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Characterising long COVID: a living systematic review

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ABSTRACT

Background While it is now apparent clinical sequelae (long COVID) may persist after acute COVID-19, their nature, frequency and aetiology are poorly characterised. This study aims to regularly synthesise evidence on long COVID characteristics, to help inform clinical management, rehabilitation strategies and interventional studies to improve long-term outcomes.

Methods A living systematic review. Medline, CINAHL (EBSCO), Global Health (Ovid), WHO Global Research on COVID-19 database, LitCovid and Google Scholar were searched till 17 March 2021. Studies including at least 100 people with confirmed or clinically suspected COVID-19 at 12 weeks or more post onset were included. Risk of bias was assessed using the tool produced by Hoy *et al*. Results were analysed using descriptive statistics and meta-analyses to estimate prevalence.

Results A total of 39 studies were included: 32 cohort, 6 cross-sectional and 1 case–control. Most showed high or moderate risk of bias. None were set in low-income countries and few included children. Studies reported on 10 951 people (48% female) in 12 countries. Most included previously hospitalised people (78%, 8520/10 951). The longest mean follow-up time was 221.7 (SD: 10.9) days post COVID-19 onset. Over 60 physical and psychological signs and symptoms with wide prevalence were reported, most commonly weakness (41%; 95% CI 25% to 59%), general malaise (33%; 95% CI 15% to 57%), fatigue (31%; 95% CI 24% to 39%), concentration impairment (26%; 95% CI 21% to 32%) and breathlessness (25%; 95% CI 18% to 34%). 37% (95% CI 18% to 60%) of patients reported reduced quality of life; 26% (10/39) of studies presented evidence of reduced pulmonary function.

Conclusion Long COVID is a complex condition with prolonged heterogeneous symptoms. The nature of studies precludes a precise case definition or risk evaluation. There is an urgent need for prospective, robust, standardised, controlled studies into aetiology, risk factors and biomarkers to characterise long COVID in different at-risk populations and settings.

PROSPERO registration number CRD42020211131.

Key questions

What is already known?

- A significant number of people continue to describe ongoing symptoms long after the acute phase of COVID-19, often referred to as long COVID.
- Long COVID is a heterogeneous condition with an uncertain prevalence, for which there is currently no precise case definition.

What are the new findings?

- The breadth of reported symptoms suggests a complex, heterogeneous condition affecting both those who were hospitalised and those managed in the community.
- Our review identifies weakness (41%; 95% CI 25% to 59%), general malaise (33%; 95% CI 15% to 57%), fatigue (31%; 95% CI 24% to 39%), concentration impairment (26%; 95% CI 21% to 32%) and breathlessness (25%; 95% CI 18% to 34%) as the most common symptoms reported.

What do the new findings imply?

- The current evidence base of the clinical spectrum of long COVID is limited, based on heterogenous data, and vulnerable to biases, hence caution should be used when interpreting or generalising the results.
- Our review identifies areas where further long COVID research is critically needed to help characterise long COVID in different populations and define its aetiology, risk factors and biomarkers, as well as the impact on variants of concern and vaccination on long-term outcomes.

INTRODUCTION

SARS-CoV-2 first emerged in December 2019 causing a widespread pandemic. Most people experience asymptomatic or mild-to-moderate acute COVID-19 symptoms, while around 15% of people are estimated to progress to more severe disease requiring hospitalisation and approximately 5% become critically ill.[1]

While the acute phase of the disease was characterised early, there are still limited data on long-term outcomes.[2] Symptoms of long-lasting COVID-19 sequelae and complications, termed long COVID by people living with long COVID,[3] have been

reported worldwide. Yet the underlying aetiology behind prolonged or fluctuating symptomatology is limited and there is no widely accepted uniformed case definition.[4] Instead, long COVID has been defined pragmatically as 'not recovering for several weeks or months following the start of symptoms'.[4] Others have distinguished between postacute COVID-19, referring to symptoms beyond 3 weeks, and chronic COVID-19, referring to symptoms beyond 12 weeks,[5] while the National Institute for Health and Care Excellence distinguishes between ongoing symptomatic COVID-19 lasting from 4 to 12 weeks and post COVID-19 syndrome continuing for over 12 weeks.[6]

The number of people living with long COVID is unknown. Attempts to quantify the prevalence of long COVID use different methods, including national surveys and patient-led studies, making it difficult to compare across studies. The UK's Office for National Statistics has estimated that on average 1 in 5 people have symptoms beyond 5 weeks, while 1 in 10 have symptoms persisting over 12 weeks.[7] A patient-led survey found that in survival analysis, the chance of full recovery by day 50 was smaller than 20%[8] and a COVID-19 symptom app study found that 13.3% (558/4182) patients had symptoms lasting 28 days or more, 4.5% (189/4182) patients had symptoms for 8 or more weeks and 2.3% (95/4182) patients had symptoms lasting over 12 weeks.[9]

The symptoms of long COVID are equally ill-defined, with patients describing it as a fluctuating illness of disparate symptoms.[8 10] Indeed, the National Institute for Health Research has suggested that postacute COVID-19 may consist of several distinct clinical syndromes including: a postintensive care syndrome, chronic fatigue syndrome, long-term COVID-19 syndrome and disease from SARS-CoV-2 inflicted organ damage.[11] Additionally, even with an expanding knowledge of risk factors in the acute phase, little is currently known on predictive factors for developing long COVID.[9] Despite suggested classifications, there is yet no clear consensus.

Our early understanding of long COVID has been accumulated from case reports and cross-sectional online survey studies as the pandemic global research focus has largely been on studies of hospitalised patients during the acute phase. As the pandemic progresses, emerging studies have followed up patients to present the fluctuating multiorgan sequelae of acute COVID-19, yet evidence is still scarce. There continues to be a call to further understand and acknowledge this condition by incorporating patient knowledge and experiences, together with standardised studies, exploring underlying aetiologies behind different syndromes.[12 13]

Given the enormous number of people worldwide who have suffered from COVID-19, it is essential to establish a precise categorisation of long COVID. Such categorisation will not only help people better understand their symptoms but also direct research into prevention, treatment and support, ultimately allowing us to understand and prepare to respond to the long-term consequences inflicted by the COVID-19 pandemic. Our review seeks to synthesise and continually update the evidence on the character and prevalence of long COVID.

METHODS

Systematic reviews conducted early during the COVID-19 pandemic soon became redundant due to the rapidity with which new research was released. In recognition of this, many reviewers have moved towards the concept of a 'living systematic review' (LSR), which compared with traditional systematic reviews has in-built mechanisms for regular update and renewal.[14 15] We conducted a 'living' systematic review to provide frequently updated evidence on the symptoms and complications of long COVID. This review was developed in collaboration with infectious disease clinicians, public health professionals, information specialists, review methodologists with experience in clinical epidemic research and members of the global Long COVID Support Group, which includes people living with long COVID. This is the first version of this LSR, which will be updated approximately every 6 months as new evidence emerges, using the established protocol and review platform. The updates will be led by the International Severe Acute Respiratory and emerging Infection Consortium (ISARIC) systematic review team in collaboration with members of Long COVID Support. Previous versions will be archived in online supplemental materials. The findings will be disseminated via *BMJ Global Health* and on a dedicated webpage with infographics and a brief summary for lay people and professionals.

Protocol registration

This report was structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement guidelines.[16] The protocol was registered with PROSPERO and published in a peer-reviewed journal.[17]

Search strategy

The following databases were searched: Medline and CINAHL (EBSCO), Global Health (Ovid), WHO Global Research Database on COVID-19 and LitCovid from 1 January 2020 to 17 March 2021. Additionally, we searched Google Scholar on 17 March 2021, screening the first 500 titles. A 'backwards' snowball search was conducted of the references of systematic reviews. Full search terms are included in online supplemental file 1. The search terms and inclusion criteria have, for this first version, been designed to cast a wide net and will be modified in line with new evidence, research priorities and clinical and policy needs.

Eligibility criteria

Peer-reviewed studies were considered eligible if they included at least 100 people with laboratory confirmed and/or clinically diagnosed COVID-19. Without a clear, internationally agreed case definition, we included studies that reported symptoms or outcomes assessed at 12 or more weeks post COVID-19 onset.[6]

There were no language restrictions. Reviews and opinion pieces were excluded. Studies were excluded if they included fewer than 100 participants, to avoid small study effects,[18] or the follow-up was unclear or less than 12 weeks post onset.

Screening

Screening was performed independently by two systematic reviewers. Any disagreements were resolved via consensus or a third reviewer. Non-English articles were translated using Google Translate and assessed by a systematic reviewer with good knowledge of the language. The data were managed using the review software Rayyan.[19]

Data extraction

Data extraction was performed using Microsoft Excel. A data extraction template informed by a previous review[20] was reviewed, updated and piloted before being finalised. Data extracted included study design, population characteristics, outcomes, prevalence, duration of symptoms and risk factors. Data extraction was performed by one systematic reviewer and checked by a second reviewer. Disagreements were resolved through consensus. To avoid duplication of data in future updates and ensure robustness, data extraction was not performed for non-peer-reviewed preprints.

Risk of bias assessment

The included studies were assessed for risk of bias using the tool produced by Hoy *et al*[21] (online supplemental file 2). This assessment checklist is a validated tool for assessing risk of bias in prevalence studies. The checklist has 10 domains for assessing risk of bias, used to calculate a cumulative overall risk of bias for the whole study.

Data analysis

We undertook individual descriptive analysis for each study. We presented symptom proportions by different settings, as presented in the individual studies: hospitalised, non-hospitalised or a mix of both populations if no subset data were available. Symptoms were broadly grouped into physiological clusters through discussion with clinicians. Proportion of symptoms and its 95% CIs were estimated using the exact method.[22] If there were two or more studies for each symptom, a meta-analysis was performed using a random intercept logistic regression model with Hartung-Knapp modification due to the heterogeneity and skewed sample sizes.[23 24] Heterogeneity between estimates was assessed using the I^2 statistic.[25] Additional subgroup analysis was conducted to explore the modification of the following factors on proportion of symptoms: hospitalisation, settings, continents and follow-up timing. We also conducted meta-regression analysis on the percentage of females and intensive care unit (ICU) patients where there were more than 10 studies for the symptom. Sensitivity analyses were conducted to examine the impact of high risk of bias studies and statistical methods, Freeman-Tukey double arcsine transformation using inverse variance meta-analysis, on the estimates. Funnel plots were plotted using proportion of the symptom against the precision and sample sizes[22] where there were more than 10 studies for the symptom to explore risk of publication bias. All analysis and data presentation were performed using metaprop[26] and ggplot2[27] in R (V.4.0.5) via RStudio (V.1.3.1093).[28] The data are presented using a combination of infographics, prepared by a design company (Design Science[29]) and scientific tables to facilitate interpretation by different stakeholders, including non-specialists.

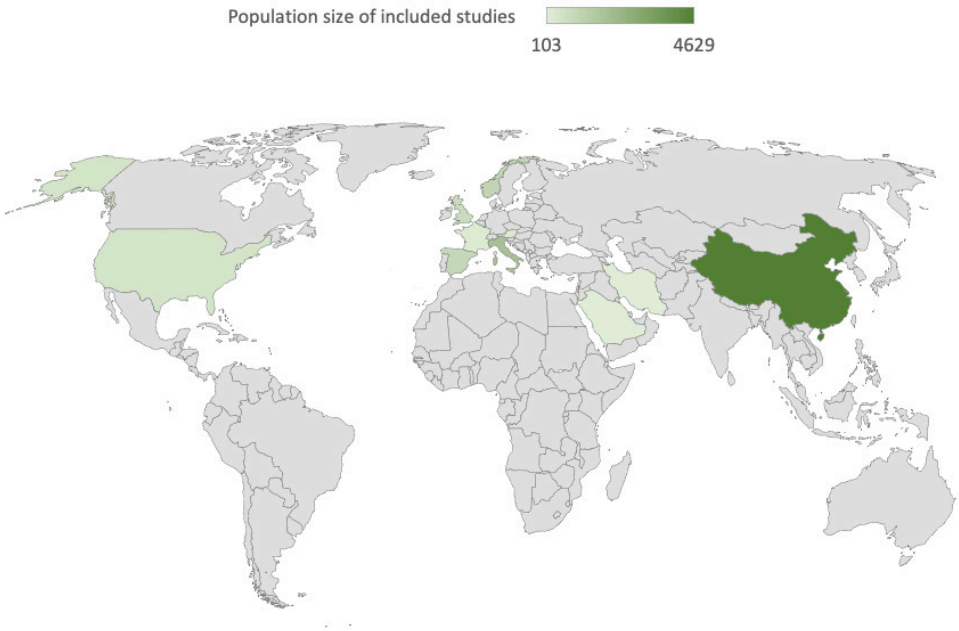

Figure 1 Map of study distribution.

