19.	Few studies (3 out of 15) in our analysis have found positive results for SARS-CoV-2 in fetal membranes, placenta, and in newborns right after birth.
R37	Sudip Sheth – USA			We summarized the data from 39 published studies that are comprised of 326 COVID-19 positive peripartum mothers with respective neonatal outcomes. Twenty-three neonates have been reported to be COVID-19 positive. Male neonates were affected significantly more (79%) than female neonates. Approximately 3% neonates acquired infection through suspected vertical transmission. Strict infection prevention measures

				during the perinatal time can significantly reduce the chance of horizontal transmission of the virus. Overall, neonates were asymptomatic or mildly symptomatic regardless of gestational age at birth and required only supportive measures. There was 0% mortality in COVID-19 positive neonates.
R38	Carina Rodrigues – Portugal	We identified 161 original studies reporting 3,985 cases of pregnant women with COVID-19 (1,007 discharged while pregnant). Preterm birth occurred in 23% of cases. Around 6% of pregnant women required admission to an intensive care unit and 28 died.	The 2,059 published cases with pregnancy outcomes resulted in 42 abortions and 21 stillbirths.	The 2,059 published cases with pregnancy outcomes resulted in 2,015 live births. There were 10 neonatal deaths. From the 163 cases with amniotic fluid, placenta, and/or cord blood analyzed for theSARS-CoV-2 virus, 10 were positive. Sixty-one newborns were positive for SARS-CoV-2. Four breast milk samples from 92 cases showed evidence of SARS-CoV-2.
R39	Marcos Nakamura-Pereira – Brazil	The total number of reported maternal deaths was 160. Twenty-two maternal deaths were documented in high-income countries, and 138 in middle-income countries (124 from Brazil, representing 77.5% of all maternal deaths reported in the literature). It is reasonable to assume that world-wide figures of maternal deaths due to COVID-19 are even higher. We did not identify published cases from low-income countries, which may reflect underreporting rather than absence of cases. The number of deaths, overall and in the obstetric population, is still rising in some countries such as Brazil and the USA, and the time gap between actual events and their reporting in peer-reviewed publications is bound to result in underestimations in literature reviews on COVID-19. Notably, the combined population size of the three high-income countries reporting maternal deaths is		

		slightly larger than that of the middle-income countries. Therefore, the incidence of maternal mortality in the latter seems at least six times higher than the figures in high-income countries. As expected, the impact of COVID-19 maternal deaths on the maternal mortality ratio tends to be proportionally higher in countries where such events are less frequent outside of the pandemic context, as seen in the UK.		
R40	Kamran Hessami – Iran	10 studies reported 37 maternal deaths. All maternal deaths were seen in women with previous co-morbidities, of which the most common were obesity, diabetes, asthma and advanced maternal age. Acute respiratory distress syndrome (ARDS) and severity of pneumonia were considered as the leading causes of all maternal mortalities, except for one case who died of thromboembolism during postpartum period.	10 studies reported 7 fetal deaths. Fetal mortalities were suggested to be a result of the severity of maternal infection.	10 studies reported 5 neonatal deaths. Neonatal mortalities were suggested to be a result of the severity of the prematurity. Interestingly, there was no evidence of vertical transmission or positive COVID-19 test result among expired neonates.
R41	Ernesto Antonio Figueiro-Filho – Canada	When analyzing the maternal characteristics of all pregnant women with COVID-19 described, most patients were in their 30s, with range from 20–49 years. The American population report described that the majority of cases (4,469/8,207; 54.5%) were in the 25–34 years range. Hispanic and Latino ethnicity also represented the majority of cases (1,822/8,428; 36.5%). Known underlying medical conditions were described in 22.8% of the patients (1,905/8,343) with special attention to chronic respiratory diseases (415/2,495; 16.6%), clinical diabetes (391/3,473;11.3%) and cardiovascular diseases (316/2,856; 11.1%). Most of the described pregnant women enrolled in the studies manifested		Live birth was present in 98% of reports, with 78% term deliveries. Preterm Birth <37 weeks was seen in 21% ofcases. The majority of cases had no newborn complications, although admission to NICU was reported in almost20% of cases. Fetal demise/stillbirth rates were 1.7% (19/11,130), neonatal death described in 0.8% (9/1,137) andSARS-COV2-Negative tests were found in 98.4% of neo-nates (1,098/1,116). Of note is that the neonatal information was not retrieved from all studies and some of them had no information on babies 'outcomes.