Table 1 Study characteristics

Study	Design	Country	Population size	Age (years)	Sex (% female)	COVID-19 confirmation method	Follow-up time (days)	Follow-up timepoint	Follow-up mode
Non-hospitalised									
Hopkins *et al*[58]	Cross sectional	UK	434	Median (range): 40 (19–77)	75	PCR or serological assays (26.3%)	6 months	First survey	Electronic survey
Klein *et al*[47]	Cohort (P)	Israel	103	Mean (SD): 35 (12)	38	PCR (RT-PCR)	6 months	Onset	Phone interview
Petersen *et al*[32]	Cohort (P)	Faroe Islands	180	Mean (SD; range): 39.9 (19.4; 0–93)	54	PCR (RT-PCR)	Mean (SD) 125 (17)	Onset	Phone interview
Stavem *et al*[68]	Crosssectional	Norway	451	Mean (SD): 49.8 (15.2)	56	PCR (RT-PCR)	Median (range): 117 (41–193)	Onset	Outpatient visit and survey
Non-hospitalised and hospitalised									
Parente-Arias *et al*[55]	Cohort (P)	Spain	151	Mean (range): 55.2 (18–88)	65	PCR (RT-PCR)	Mean (SD): 100.5 (3.3)	Admission	Phone interview
Venturelli *et al*[60]	Cohort (P)	Italy	767	Mean (SD): 63 (13.6)	33	PCR (RT-PCR) (94%); serology (5%) Clinician diagnosis (1.2%)	Median (IQR): 105 (84–127)	Onset	Outpatient visit
Anastasio *et al*[41]	Cohort (P)	Italy	379	Median (IQR; range): 56 (49–63; 20–80)	54	PCR (RT-PCR)	Median (IQR): 135 (102–175)	Onset	Outpatient visit
Einvik *et al*[67]	Crosssectional	Norway	538	Mean (SD) 57.7 (14.2) (hospital) 49.6 (15.3)	42 (hospital) 56	PCR (RT-PCR)	Mean (SD): 112 (30) (hospital) 118 (27)	Onset	Outpatient visit and survey
Jacobson *et al*[40]	Cohort (P)	USA	118	Mean (SD): 43.3 (14.4)	47	PCR (RT-PCR)	Mean (SD): 119.3 (33)	Diagnosis	Outpatient visit
Logue *et al*[35]	Cohort (P)	USA	177 21 (C)	Mean (SD): 48 (15.2)	57	Lab confirmed	Median (range): 169 (31–300)	Onset	Electronic survey
Mazza *et al*[70]	Cohort (P)	Italy	226	Mean (SD; range): 58 (12.8; 26–87)	34	PCR (RT-PCR)	Mean (SD): 90 (13.4)	Discharge	Phone interview
Rass *et al*[50]	Cohort (P)	Austria	135	Median (IQR; range) 56 (48–68; 19–87)	39	PCR (RT-PCR)	Median (IQR): 102 (91–110)	Onset	Outpatient visit
Sonnweber *et al*[48]	Cohort (P)	Austria	145	Mean (SD): 57 (14)	43	PCR (RT-PCR)	Mean (SD): 103 (21)	Diagnosis	Outpatient visit
Hospitalised									
Alharthy *et al*[54]	Cohort (P)	Saudi Arabia	127	Mean (SD): 47 (11.38)	21	PCR (RT-PCR)	4 months	Discharge	Outpatient visit
Arnold *et al*[37]	Cohort (P)	UK	110	Median (IQR): 60 (46–73)	38	PCR or radiological diagnosis	Median (IQR): 90 (80–97)	Onset	Outpatient visit
Baricich *et al*[63]	Crosssectional	Italy	204	Mean (SD): 57.9 (12.8)	40	NR	Mean (SD): 124.7 (17.5)	Discharge	Outpatient visit

Continued

Table 1 Continued

Study	Design	Country	Population size	Age (years)	Sex (% female)	COVID-19 confirmation method	Follow-up time (days)	Follow-up timepoint	Follow-up mode
Bellan *et al*[42]	Cohort (P)	Italy	238	Median (IQR): 61 (50–71)	40	PCR (RT-PCR) (97.5%); bronchoalveolar lavage (0.4%); serology/ radiological (2.1%)	3–4 months	Discharge	Outpatient visit
Blanco *et al*[38]	Cohort (P)	Spain	100	Mean (SD) TLco<80: 54.98 (10.72) TLco>80: 54.75 (9.83)	36	PCR (RT-PCR)	Median (IQR): 104 (89.25–126.75)	Onset	Outpatient visit
Doyle *et al*[66]	Cohort (P)	UK	129	Mean: 62 (Cambridge) 56 (London)	31 (Cambridge) 27 (London)	PCR (RT-PCR)	Median (range): 113 (96–138)	Discharge	NR
Garrigues *et al*[65]	Cohort (P)	France	120	Mean (SD): 63.2 (15.7)	38	PCR (RT-PCR)	Mean (SD): 110.9 (11.1)	Admission	Phone interview
Gherlone *et al*[57]	Cohort (P and R)	Italy	122	Median (IQR): 62.5 (53.9–74.1)	25	PCR (RT-PCR)	Median (IQR): 104 (95–132)	Discharge	Outpatient visit
Han *et al*[46]	Cohort (P)	China	114	Mean (SD; range): 54 (12; 24–82)	30	PCR (RT-PCR)	Mean (SD): 175 (20)	Onset	Outpatient visit
Huang *et al*[56]	Cohort (P and R)	China	1733	Median (IQR): 57 (47–65)	48	Lab confirmed	Median (IQR): 186 (175–199)	Onset	Outpatient visit
Zhang *et al*[31]	Cohort (R/S)	China	527	Median (IQR; range): 42.5 (32–54; 0–91)	44	NR	6 months	Discharge	Outpatient visit
Lerum *et al*[61]	Cohort (P)	Norway	103	Median (25th–75th percentile): 59 (49–72)	48	Nasopharyngeal swab	3 months	Discharge	Outpatient visit
Méndez *et al*[49]	Cohort (R/S)	Spain	215	Median (IQR): 55 (47–66)	40	Lab confirmed	Median (IQR): 87 (62–109)	Discharge	Outpatient visit
Nguyen *et al*[33]	Cohort (P)	France	125	Median (IQR; range): 36 (27–48; 16–85)	55	PCR (RT-PCR)	Mean (SD): 221.7 (10.9)	Onset	Phone interview
Nugent *et al*[36]	Cohort (R/S)	USA	182 1430 (C)	Median (IQR): 67.4 (58.3–80.1)	47	PCR (RT-PCR)	Median (IQR): 92.9 (52.5–127.7)	Discharge	Outpatient visit
Qin *et al*[53]	Cohort (P)	China	647	Mean (SD): 58 (15)	56	PCR (RT-PCR)	90	Discharge	Outpatient visit
Qu *et al*[34]	Cohort (P)	China	540	Median (IQR): 47.50 (37–57)	50	PCR (RT-PCR)	3 months	Discharge	Electronic survey
Sibila *et al*[51]	Cohort (P)	Spain	172	Mean (SD): 56.1 (19.8)	43	NR	Mean (SD): 101.5 (19.9)	Discharge	Outpatient visit
Simani *et al*[59]	Cohort (P)	Iran	120	Mean (SD): 54.62 (16.94)	33	PCR or radiological diagnosis	6 months	Discharge	Outpatient visit
Suárez-Robles *et al*[64]	Crosssectional	Spain	134	Mean (SD): 58.53 (18.53)	54	PCR (RT-PCR)	90	Discharge	Phone survey

Continued

Table 1 Continued

Study	Design	Country	Population size	Age (years)	Sex (% female)	COVID-19 confirmation method	Follow-up time (days)	Follow-up timepoint	Follow-up mode
Sykes *et al*[39]	Cohort (P)	UK	134	Median (range): 58 (25–89)	34	PCR (RT-PCR)	Median (range): 113 (46–167)	Discharge	Outpatient visit
Taboada *et al*[62]	Cross sectional	Spain	183	Mean (SD): 65.9 (14.1)	40	PCR (RT-PCR)	6 months	Discharge	Unstructured interview
Weng *et al*[45]	Cohort (P)	China	117	45.3%≥60 years	44	Viral nucleic acid test	90	Discharge	Phone interview
Xiong *et al*[44]	Cohort (P)	China	538 184 (C)	Median (IQR; range): 52 (41–62; 22–79)	55	PCR (RT-PCR)	Median (IQR; range): 97.0 (95.0–102.0; 91–116)	Discharge	Phone interview
Xu *et al*[43]	Case–control	China	103 27 (C)	Median (IQR) M/M: 56 (45–63) S/C: 61 (55–68)	M/M: 58.8 S/C: 53.6	NR	3 months	Discharge	Outpatient visit
Zhang *et al*[62]	Cohort (P)	China	310	Median (IQR): 51 (31.8–61)	50	PCR (RT-PCR)	Median (IQR): 92.0 (90–100)	Discharge	Outpatient visit

C, control group; M/M, mild/moderate; NR, not reported; P, prospective; PCR, polymerase chain reaction; R, retrospective; RT, Reverse transcription; S/C, severe/critical; TLco, carbon monoxide transfer factor.

Patient and public involvement

The study team includes members who have been affected by long-term COVID-19 sequalae, including members of Long COVID Support,[10] a patient support group with global reach, with approximately 40 000 members.

They actively contributed to the development of the study protocol, to inform the research questions and interpretation and presentation of the findings and to communicate the results to different audiences. The results of this LSR will be disseminated to long COVID patient forums for discussion and feedback to inform research priorities and updates.

RESULTS

We identified 6459 studies, of which 39 met the inclusion criteria (online supplemental file 3), all of which were published in English. Of these, 32 were included in the meta-analysis. The remaining studies include single symptoms or imaging and diagnostics and are presented narratively.

Characteristics of included studies

Most studies were set in Europe (62%, 24/39), followed by Asia (23%, 9/39), North America (8%, 3/39) and the Middle East 8% (3/39) (figure 1). There was no study set in a low-middle income country.[30] Most were cohort studies (82%, 32/39), followed by cross sectional studies (15%, 6/39) and a case–control study (3%, 1/39). These studies present data on 10 951 (range: 100–1733) people in 12 countries, aged from 9 months to 93 years old and 48% (5206/10 951) were females.

The map shows the global distribution of the studies identified and the shading shows the combined studies population size by country.

Most studies included adults, while 10% (4/39) also included children.[31–34] Only 15% (6/39) of studies reported ethnicity of the participants,[35–40] but without stratification. Table 1 presents the included study characteristics.

Most studies (67%, 26/39) were cohorts of hospitalised patients post discharge, 10% (4/39) followed up people who were not hospitalised, while 23% (9/39) included both (hospitalised and non-hospitalised populations). Of the inclusions in this review, 78% (8520/10 951) were previously hospitalised during the acute COVID-19 phase . Twenty-two studies included people requiring ICU admission during the acute phase.[31 33–35 37 38 40–55]

The longest follow-up period in any study was a mean of 221.7 (SD: 10.9) days post onset. Only 56% (22/39) of studies specified COVID-19 severity,[31 33–35 37 38 40–55] 31% (12/39) treatment received during the acute phase[36 40 41 45 46 50 53 56–60] and 62% (24/39) described ventilation support requirements.[36–42 45 46 48–51 53 54 56 57 60–66] Pre-existing comorbidities were reported in the majority of studies (85%, 33/39), with hypertension and diabetes most commonly documented.[33 35–57 59–63 65 67–69]

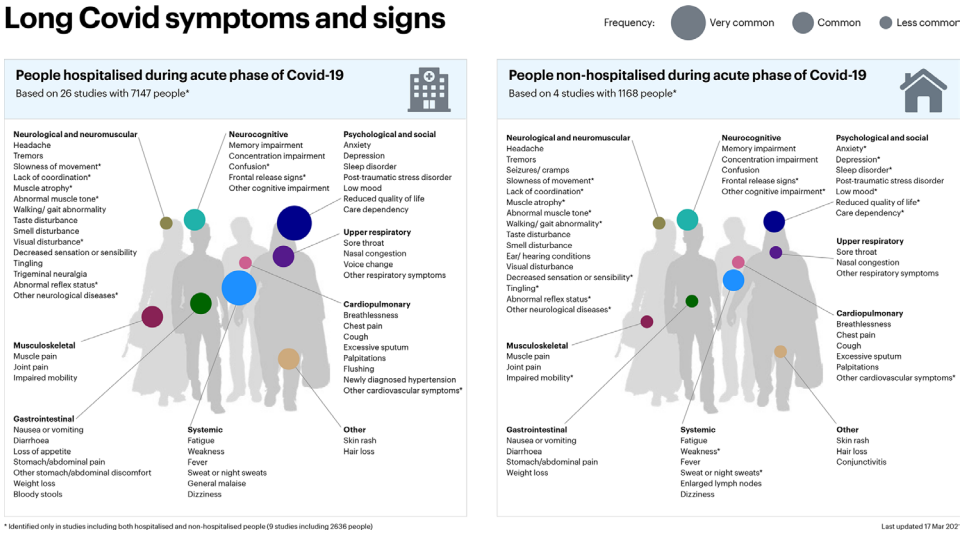

Figure 2 Long COVID signs and symptoms.

Risk of bias

Overall, 12 studies were assessed as high risk of bias, 22 as moderate risk of bias and 5 as low risk of bias. Most studies had a high risk of bias with regard to the generalisability of their results to the wider population with COVID-19. High risk of bias ratings were most common for external validity, with item 1 (representation of target population) and item 3 (random selection) having the most high risk of bias ratings (online supplemental file 2). Further, the recruitment process and response rates were often not well described and several studies applied different data collection methods. Although many studies applied validated measurement methods to assess participants, most were not designed to detect symptoms arising from COVID-19. Only four studies included a comparative control group.[35 36 43 44]

Symptoms and signs

Patients suffering from long COVID report a wide range of new or persistent symptoms, in both the hospitalised and non-hospitalised populations. Symptoms were broadly organised into physiological 'clusters' for the purpose of presentation and interpretation of this review (figure 2).

The focus of each study included in our analysis varied. Some authors focused solely on a specialty, such as dentistry, or a specific symptom, such as cognition, making comparative analysis difficult. Even among those studies which took a broad approach, the prevalence of symptoms was diverse. Similarly, the prevalence of the more commonly reported symptoms varied markedly.

Within these limitations, we performed a meta-analysis of the most commonly reported symptoms and signs of long COVID. The most commonly described symptoms (with prevalence of 25% or greater) were weakness (41%, 95% CI 25.43 to 59.01), general malaise (33%, 95% CI 14.91 to 57.36), fatigue (31%, 95% CI 23.91 to 39.03), concentration impairment (26%, 95% CI 20.96 to 31.73) and breathlessness (25%, 95% CI 17.86 to 33.97). Across studies, 37% (95% CI 18.43 to 59.93) of patients reported reduced quality of life. Although high I^2 values (>80%) were observed, they resulted from narrow dispersions in the estimates and well-separated estimates and CIs between studies (online supplemental file 4). The differences between these symptoms and the heterogeneity within them are likely to be, to some extent, due to other factors (eg, study settings, populations and different measurement tools used).

Patients also reported a diverse array of less prevalent symptoms and signs, including sweating, chest pain, sore throat, anxiety and headaches, among others. The prevalence of these symptoms was lower, usually less than 20%. Figure 3 presents the range of documented patient symptoms and signs, including all the studies.

Figure 4 displays these data by population, including the studies that specified hospitalised and non-hospitalised cohorts. We also performed subgroup analysis based on setting (hospitalised vs non-hospitalised) and follow-up time. In several symptoms and signs, the heterogeneity of the results was found to be associated with level of hospitalisation, hospital settings, location of the studies and follow-up timing using subgroup analysis (online supplemental files 5-8). Using meta-regression, the proportion of female patients in the studies was positively associated with headache and smell and taste disturbance (online supplemental file 9), while the proportion of ICU patients in the studies was positively associated with muscle pain (online supplemental file 10). No major difference was found in the sensitivity analyses (online supplemental files 11 and 12). Asymmetries found in the funnel plots suggest reporting biases and poor methodological quality in the included studies (online supplemental file 13).

Imaging and diagnostics

Multiple studies assessed lung sequelae and respiratory performance through outpatient visits follow-up (49%, 19/39).[31 37–43 46 48 49 51–54 56 60 61 66] Imaging results were reported in 33% (13/39)[31 37–39 43 46 48 52–54 56 61 66] of the

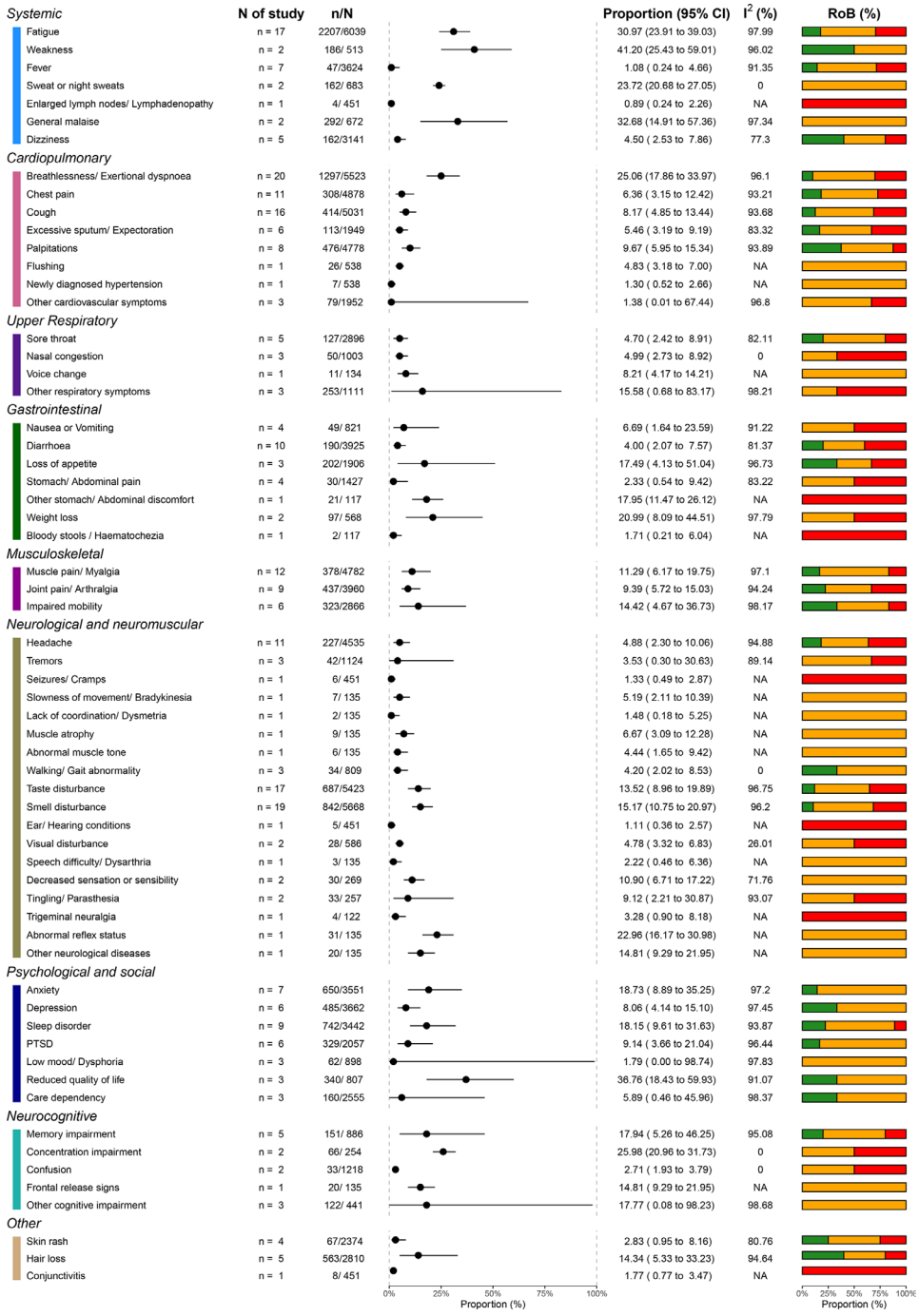

Figure 3 Signs and symptoms in all studies. RoB, risk of bias.

cohort studies, with one including controls[43] and one with a population including children.[31] Authors used heterogenous measurement techniques with an observed tendency towards novel imaging, including artificial intelligence and point-of-care ultrasound.[43 54] Studies found abnormal CT results, including consolidation, reticulation, residual ground glass opacity, interstitial thickening and fibrotic changes. Some of these studies presented comparisons between initial CT findings and those at follow-up, showing improvements in pulmonary clinical measures and radiologic resolutions at follow-up visits.[37 39 46 48 54] One study assessing thrombotic complications in COVID-19 with a minimum of 90-day follow-up from critical care admission found low rates of hospital-associated venous thromboembolism post discharge.[66]

Pulmonary function tests were reported in 26% (10/39) of studies,[37 38 41–43 48 49 51 53 61] including spirometry, diffusion capacity, lung volume and exercise tests. These studies found evidence of altered pulmonary function, most frequently significant reduction of carbon monoxide transfer factor.

One study assessed kidney function in people with COVID-19-associated acute kidney injury (AKI) compared

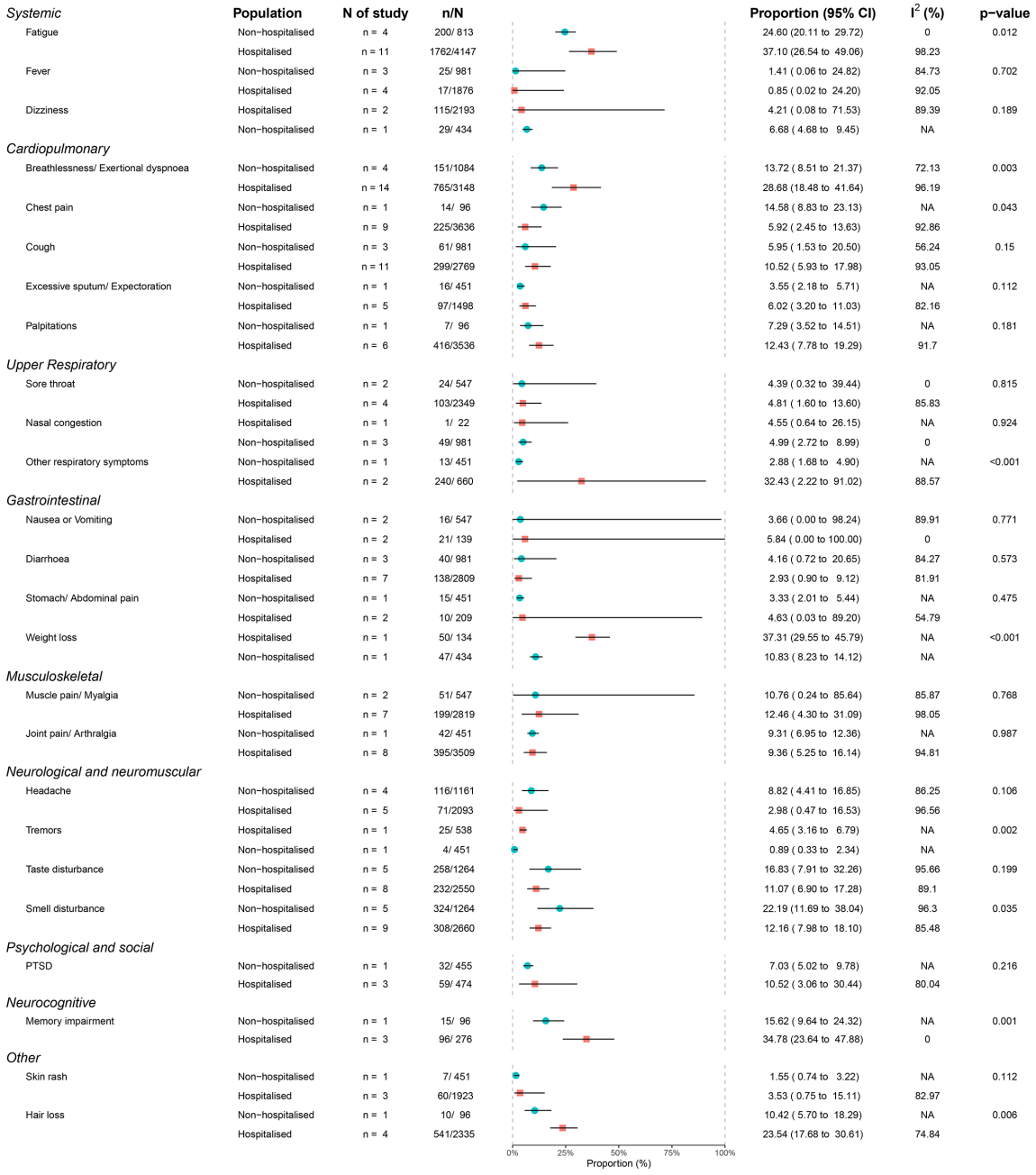

Figure 4 Sign and symptoms in hospitalised and non-hospitalised cohorts.
Note: The data on sign and symptoms from studies with data on hospitalised or non-hospitalised cohorts, it does not include studies that included mixed cohorts without subcategorisation. PTSD, post-traumatic stress disorder.

with people with non-COVID-19-associated AKI, found that COVID-19-related AKI was associated with decreased kidney recovery during outpatient follow-up.[36]

Risk factors

Exploring the literature, we sought to produce a meta-analysis of risk factors for long COVID. We found a considerable diversity of reported risk factors, including age, sex, comorbidities, ethnicity and severity of the acute phase.

Several cohorts (64%, 25/39) assessed whether there was an association between the severity of initial COVID-19, including symptom load, level of hospital care, need for mechanical ventilation and the risk of persisting sequelae. An association between female gender and long COVID risk has also been noted in longitudinal studies (20.5%, 8/39), as has the association between presence of comorbidity,[40 55 57 63 68 70] increasing age[32 34 50 55 62 63] and minority ethnicity,[40 67] with long COVID and long COVID risk.

The limitations of the existing evidence base and inconsistency of reported findings preclude confident conclusions at this time. Instead, we have summarised the reported significant associations to date (online supplemental file 14) and suggest that these associations be explored in prospective controlled trials.