		symptoms (7,169/7,576;94.6%), but with mild presentation (921/1,243; 74.1%). The symptoms that were more frequently described during pregnancy were: cough (51.8%), fever (40%) and myalgia (43%), although more than 1/3 of cases manifested a variety of other symptoms, with a special significance to loss of taste/smell in almost 20% of cases (759/4,091; 18.4%).The most common and frequent radiological sign described was patchy shadowing/ground glass opacity (88%) and laboratory results revealed reduced leukocytes (80%), elevated CRP (27%) and elevated D-dimer (22%). The gestational age at diagnosis had aide range of 6–41 weeks, with almost half of cases diagnosed from 32–36 weeks (23%) and after 37 weeks and post-partum (22.3%). This information was only available in the French report. The systematic review including 385 patients described that 72% of cases were diagnosed with COVID-19 with GA>24 weeks. At the time of all publications, approximately 62% (1,119/1,811) of patients had delivered, therefore this information was not available in the American population report [18], nor in the Brazilian case series [16]. Out of the patients delivered, the gestational age at delivery ranged from 28–41 w, with cesarian deliveries representing 68% (761/1,119) and vaginal births 31.2% (349/1,119). Cesarian indicated exclusively for severeCOVID-19 infection was found in 28% of cases (149/531). Maternal ICU admission was described in 3.7% of cases, with respiratory support necessary in 5.25% of cases. Maternal hospitalization occurred in		

		35% of cases and 84%of pregnant women recovered from COVID-19 (1,340/1,595). Maternal death was described in 1.13% of cases (144/10,987) with special attention to the Brazilian report [16] that described an alarming rate of 12.7% (124/978).		
R42	Megan C Sharps – UK	Eighteen studies, involving 45 pregnancies, reported no evidence of pregnancy complications in their cases. There was no apparent increase in the frequency of maternal pregnancy complications in the remaining cases.The timing of infection relative to delivery varied widely; 186 women tested positive for SARS-CoV-2 on the day of delivery, 27 tested positive up to a week before birth, 6 tested positive up to two weeks before, 8 tested positive up to a month before and 2 tested positive up to 3 months before. Four women were admitted for delivery, but it is unclear when they were diagnosed]. Seven women were diagnosed postnatally; although one woman's swab tested negative, the CT scan indicated that she had COVID-19. The timing of diagnosis was unclear for 85women. Corticosteroids were administered to a total of 43 women (in 15 reports). Four studies reported that the corticosteroids were primarily given for prophylaxis against fetal lung disease. Yin et al. noted that 11 of 31 women had glucocorticoid therapy, but it is unclear which of the women had given birth. The remaining studies did not state whether any corticosteroids were administered to the mothers during their hospital admission for COVID-19.	Four studies tested fetal tissues following terminations, miscarriages or stillbirths reported negative PCR results for SARS-CoV-2. The birthweight of 5 stillborn infants were provided: 1070 g, 329 g, 2895 g, 680 g, and 1430 g at 28, 21-, 38-, 23- and 30-weeks' gestation, respectively	A total of 167 infants were born after 37 weeks' gestation, and 58 were born preterm (including four sets of twins), with the majority being born after 30 weeks' gestation. Seven infants were born in the "third trimester" (not defined by studies) and the exact gestation of 95 infants was unclear, with one study providing median gestational ages and the interquartile range which included four multiple-pregnancies. There were six terminations of pregnancy including one at 22weeks' gestation. In another case the outcome of the pregnancy was unclear. Two infants were described as small-for-gestational-age (SGA), but no definition was provided, three infants had FGR or SGA, but no definitions were provided and 11 birthweights were recorded as <2500 g, with no comment on whether the weights were appropriate for gestational age. Of the studies reporting live births, 34 tested some or all the neonates for SARS-CoV-2. Out of 307neonates tested, 7 (2%) were positive: three within 24 h of birth, two within 36 h of birth (although these studies may report the same infant), one 7 days after delivery and for one infant it was unclear when testing for SARS-CoV-2 was carried out.

R43	Reem S Chamseddine – Qatar	We reviewed 245 pregnancies complicated by maternal SARS-CoV-2 infection across 48 studies listed on PubMed and MedRxiv. The most common clinical presentations were fever (55.9%), cough (36.3%), fatigue (11.4%), and dyspnea (12.7%). Only 4.1% of patients developed respiratory distress. Of all patients, 89.0% delivered via cesarean section (n= 201), with a 33.3% rate of gestational complications, a 35.3% rate of preterm delivery.		There was a concerning 2.5% rate of stillbirth delivery or neonatal death. Among those tested, 6.45% of newborns were reported positive for SARS-CoV-2 infection.
R44	Marina N Boushra – USA	The physiological and mechanical changes associated with pregnancy increase maternal susceptibility to infections and complicate intubation and mechanical ventilation. The most common symptoms of COVID-19 in pregnant patients are cough and fever, although many infected individuals are asymptomatic. The majority of pregnant women diagnosed with COVID-19 disease have a mild course of illness and will recover without needing to deliver, but the risks of critical illness and need for mechanical ventilation are increased compared to the general population. Risk factors for death and severe disease include obesity, diabetes, and maternal age > 40 years. Women in their third trimester have the highest risk for critical illness, intensive care unit admission, and need for mechanical ventilation.	Adverse fetal outcomes of maternal COVID-19 infection include in-creased risk of miscarriage, prematurity, and fetal growth restriction.	Vertical transmission of SARS-CoV-2 is possible but has not been conclusively proven.
R45	Ionara Diniz Evangelista Santos Barcelos – Brazil			Nine cases of potential vertical transmission were de-scribed in ten reports: – Three reports of the same case of a potential vertical transmission at Tongji Hospital, Wuhan, China.

				–One report of a potential vertical transmission at Renmin Hospital, Wuhan, China. –One report of a potential vertical transmission at Imam Khomeini Hospital, Sari, Iran. –One report of two suspect cases at hospital maternity units of the COVID-network in Lombardy and units of Padua and Modena, northern Italy. –One report of a potential vertical transmission at the British American Hospital, Lima, Peru. –One report of a potential vertical transmission at Parissa clay University Hospitals, France. –One report of a potential vertical transmission at Saint Barnabas Medical Center, United States. –One report of potential vertical transmission at Henan Provincial People's Hospital, China.
R46	Agustín Ciapponi – Argentina	The most frequent COVID-19 clinical findings during pregnancy were fever (28–100%), mild respiratory symptoms (20–79%), raised C-reactive protein (28–96%), lymphopenia (34–80%), and pneumonia signs in diagnostic imaging (7–99%). The most frequent maternal outcomes were C-section (23–96%) and preterm delivery (14–64%).		Most of their babies were asymptomatic (16–93%) or presented fever (0–50%), low birth weight (5–43%) or preterm delivery (2–69%). The odds ratio (OR) of receiving invasive ventilation for COVID-19 versus non-COVID-19 pregnant women was 1.88 (95% Confidence Interval [CI] 1.36–2.60) and the OR that their babies were admitted to neonatal intensive care unit was 3.13 (95%CI 2.05–4.78). The risk of congenital transmission or via breast milk was estimated to be low, but close contacts may carry risks.
R47	Rajani Dube – UAE BL note: focus mainly on foetal/perinata	The rate of preterm labour was 26.4% (OR=1.45, 95% CI 1.03 to 2.03 with p=0.03) and caesarean delivery (CS) was 59.9% (OR=1.54, 95% CI 1.17 to 2.03 with p=0.002).	29 case reports and 31 case series and cohort studies describing 1318 foetuses were included for the evaluation of perinatal	38 case reports, 34 cohort and case series describing 1408 neonates were included for evidence acquisition of mother to child transmission. A pooled proportion of 3.67% neonates had positive SARS- CoV-2 viral RNA nasopharyngeal swab results and 7.1% had positive