DISCUSSION

Our work represents the most comprehensive review of evidence regarding long COVID yet produced. Accurate to 17 March 2021, this LSR captures the breadth of persistent symptoms reported in 39 studies, including over 10 000 people. These data suggest long COVID is a syndrome affecting both previously hospitalised and non-hospitalised people, characterised by marked fatigue, weakness, general malaise, breathlessness and concentration impairment lasting for a prolonged period of time. Besides these common symptoms, there is a diverse array of secondary symptoms. The findings in this review show symptoms and prevalence aligned to current knowledge on long COVID. The Office for National Statistics (ONS) Cohort Study, including control participants, reports the most common symptoms persisting for 12 or more weeks included fatigue (8.3%), headache (7.2%), cough (7%) and myalgia (5.6%).[7]

A deeper understanding of long COVID is currently prevented by the limitations of the published literature. The studies included in our review were highly heterogeneous due to differences in their study designs, settings, populations, follow-up time and symptom ascertainment methods. In addition, studies used inconsistent terminology describing symptoms and limited details and stratification on pre-existing comorbidities, the severity of COVID-19 and treatment methods. This inconsistency and limited reporting partly explain the high degree of variability observed. The lack of case–control studies prevent a direct attribution of symptoms solely to COVID-19; larger prospective studies with matched control groups are needed. We note that there are large, robust prospective cohort studies of hospitalised patients[71] and non-hospitalised people.[72] Simultaneously, qualitative studies are ongoing to better explore the long COVID patient experience.[73]

The findings have identified several research gaps and priorities. The majority of long COVID cohorts were conducted in Western Europe on patients recently discharged from hospital. There is a paucity of evidence on the long-term effects of COVID-19 in low-to-middle income countries and in people who were not hospitalised. Similarly, there were no studies identified focusing on children, despite evidence showing that children and young people are also affected by long COVID.[74] Additionally, no study stratified by ethnicity, an important risk factor for the acute phase.

Our review also highlights a need for standardised and validated COVID-19 research tools to harmonise data collection, improve quality and reduce reporting variability. For instance, fatigue is one of the most commonly reported symptoms of long COVID. However, the symptom alone is not clearly defined and it is open to different interpretations, hence it requires a validated tool such as the Visual Analogue Scale, graded fatigue scale for robust, objective and comparative analysis. ISARIC has developed open access research tools available to sites globally to facilitate standardisation of data collection, analysis and interpretation for adults and children of an age.[75] We support the broader use of this tool as well as initiatives to standardise outcome measures for long COVID.

Similarly, our study highlights the need for further research to refine the many circulating interim case definitions and precisely characterise long COVID, including the potential impacts of variants of concern and vaccination on long COVID.

As this is an LSR, emerging themes from this first version will inform future updates. The LSR will be updated periodically, as new research is published internationally, in order to provide relevant up to date information for clinicians, patients, researchers, policy-makers and health-service commissioners. Version changes will be identified and previous reports will be archived.

CONCLUSION

This LSR summarises published evidence on the spectrum of long-term COVID-19-associated symptoms and sequelae (as of 17 March 2021). It is clear that long COVID affects different populations, with a wide range of symptomatology. Our findings suggest this multiorgan syndrome is characterised by fatigue, weakness, malaise, breathlessness and concentration impairment, among other less frequent symptoms. Currently, the strength of the available evidence is limited and prone to bias. The long-term effects of COVID-19, in both hospitalised and non-hospitalised individuals, including children and at-risk populations, should be a priority for future research using standardised and controlled study designs. Robust research is needed to characterise and define long COVID and identify risk factors and underlying aetiology, in order to inform prevention, rehabilitation, clinical and public health management to improve recovery and long-term COVID-19 outcomes. This LSR will be updated approximately every 6 months as new evidence emerges for up to 2 years.

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Supplement 1: Search strategy summary

Database	Strategy	Results (16/3/2021)
Medline (EBSCOhost)	(COVID-19 OR covid OR SARS-CoV-2. ab) AND (symptom* OR "clinical features" OR signs OR characteristic* OR sequela* OR complication*.ab) AND ("long-term Covid" OR long-term OR consequence* OR "long-term impact" OR "long-term effect" OR "post-acute" OR long-tail OR persist* OR "chronic-COVID" OR "long-COVID" OR post-discharge OR postdischarge OR "prolonged symptom" OR "long-haul" .ab) **Limits**: 2020-	1952
CINAHL (EBSCOhost)	(COVID-19 OR covid OR SARS-CoV-2. ab) AND (symptom* OR "clinical features" OR signs OR characteristic* OR sequela* OR complication*.ab) AND ("long-term Covid" OR long-term OR consequence* OR "long-term impact" OR "long-term effect" OR "post-acute" OR long-tail OR persist* OR "chronic-COVID" OR "long-COVID" OR post-discharge OR postdischarge OR "prolonged symptom" OR "long-haul" .ab) **Limits**: 2020-	384
Global Health	(COVID-19 or covid or SARS-CoV-2) AND (symptom* or "clinical features" or signs or characteristic* or sequelae or complication*) AND ((("long-term Covid" or long-term) adj2 consequence*) or "long-term impact" or "long-term effect" or "post-acute" or long-tail or persist* or "chronic-COVID" or "long-COVID" or post-discharge or postdischarge or "prolonged symptom" or "long-haul")).ab. **Limits**: 2020-	35
WHO COVID-19 (WHO COVID, ELSEVIER and Lanzhou University/CNKI)	tw:((ab:(covid-19 OR covid OR sars-cov-2)) AND (ab:(symptom OR "clinical features" OR signs OR characteristic OR sequela OR complication)) AND (ab:("long-term Covid" OR "long-term consequence" OR "long-term impact" OR "long-term effect" OR "post-acute" OR long-tail OR persist* OR "chronic-COVID" OR "long-COVID" OR post-discharge OR postdischarge OR "prolonged symptom" OR "long-haul"))) AND db:("COVIDWHO" OR "ELSEVIER" OR "CNKI_Lanzhou")	195

Lit Covid	(“persistent symptoms” OR “after covid-19 infection").ti,ab,kw OR ((“outcomes “ OR “characteristics” OR “features” OR “symptoms” OR “inflammation” OR “function” OR “complications” OR “syndrome” OR “manifestation”) ADJ10 (“long-haul” OR “recovery” OR “recovered” OR “recovering” OR “survivors” OR “post-discharge” OR “postdischarge” OR “discharge” OR “persisting” OR “prolonged” OR “long-term” OR “after admission” OR “post-COVID-19” OR “post-COVID”)).ti,ab. OR ((“outcomes “ OR “characteristics” OR “features” OR “symptoms” OR “inflammation” OR “function” OR “complications” OR “syndrome” OR “manifestation”) ADJ/10 (“after admission” OR “after hospital” OR “after hospitalisation" OR “after hospitalization" OR “after COVID-19” OR “after SARS-CoV-2")).ti,ab.	1432
Google Scholar	post COVID after discharge persistent symptom	1000
Ovid Embase (top-up) [17 Mar 2021]	See Appendix 1 **Limit**: 2020-	483
Ovid Medline (top-up) [17 Mar 2021]	See Appendix 2 **Limit**: 2020-	336
WHO (top-up) [19 Mar 2021] (excluded: PREPRINT-BIORXVI, PREPRINT-MEDRXVI, PREPRINT-other preprint, ITCRP)	See Appendix 3	340

Appendix 1

Database(s): **Embase** 1974 to 2021 March 17

#	Searches	Results
1	(long* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	462
2	(persist* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	265
3	(chronic adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	191
4	((long term or long-term or longterm) adj3 effect* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	59
5	(sequela* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	150
6	((post acute or post-acute or postacute) adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	38
7	((longhaul* or long haul* or long-haul*) adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	18
8	((post-covid* or postcovid*) adj2 (syndrome or condition)).mp.	32
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	1123
10	symptom/	151132
11	symptom assessment/	8515
12	exp complication/	1237024
13	(symptom* or "clinical feature*" or signs or characteristic* or sequela* or complication*).mp.	6906139
14	exp physical disease by body function/	9306422
15	10 or 11 or 12 or 13 or 14	13028765
16	9 and 15	748
17	limit 16 to yr="2020"	483

Appendix 2

Database(s): **Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily** 1946 to March 17, 2021

#	Searches	Results
1	(long* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	507
2	(persist* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	273
3	(chronic adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	173
4	((long term or long-term or longterm) adj3 effect* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	62
5	(sequela* adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	159
6	((post acute or post-acute or postacute) adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	66
7	((longhaul* or long haul* or long-haul*) adj3 (covid* or ncov* or novel coronavirus or novel betacoronavirus or sars-ncov-2 or sars-cov-2)).mp.	25
8	((post-covid* or postcovid*) adj2 (syndrome or condition)).mp.	36

9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8	1179
10	exp "signs and symptoms"/	2127623
11	(symptom* or "clinical feature*" or signs or characteristic* or sequela* or complication*).tw.	3644236
12	10 or 11	5362470
13	9 and 12	591
14	limit 13 to yr="2020"	336

Appendix 3

There are only three strings of syntax:

1. keywords and phrases associated with “long COVID”
2. keywords and phrases associated with “hospitalisation” and “quarantine”
3. keywords and phrases associated with “symptoms” and “complications”

The combinations of 1 AND 3 and 2 AND 3 were used to search in the combinations of title, abstract and TW (title + abstract + subjects) in the database. These consist of 18 searches as follows:

#	Syntax	Hits
1	(**ti**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND ti**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	135
2	(**ti**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND ti**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	11

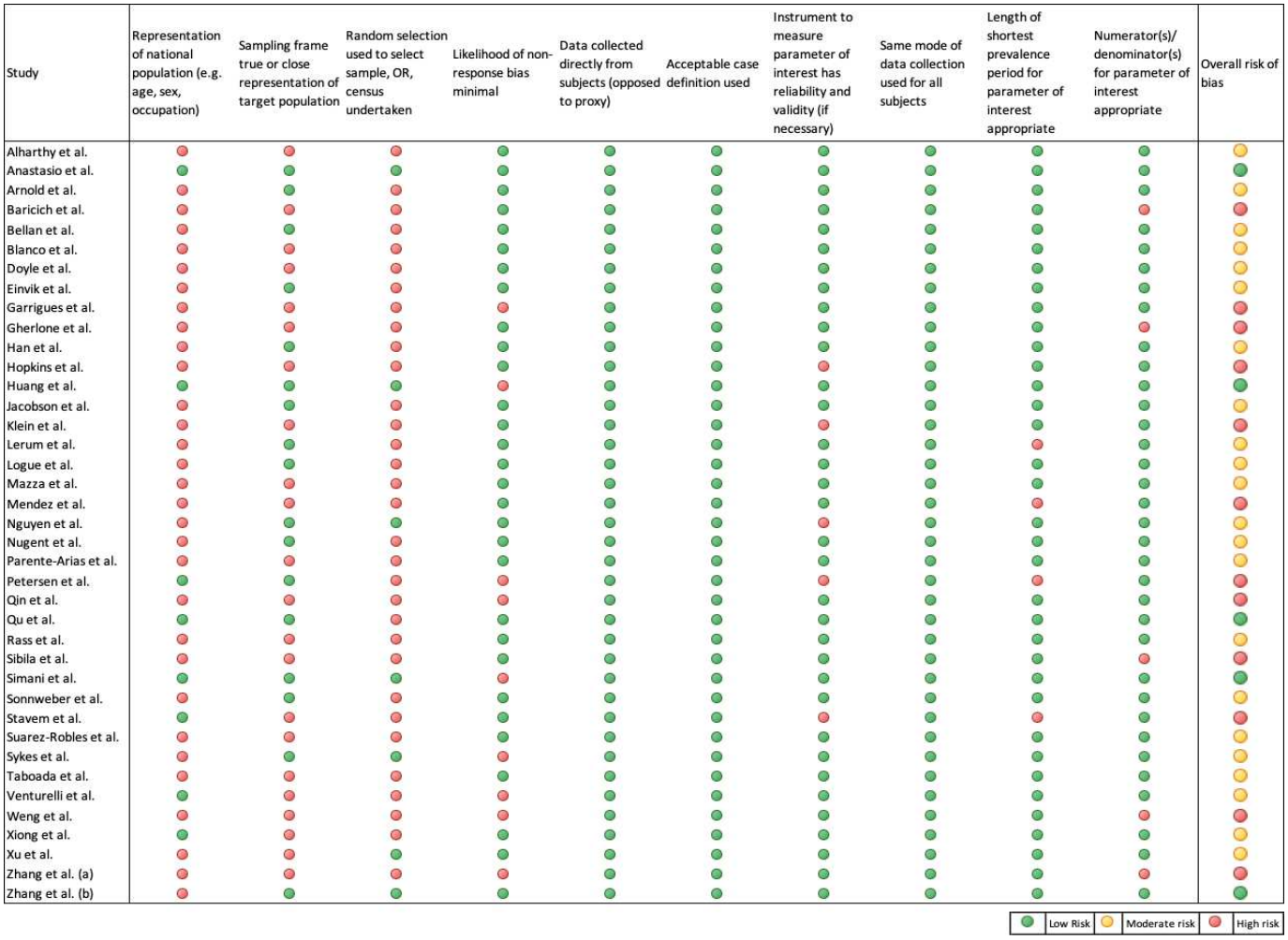
3	(**ti**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	352
4	(**ti**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	35
5	(**ti**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	508
6	(**ti**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	38
7	(**ab**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*"	159

	OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND ti**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	
8	(**ab**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND ti**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	202
9	(**ab**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	800
10	(**ab**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	680
11	(**ab**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic*	830