	l/neonatal outcomes; did have preterm labour		outcome and congenital anomalies	cord blood samples. 11.7% of the placenta, 6.8% of amniotic fluid, 9.6% of fecal and rectal swabs and none of the urine samples were positive. The most common neonatal symptom was breathing difficulty (1.79%). Stillbirth rate was 9.9 per 1000 total births in babies born to COVID-19 mothers.
R48	Mona Mirbeyk – Iran	37 articles involving 364 pregnant women with COVID-19. The vast majority of pregnant patients were in their third trimester of pregnancy, and only 45 cases were in the first or second trimester (12.4%). Most mothers described mild to moderate manifestations of COVID-19. Of 364 pregnant women, 25 were asymptomatic at the time of admission. The most common symptoms were fever (62.4%) and cough (45.3%). Two maternal deaths occurred. Some pregnant patients (12.1%) had a negative SARS-CoV-2 test but displayed clinical manifestations and abnormalities in computed tomography (CT) scan related to COVID-19. Twenty-two (6.0%) pregnant patients developed severe pneumonia. Two maternal deaths occurred from severe pneumonia and multiple organ dysfunction.		Studies included a total of 302 neo-nates from mothers with COVID-19. Of the studies that provided data on the timing of birth, there were 65 (23.6%) preterm neonates. One baby was born dead from a mother who also died from COVID-19. Of the babies born alive from mothers with COVID-19, five newborns faced critical conditions, and two later died. A total of 219 neonates underwent nasopharyngeal specimen collection for SARS-CoV-2, of which 11 tested positive (5%). Seventeen studies examined samples of the placenta, breast milk, umbilical cord, and amniotic fluid, and all tested negative except one amniotic fluid sample.
R49	Karoline Faria de Oliveira – Brazil			In order to track the infection, specimens were collected from neonates through nasal swabs and C-reactive protein from breast milk, cord blood, amniotic fluid, placenta and vaginal secretion was analyzed. A small percentage of neonates tested positive for COVID-19, but these cases were not attributed to vertical transmission.
R50	Rachel R Oshay – USA	A total of 67 articles and 427 pregnant patients diagnosed with COVID-19 were analyzed. The most frequently encountered pulmonary findings on chest		Of the 251 neonates delivered, 96.8% had negative RT-PCR and/or IgG antibody testing for COVID-19. In the eight cases (3.2%) of reported neonatal

		CT were ground-glass opacities (77.2%, 250/324), posterior lung involvement (72.5%, 50/69), multilobar involvement (71.8%, 239/333), bilateral lung involvement (69.4%, 231/333), peripheral distribution (68.1%, 98/144), and consolidation (40.9%, 94/230). Pregnant patients were also found to present more frequently with consolidation (40.9% vs. 21.0–31.8%) and pleural effusion (30.0% vs. 5.0%) in comparison to the general population. Associated clinical features included ante-partum fever (198 cases), lymphopenia (128 cases), and neutrophilia (97 cases).		infection, tests were either conducted on samples collected up to 72 h after birth or were found negative on all subsequent RT-PCR tests.
R51	Lemi Belay Tolu – Ethiopia			We identified 51 studies reporting 336 newborns screened for COVID-19. From the 336 newborns screened for COVID-19, only 15 (4.4%) were positive for throat swab RT-PCR. All neonates with positive throat swab RT-PCR were delivered by cesarean section. Among neonates with throat swab SARS-CoV-2 positive only five (33.3%) had concomitant placenta, amniotic fluid, and cord blood samples tested, of which only one amniotic fluid sample is positive for RT PCR. Five neonates had elevated IgG and IgM but without intrauterine tissue tested. Four neonates had chest imaging suggestive of COVID-19 pneumonia.
RR01	Xue Ling Ang – Singapore			
RR02	Michail Papapanou – Greece	Reported rates, regarding both preterm and term gestations, varied between 52.3 and 95.8% for cesarean sections; 4.2-44.7% for vaginal deliveries; 14.3-63.8% specifically for preterm deliveries and 22.7-32.2% for preterm labor; 5.3-12.7% for PROM	Maternal anxiety for potential fetal infection contributed to abortion decisions, while SARS-CoV-2-related miscarriages could	Neonatal ICU admission and mortality rates were 3.1-76.9% and <3%, respectively. Neonatal PCR positivity rates ranged between 1.6% and 10%.

		and 6.4-16.1% for pPROM. Maternal ICU admission and mechanical ventilation rates were 3-28.5% and 1.4-12%, respectively. Maternal mortality rate was <2%. After accounting for quality of studies, ranges of our primary outcomes remained almost unchanged, while among our secondary outcomes, maternal ICU admission (3-10%) and mechanical ventilation rates (1.4-5.5%) were found to be relatively lower.	not be excluded. Stillbirth = <2.5%.	

Annex 19

Respiratory System

NOTE: The full citation for each article in the table can be found in the excel spreadsheet file 'COVID Review Citations Jan2020 to Aug2021', Respiratory Tab

Type of Reference	Review Period	Author	Country	Focus
1. Reviews	Aug2020	1. Shelmerdine SC	Europe	COVID-19 in children: systematic review of imaging findings
	Aug2020	2. Baksh M	India/Pakist	Systematic review of ARDS in COVID-19
	Aug2020	3. Anapat.hrc	Spain	First COVID-19 autopsy in Spain
	Dec2020	4. Kadyrova A	Kyrgyz	Identifying pulmonary manifestations of COVID-19 on CT
2. Meta-Analyses				
3. Pathogenesis / hypothesis*	May2020	1. Gattinoni L	Italy	COVID-19 Does not lead to a "typical" ARDS
	May2020	2. Gattinoni L	Italy/Germany	COVID19 pneumonia: ARDS or not?
	Dec2020	3. Lin SH	China	COVID-19: cytokine storms, hyper-inflammatory phenotypes, ARDS
	Dec2020	4. Painter JD	USA	Role of Autophagy in Lung Inflammation
	Dec2020	5. Sadegh Beigee	Iran	Diffuse alveolar damage/thrombotic microangiopathy main lung biopsy finding
	Dec2020	6. Holter JC	Norway	Systemic complement activation associated with respiratory failure in COVID-19
	Dec2020	7. Ronit A	Denmark	Compartmental immunophenotyping in COVID-19 ARDS
	Dec2020	8. Bussani R	Italy/UK	Viral RNA persistence/pneumocyte syncytia/thrombosis: hallmarks of COVID-19
	Dec2020	9. Notz Q	Germany	Pro&Anti-Inflammatory Responses in Severe COVID-19 ARDS
	Dec2020	10. Stukas S	Canada	Association of Inflammatory Cytokines in COVID-19 Respiratory Failure
	Dec2020	11. Quan C	China	Immunopathogenesis of COVID-19 ARDS
	Dec2020	12. Thachil J	UK/India	Hemostatic Lung Abnormality in COVID-19: Thrombosis or Embolism?
4. Guidelines*				
5. Studies*	May2020	1. Mo P	China	Clinical characteristics of refractory COVID-19 pneumonia in Wuhan
	Aug2020	2. Carsana L	Italy	Pulmonary post-mortem findings in COVID-19: case series from Italy
	Dec2020	3. Kangas-Dick A	USA	Clinical characteristics and outcome of pneumomediastinum in COVID-19
	Dec2020	4. Jalobe OMP	UK	Implications of COVID-19 related pneumomediastinum
	Dec2020	5. Jones E	UK	Subcutaneous emphysema/pneumomediastinum/pneumothorax in COVID19