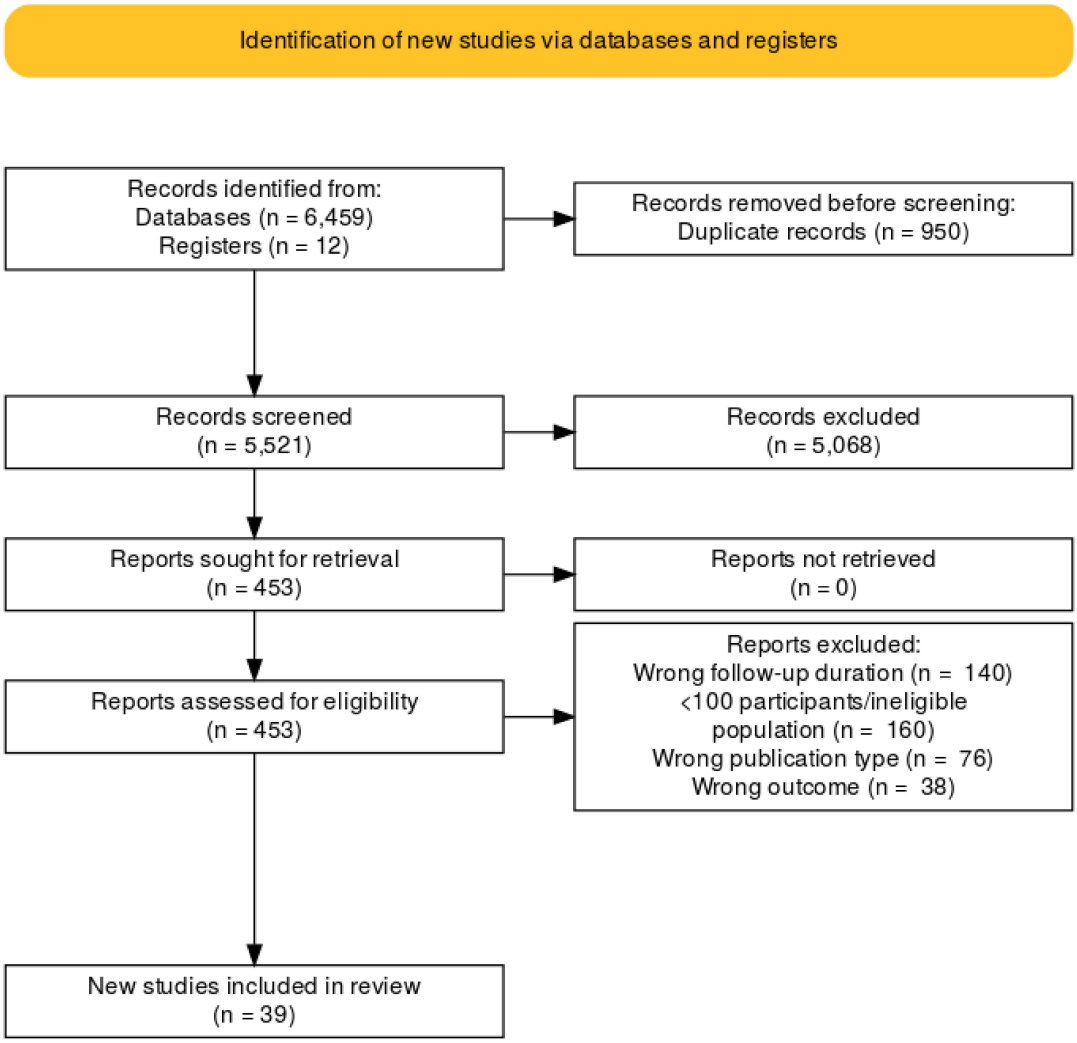
	COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	
12	(**ab**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	681
13	(**tw**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND** ti:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	167
14	(**tw**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND** ti:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	93
15	(**tw**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel	752

	coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	
16	(**tw**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND ab**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	339
17	(**tw**:(post-COVID* OR post-nCov* OR "post novel coronavirus" OR "post novel betacoronavirus" OR "post SARS-nCoV-2" OR "post SARS-CoV-2" OR postCOVID* OR "post nCov*" OR "long* COVID*" OR "long* nCov*" OR "long* novel coronavirus" OR "long* novel betacoronavirus" OR "long* SARS-nCoV-2" OR "long* SARS-CoV-2" OR "long-term COVID*" OR "long-term nCov*" OR "long-term novel coronavirus" OR "long-term novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "long-term COVID*" OR "longterm COVID*" OR "post acute COVID*" OR "postacute COVID*" OR "longhaul* COVID*" OR "long haul* COVID*" OR "long-haul* COVID*" OR "chronic* COVID*" OR "prolonged* COVID*" OR "presist* COVID*" OR "long-term nCov*" OR "longterm nCov*" OR "post acute nCov*" OR "postacute nCov*" OR "longhaul* nCov*" OR "long haul* nCov*" OR "long-haul* nCov*" OR "chronic* nCov*" OR "prolonged* nCov*" OR "presist* nCov*" OR "long-term novel coronavirus" OR "longterm novel coronavirus" OR "post acute novel coronavirus" OR "postacute novel coronavirus" OR "longhaul* novel coronavirus" OR "long haul* novel coronavirus" OR "long-haul* novel coronavirus" OR "chronic* novel coronavirus" OR "prolonged* novel coronavirus" OR "presist* novel coronavirus" OR "long-term novel betacoronavirus" OR "longterm novel betacoronavirus" OR "post acute novel betacoronavirus" OR "postacute novel betacoronavirus" OR "longhaul* novel betacoronavirus" OR "long haul* novel betacoronavirus" OR "long-haul* novel betacoronavirus" OR "chronic* novel betacoronavirus" OR "prolonged* novel betacoronavirus" OR "presist* novel betacoronavirus" OR "long-term SARS-nCoV-2" OR "longterm SARS-nCoV-2" OR "post acute SARS-nCoV-2" OR "postacute SARS-nCoV-2" OR "longhaul* SARS-nCoV-2" OR "long haul* SARS-nCoV-2" OR "long-haul* SARS-nCoV-2" OR "chronic* SARS-nCoV-2" OR "prolonged* SARS-nCoV-2" OR "presist* SARS-nCoV-2" OR "long-term SARS-CoV-2" OR "longterm SARS-CoV-2" OR "post acute SARS-CoV-2" OR "postacute SARS-CoV-2" OR "longhaul* SARS-CoV-2" OR "long haul* SARS-CoV-2" OR "long-haul* SARS-CoV-2" OR "chronic* SARS-CoV-2" OR "prolonged* SARS-CoV-2" OR "presist* SARS-CoV-2") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	906
18	(**tw**:("after admission" OR "after discharg*" OR "after hospital*" OR "after isolat*" OR "after quarantine" OR "after self isolat*" OR "after self-isolat*" OR "after self-quarantine" OR "post admission" OR "post discharg*" OR "post hospital*" OR "post isolat*" OR "post quarantine" OR "post self isolat*" OR "post self-isolat*" OR "post self-quarantine") **AND tw**:("clinical feature*" OR abnormal* OR characteristic* OR complication* OR condition* OR convalescence OR disorder* OR dysfunction OR illness* OR impair* OR inflammation OR manifestation OR outcome* OR prevalence OR problem* OR sequela* OR sign* OR symptom* OR syndrome))	340

Supplement 2: Risk of bias assessment



Supplement 3: PRISMA diagram



Supplement 4: Individual forest plots in main results

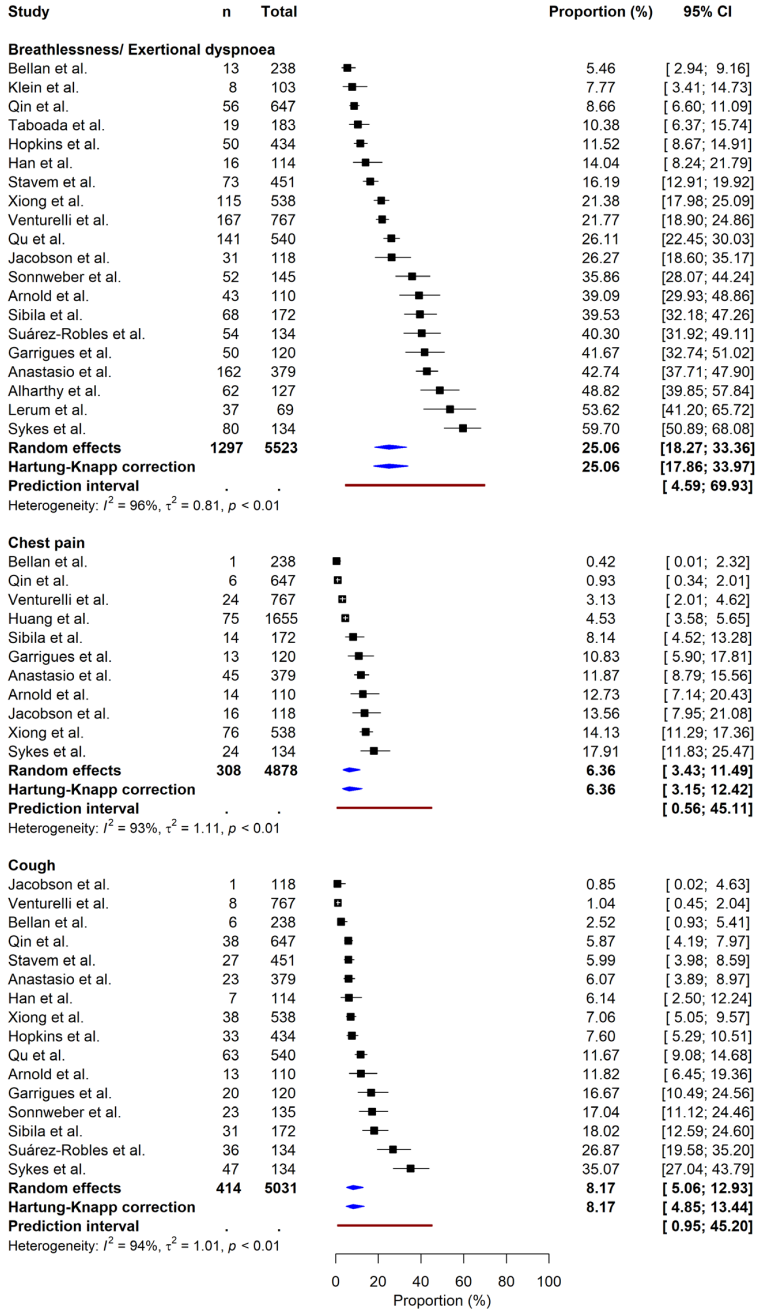


Figure 1. Cardiopulmonary

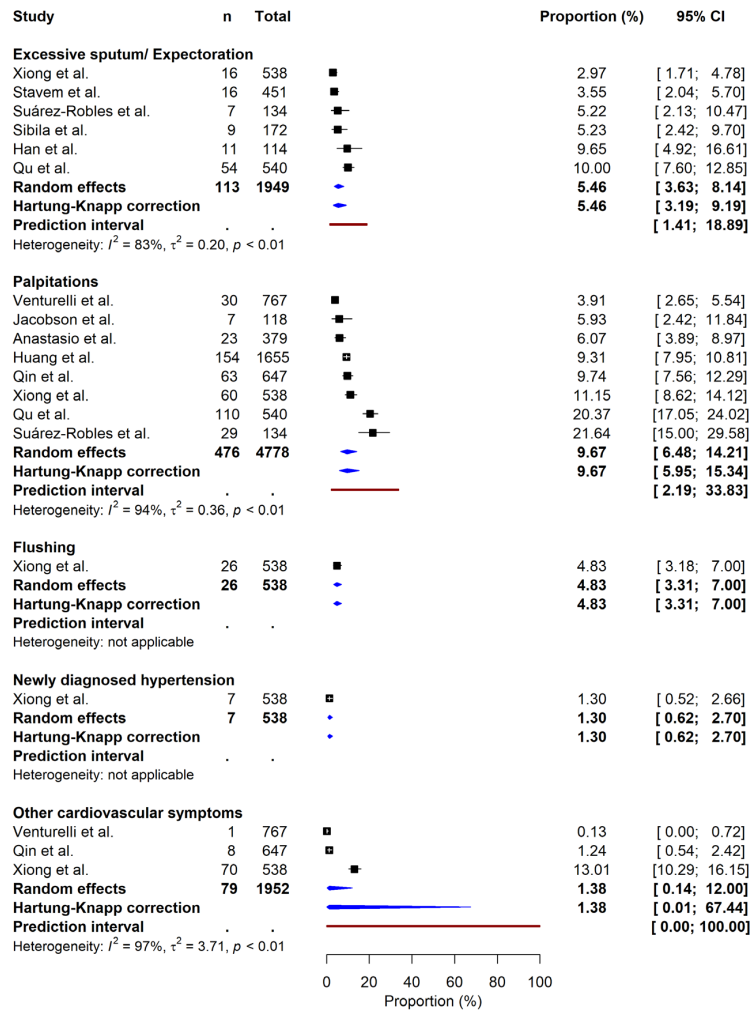


Figure 2.Cardiopulmonary (page 2)