	Dec2020	6. Morrone KA	USA	Acute chest syndrome in setting of COVID-19: case series from the Bronx
	Dec2020	7. Martinelli AW	UK	COVID-19 and pneumothorax: multicentre retrospective case series
	Dec2020	8. Marsico S	Spain	Spontaneous pneumothorax in COVID-19 patients
	Dec2020	9. Zantah M	USA	Pneumothorax in COVID-19 disease – incidence and clinical characteristics
	Dec2020	10. Wang XH	China	High incidence and mortality of pneumothorax in COVID-19 critically ill.
6. Case Reports/Series*				
Spontaneous pneumothorax	May2020	1. Rohailla S	Canada	SARS-CoV-2 infection associated with spontaneous pneumothorax
	Aug2020	12 new reports	Multiple	For Q1/Dec2020 see COVID-19 spreadsheet – respiratory tab, subgroup 1 = pneumothorax, subgroup 2 = case reports
	Dec2020	21 new reports	Multiple	
Pneumomed-iastinum +/- Pneumothorax	May2020	1. Zhou C	China	COVID-19 with spontaneous pneumomediastinum
	May2020	2. Kolani S	Morocco	Spontaneous pneumomediastinum in SARS-CoV02 infection 23yo F
	Aug2020	14 new reports	Multiple	For Q1/Dec2020 see COVID-19 spreadsheet – respiratory tab, subgroup 1 = pneumomediastinum, subgroup 2 = case reports
	Dec2020	19 new reports	Multiple	
Other	May2020	1. Shi F	China	COVID 19 pneumonia with hemoptysis as the initial symptom
	May2020	2. Beerkens F	USA	COVID -19 pneumonia as cause of acute chest syndrome in adult sickle cell patient
	May2020	3. Sivakorn C	Thailand	Walking pneumonia in COVID-19: mild symptoms with marked CT abnormalities
	Aug2020	4. Suess C	Switzerland	Gross and histopathologic pulmonary findings in COVID-19 death in self-isolation.
	Aug2020	5. Chen Y	China	Large pulmonary cavity in COVID-19 cured patient case report.
	Aug2020	6. Renaud-Picard	France	Delayed pulmonary abscess following COVID-19 pneumonia: A case report.
	Aug2020	7. Borghesi A	italy	COVID-19 Pneumonia: Three Thoracic Complications in the Same Patient
	Aug2020	8. Schwensen HF	Denmark	Fatal pulmonary fibrosis: a post-COVID-19 autopsy case
	Aug2020	9. Amaral LTW	Brazil	Lung cavitation in COVID-19: co-infection complication or rare evolution?
	Dec2020	10. Mughal MS	USA	Hilar lymphadenopathy, novel finding in COVID-19
	Dec2020	11. Longo C	Ital	Platypnea-orthodeoxia after fibrotic evolution of COVID-19 interstitial pneumonia.
	Dec2020	12. Lari A	Kuwait	Caution against precaution: A case report on silent hypoxia in COVID-19
	Dec2020	13. Berhane S	UK	Bullous lung disease in a patient with severe COVID-19 pneumonitis
	Dec2020	14. Widysanto A	Indonesia	Happy hypoxia in critical COVID-19 patient: A case report in Tangerang, Indonesia
	Dec2020	15. Peys E	Belgium	Haemoptysis as the first presentation of COVID-19: a case report

* The August 2021 search excluded these types of articles (Guidelines, Studies, Case Series, Case Reports, Commentary, Letters to the Editor).