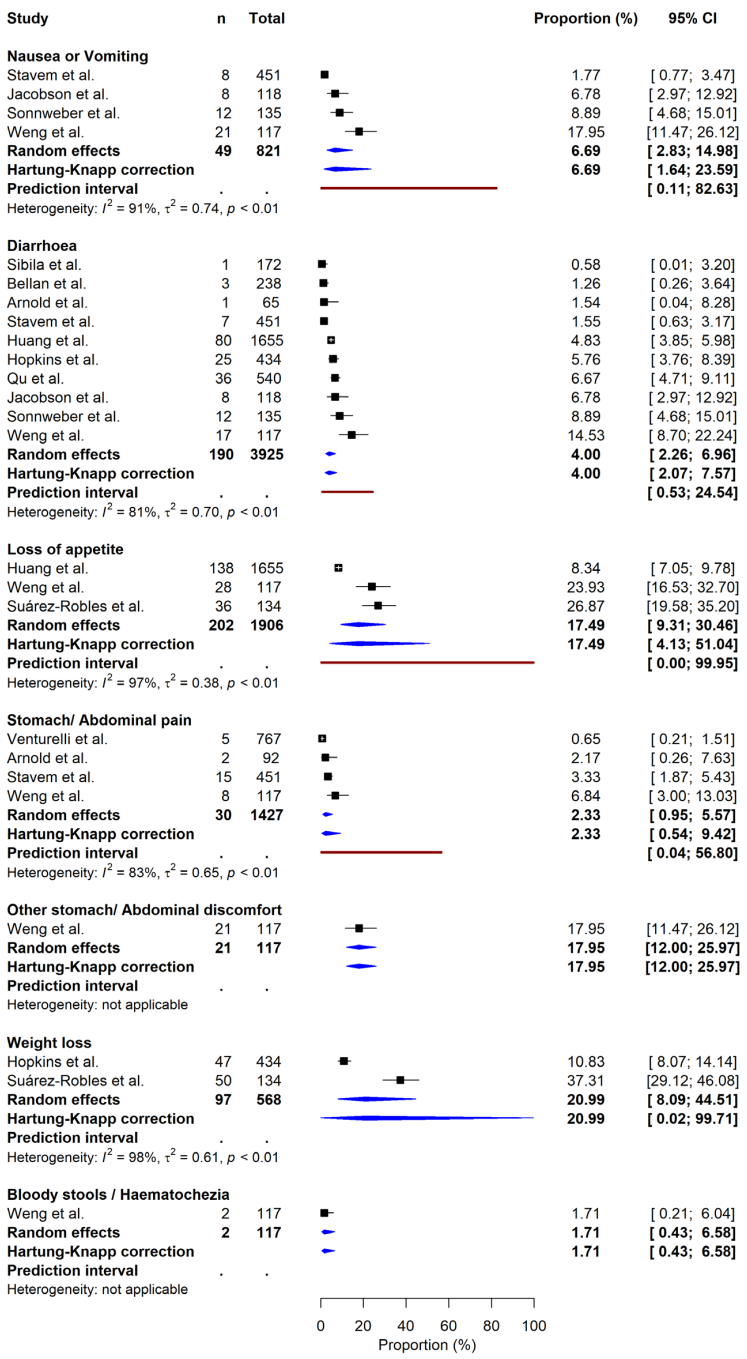


Figure 3. Gastrointestinal

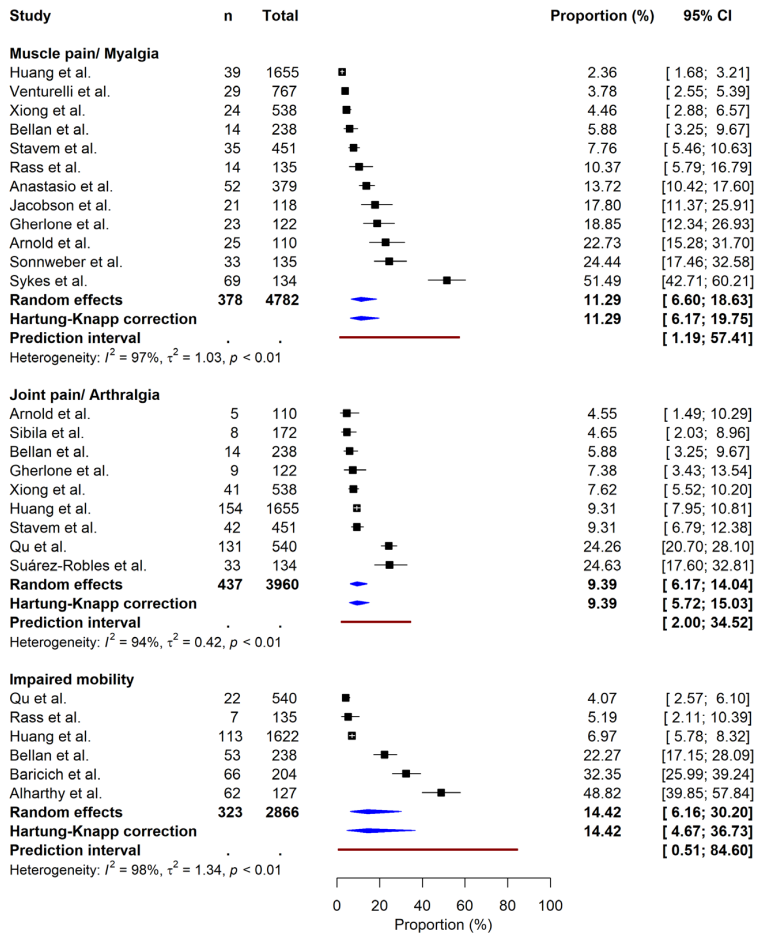


Figure 4. Musculoskeletal

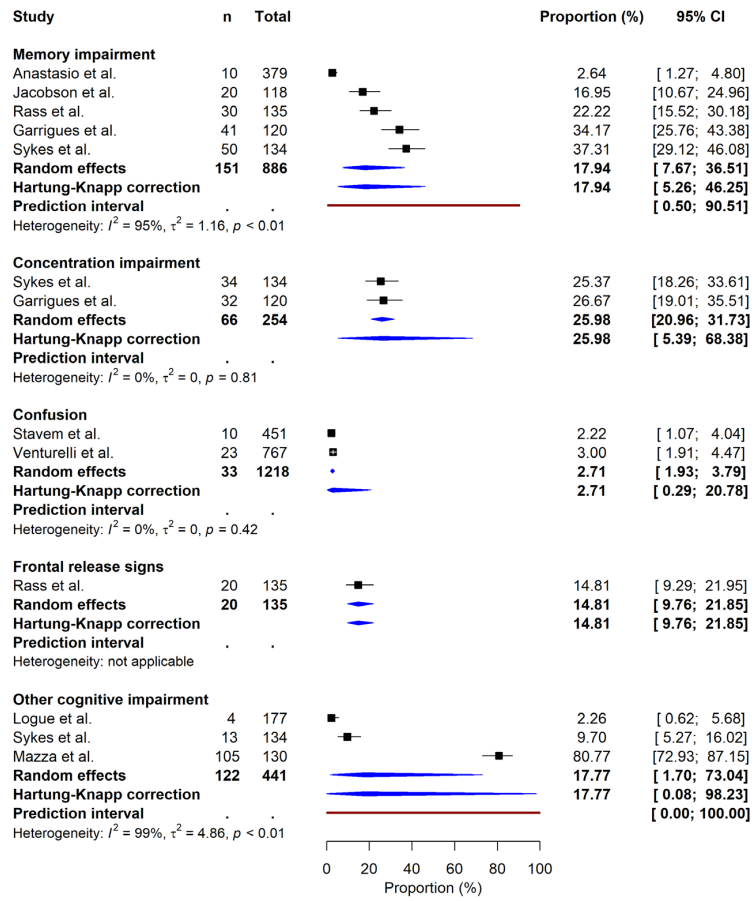


Figure 5. Neurocognitive

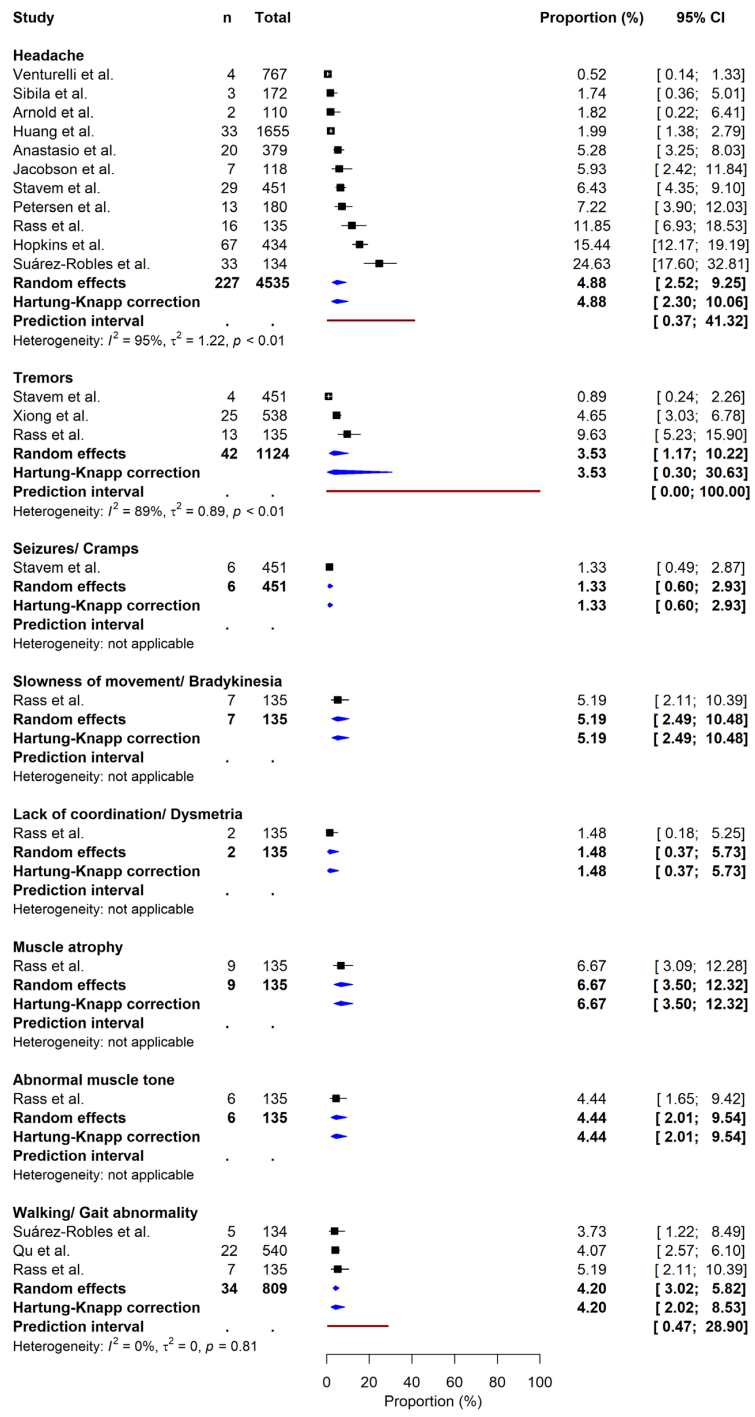


Figure 6. Neurological and neuromuscular

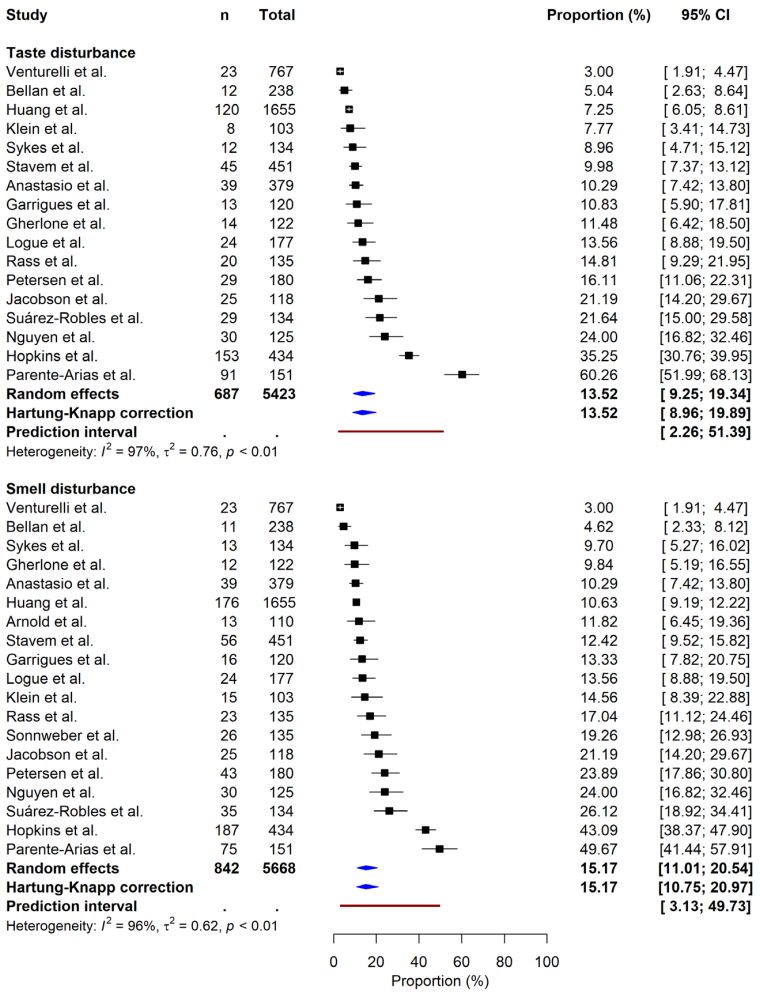


Figure 7.Neurological and neuromuscular (page 2)

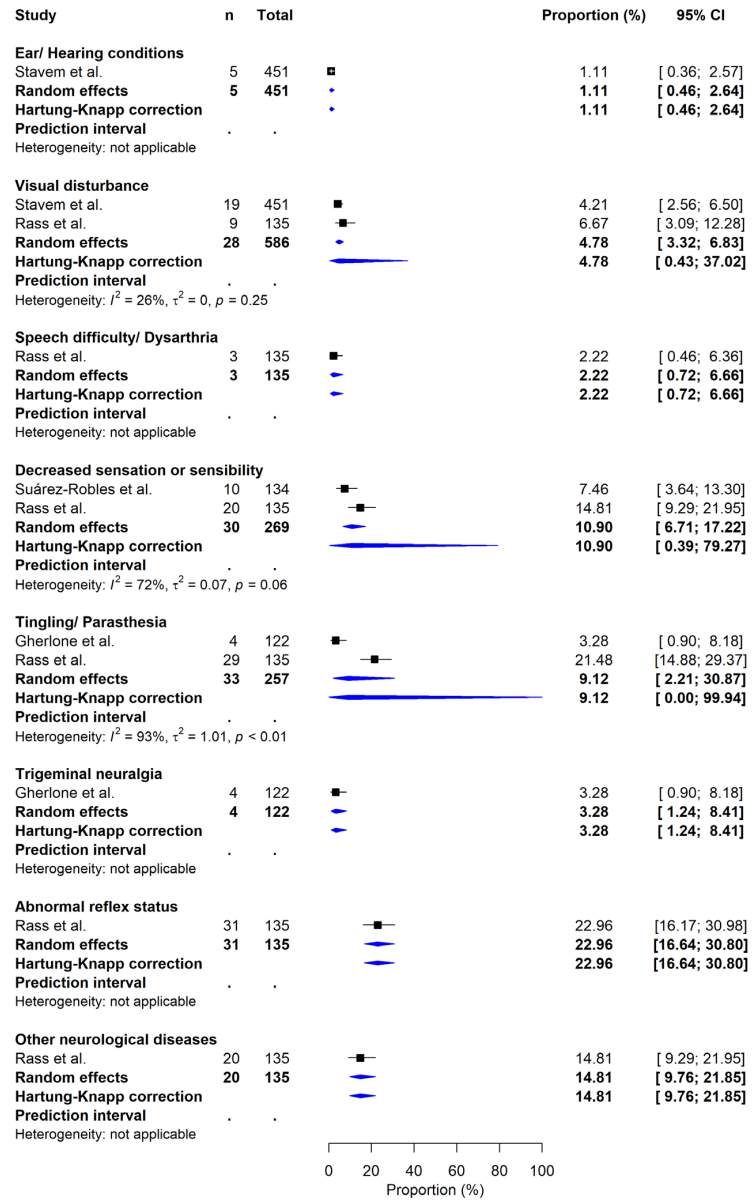


Figure 8. Neurological and neuromuscular (page 3)

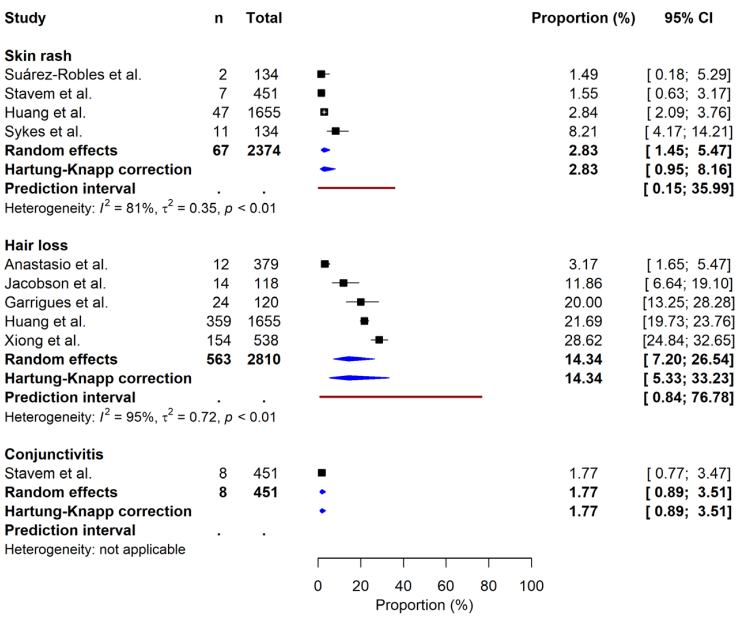


Figure 9. Other

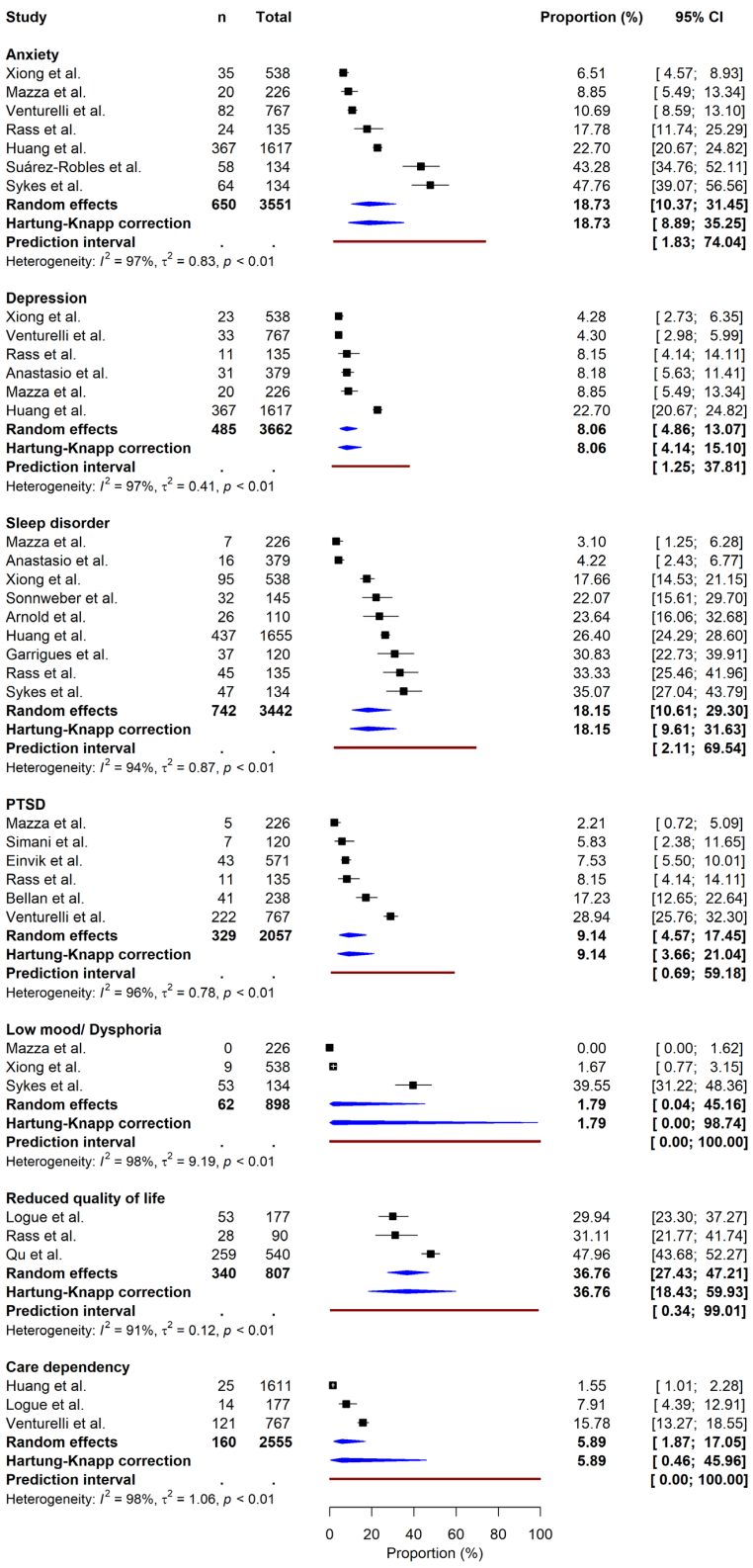


Figure 10. Psychological and social

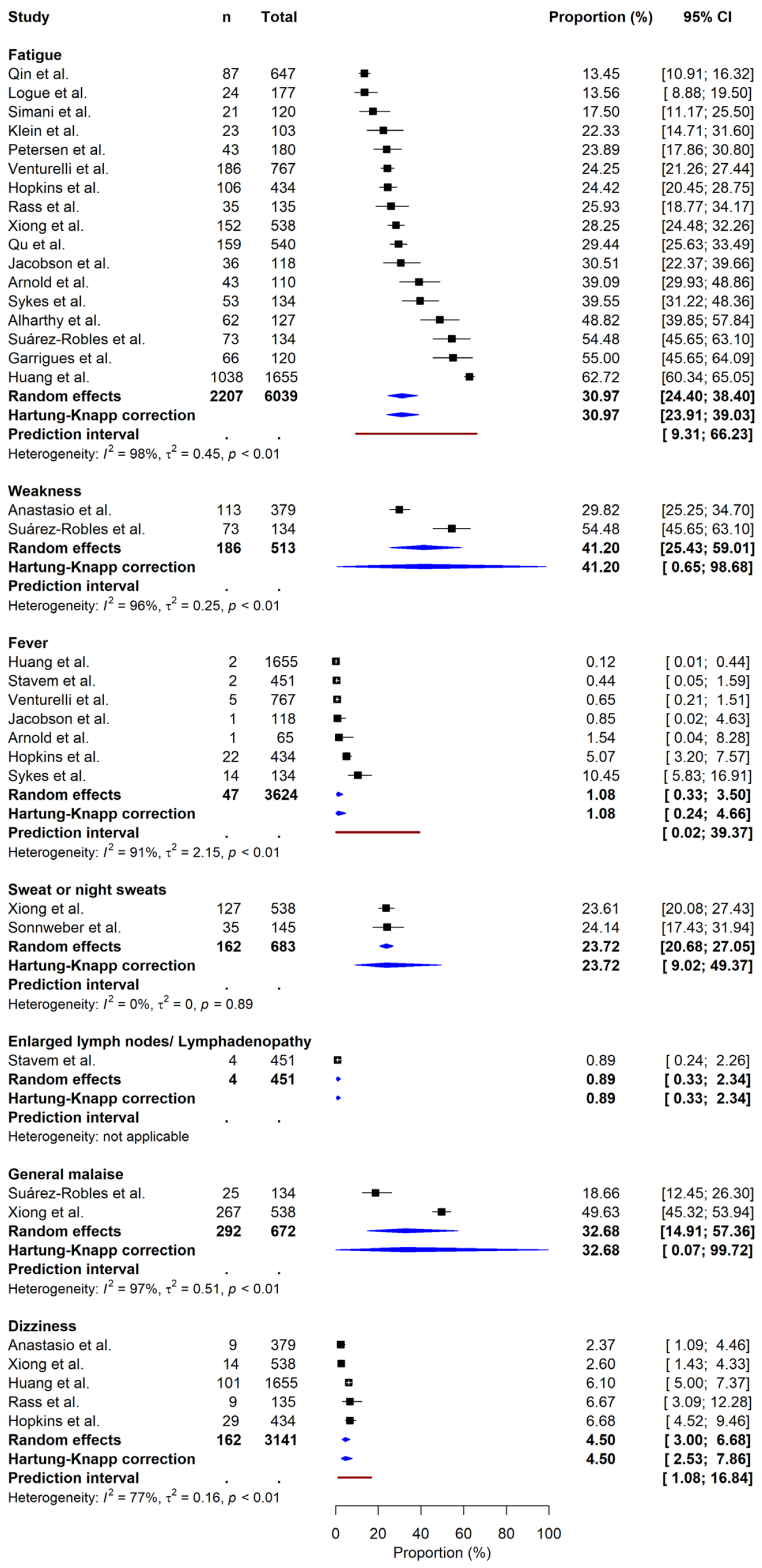


Figure 11. Systemic

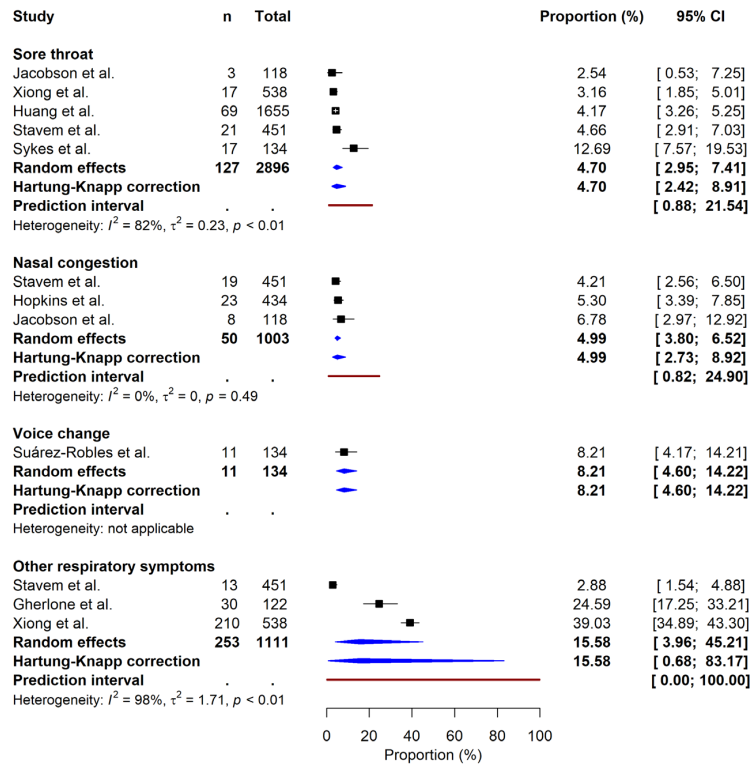


Figure 12. Upper respiratory

Supplement 5: Subgroup analysis: hospitalisation

Classification	Symptom	Subgroup	N Studies	Event/total	Proportion% (95% CIs)	Heterogeneity (%)	P value
Cardiopulmonary	Breathlessness/ Exertional dyspnoea	Hospitalised	n = 14	765/3148	28.68 (18.48 to 41.64)	96.19	<0.001
		Mixed	n = 3	381/1291	32.57 (14.26 to 58.38)	96.38	
		Non-hospitalised	n = 4	151/1084	13.72 (8.51 to 21.37)	72.13	
	Chest pain	Mixed	n = 2	69/1146	6.18 (0.01 to 97.66)	96.65	0.071
		Hospitalised	n = 9	225/3636	5.92 (2.45 to 13.63)	92.86	
		Non-hospitalised	n = 1	14/ 96	14.58 (8.83 to 23.13)	NA	
	Cough	Mixed	n = 3	54/1281	4.91 (0.25 to 51.82)	96.03	0.265
		Hospitalised	n = 11	299/2769	10.52 (5.93 to 17.98)	93.05	
		Non-hospitalised	n = 3	61/981	5.95 (1.53 to 20.50)	56.24	
	Excessive sputum/ Expectoration	Hospitalised	n = 5	97/1498	6.02 (3.20 to 11.03)	82.16	0.112
		Non-hospitalised	n = 1	16/451	3.55 (2.18 to 5.71)	NA	
	Other cardiovascular symptoms	Hospitalised	n = 2	78/1185	4.20 (0.00 to 99.97)	97.68	0.009
		Mixed	n = 1	1/767	0.13 (0.02 to 0.92)	NA	
	Palpitations	Mixed	n = 2	53/1146	4.67 (0.60 to 28.47)	62.05	<0.001
		Hospitalised	n = 6	416/3536	12.43 (7.78 to 19.29)	91.7	
		Non-hospitalised	n = 1	7/ 96	7.29 (3.52 to 14.51)	NA	
Gastrointestinal	Diarrhoea	Hospitalised	n = 7	138/2809	2.93 (0.90 to 9.12)	81.91	0.077
		Non-hospitalised	n = 3	40/981	4.16 (0.72 to 20.65)	84.27	
		Mixed	n = 1	12/135	8.89 (5.12 to 15.00)	NA	
	Nausea or Vomiting	Hospitalised	n = 2	21/139	5.84 (0.00 to 100.00)	0	0.343
		Non-hospitalised	n = 2	16/547	3.66 (0.00 to 98.24)	89.91	
		Mixed	n = 1	12/135	8.89 (5.12 to 15.00)	NA	
	Stomach/ Abdominal pain	Hospitalised	n = 2	10/209	4.63 (0.03 to 89.20)	54.79	0.002
		Non-hospitalised	n = 1	15/451	3.33 (2.01 to 5.44)	NA	
		Mixed	n = 1	5/767	0.65 (0.27 to 1.56)	NA	
	Weight loss	Non-hospitalised	n = 1	47/434	10.83 (8.23 to 14.12)	NA	<0.001
		Hospitalised	n = 1	50/134	37.31 (29.55 to 45.79)	NA	
Musculoskeletal	Impaired mobility	Hospitalised	n = 5	316/2731	17.33 (4.75 to 46.83)	98.49	0.038
		Mixed	n = 1	7/135	5.19 (2.49 to 10.48)	NA	

	Joint pain/ Arthralgia	Hospitalised	n = 8	395/3509	9.36 (5.25 to 16.14)	94.81	0.987
		Non-hospitalised	n = 1	42/451	9.31 (6.95 to 12.36)	NA	
	Muscle pain/ Myalgia	Mixed	n = 4	128/1416	10.86 (3.45 to 29.36)	95.21	0.954
		Hospitalised	n = 7	199/2819	12.46 (4.30 to 31.09)	98.05	
		Non-hospitalised	n = 2	51/547	10.76 (0.24 to 85.64)	85.87	
Neurocognitive	Confusion	Non-hospitalised	n = 1	10/451	2.22 (1.20 to 4.07)	NA	0.419
		Mixed	n = 1	23/767	3.00 (2.00 to 4.47)	NA	
	Memory impairment	Mixed	n = 2	40/514	8.06 (0.00 to 99.97)	97.38	<0.001
		Hospitalised	n = 3	96/276	34.78 (23.64 to 47.88)	0	
		Non-hospitalised	n = 1	15/ 96	15.62 (9.64 to 24.32)	NA	
	Other cognitive impairment	Mixed	n = 2	109/307	23.55 (0.00 to 100.00)	98.87	0.581
		Hospitalised	n = 1	13/134	9.70 (5.72 to 15.99)	NA	
Neurological and neuromuscular	Decreased sensation or sensibility	Mixed	n = 1	20/135	14.81 (9.76 to 21.85)	NA	0.060
		Hospitalised	n = 1	10/134	7.46 (4.06 to 13.31)	NA	
	Headache	Mixed	n = 3	40/1281	3.30 (0.12 to 50.20)	93.93	0.145
		Hospitalised	n = 5	71/2093	2.98 (0.47 to 16.53)	96.56	
		Non-hospitalised	n = 4	116/1161	8.82 (4.41 to 16.85)	86.25	
	Smell disturbance	Mixed	n = 6	210/1744	14.63 (5.46 to 33.72)	97.32	0.108
		Hospitalised	n = 9	308/2660	12.16 (7.98 to 18.10)	85.48	
		Non-hospitalised	n = 5	324/1264	22.19 (11.69 to 38.04)	96.3	
	Taste disturbance	Mixed	n = 5	197/1609	14.50 (3.40 to 44.98)	98.32	0.425
		Hospitalised	n = 8	232/2550	11.07 (6.90 to 17.28)	89.1	
		Non-hospitalised	n = 5	258/1264	16.83 (7.91 to 32.26)	95.66	
	Tingling/ Paraesthesia	Hospitalised	n = 1	4/122	3.28 (1.24 to 8.41)	NA	<0.001
		Mixed	n = 1	29/135	21.48 (15.36 to 29.21)	NA	
	Tremors	Mixed	n = 1	13/135	9.63 (5.67 to 15.88)	NA	<0.001
		Non-hospitalised	n = 1	4/451	0.89 (0.33 to 2.34)	NA	
		Hospitalised	n = 1	25/538	4.65 (3.16 to 6.79)	NA	
	Visual disturbance	Mixed	n = 1	9/135	6.67 (3.50 to 12.32)	NA	0.245
		Non-hospitalised	n = 1	19/451	4.21 (2.70 to 6.51)	NA	
	Walking/ Gait abnormality	Hospitalised	n = 2	27/674	4.01 (0.34 to 33.61)	0	0.534
		Mixed	n = 1	7/135	5.19 (2.49 to 10.48)	NA	

Other	Hair loss	Mixed	n = 1	12/379	3.17 (1.81 to 5.49)	NA	<0.001
		Hospitalised	n = 4	541/2335	23.54 (17.68 to 30.61)	74.84	
		Non-hospitalised	n = 1	10/ 96	10.42 (5.70 to 18.29)	NA	
	Skin rash	Hospitalised	n = 3	60/1923	3.53 (0.75 to 15.11)	82.97	0.112
		Non-hospitalised	n = 1	7/451	1.55 (0.74 to 3.22)	NA	
Psychological and social	Anxiety	Hospitalised	n = 4	524/2423	25.58 (6.36 to 63.49)	97.85	0.072
		Mixed	n = 3	126/1128	11.60 (6.03 to 21.15)	72	
	Care dependency	Hospitalised	n = 1	25/1611	1.55 (1.05 to 2.29)	NA	<0.001
		Mixed	n = 2	135/944	12.00 (0.39 to 82.45)	85.63	
	Depression	Mixed	n = 4	95/1507	6.80 (3.99 to 11.37)	71	0.506
		Hospitalised	n = 2	390/2155	10.38 (0.00 to 99.83)	98.62	
	Low mood/ Dysphoria	Mixed	n = 1	0/226	0.00 (0.00 to 100.00)	NA	1.000
		Hospitalised	n = 2	62/672	9.49 (0.00 to 100.00)	98.92	
	PTSD	Hospitalised	n = 3	59/474	10.52 (3.06 to 30.44)	80.04	0.458
		Non-hospitalised	n = 1	32/455	7.03 (5.02 to 9.78)	NA	
		Mixed	n = 3	238/1128	8.73 (0.46 to 66.23)	96.63	
	Reduced quality of life	Mixed	n = 2	81/267	30.34 (7.43 to 70.27)	0	<0.001
		Hospitalised	n = 1	259/540	47.96 (43.77 to 52.18)	NA	
	Sleep disorder	Mixed	n = 4	100/885	10.66 (1.76 to 44.22)	96.51	0.081
		Hospitalised	n = 5	642/2557	25.81 (18.85 to 34.26)	84.7	
Systemic	Dizziness	Mixed	n = 2	18/514	3.78 (0.03 to 83.74)	79.93	0.224
		Non-hospitalised	n = 1	29/434	6.68 (4.68 to 9.45)	NA	
		Hospitalised	n = 2	115/2193	4.21 (0.08 to 71.53)	89.39	
	Fatigue	Hospitalised	n = 11	1762/4147	37.10 (26.54 to 49.06)	98.23	0.017
		Non-hospitalised	n = 4	200/813	24.60 (20.11 to 29.72)	0	
		Mixed	n = 3	245/1079	21.04 (10.48 to 37.75)	79.86	
	Fever	Hospitalised	n = 4	17/1876	0.85 (0.02 to 24.20)	92.05	0.661
		Non-hospitalised	n = 3	25/981	1.41 (0.06 to 24.82)	84.73	
		Mixed	n = 1	5/767	0.65 (0.27 to 1.56)	NA	
	Sweat or night sweats	Mixed	n = 1	35/145	24.14 (17.87 to 31.76)	NA	0.894
		Hospitalised	n = 1	127/538	23.61 (20.21 to 27.38)	NA	
	Weakness	Mixed	n = 1	113/379	29.82 (25.42 to 34.61)	NA	<0.001

		Hospitalised	n = 1	73/134	54.48 (46.00 to 62.70)	NA	
Upper respiratory	Nasal congestion	Non-hospitalised	n = 3	49/981	4.99 (2.72 to 8.99)	0	0.924
		Hospitalised	n = 1	1/ 22	4.55 (0.64 to 26.15)	NA	
	Other respiratory symptoms	Hospitalised	n = 2	240/660	32.43 (2.22 to 91.02)	88.57	<0.001
		Non-hospitalised	n = 1	13/451	2.88 (1.68 to 4.90)	NA	
	Sore throat	Hospitalised	n = 4	103/2349	4.81 (1.60 to 13.60)	85.83	0.815
		Non-hospitalised	n = 2	24/547	4.39 (0.32 to 39.44)	0	

Supplement 6: Subgroup analysis: Setting

Classification	Symptom	Subgroup	N Studies	Event/total	Proportion% (95% CIs)	Heterogeneity (%)	P value
Cardiopulmonary	Cough	Multicentre	n = 5	121/1358	6.90 (2.46 to 17.92)	84.05	0.842
		Single-centre	n = 10	260/3239	9.07 (4.23 to 18.41)	95.62	
		Online survey	n = 1	33/ 434	7.60 (5.46 to 10.50)	NA	
	Chest pain	Single-centre	n = 10	292/4760	5.87 (2.70 to 12.26)	93.7	0.039
		Multicentre	n = 1	16/ 118	13.56 (8.48 to 20.99)	NA	
	Breathlessness/ Exertional dyspnoea	Multicentre	n = 6	350/1437	26.79 (15.81 to 41.63)	91.82	<0.001
		Single-centre	n = 12	889/3549	27.78 (17.16 to 41.67)	96.93	
		Online survey	n = 2	58/ 537	10.80 (2.03 to 41.47)	16.75	
	Palpitations	Single-centre	n = 6	359/4120	9.02 (5.17 to 15.27)	90.72	0.571
		Multicentre	n = 2	117/ 658	11.96 (0.02 to 98.84)	91.67	
	Excessive sputum/ Expectoration	Multicentre	n = 3	81/1105	6.97 (2.02 to 21.38)	86.45	0.066
		Single-centre	n = 3	32/ 844	3.79 (1.78 to 7.88)	24.53	
Gastrointestinal	Weight loss	Online survey	n = 1	47/ 434	10.83 (8.23 to 14.12)	NA	<0.001
		Single-centre	n = 1	50/ 134	37.31 (29.55 to 45.79)	NA	
	Stomach/ Abdominal pain	Single-centre	n = 2	7/ 859	0.81 (0.01 to 50.51)	52.12	<0.001
		Multicentre	n = 2	23/ 568	4.05 (0.28 to 38.69)	64.62	
	Loss of appetite	Single-centre	n = 2	174/1789	15.09 (0.03 to 98.93)	97.64	0.288
		Multicentre	n = 1	28/ 117	23.93 (17.06 to 32.48)	NA	
	Diarrhoea	Single-centre	n = 4	85/2130	1.81 (0.36 to 8.72)	72.7	0.081
		Multicentre	n = 5	80/1361	6.23 (2.49 to 14.76)	85.33	
		Online survey	n = 1	25/ 434	5.76 (3.92 to 8.39)	NA	
Musculoskeletal	Impaired mobility	Single-centre	n = 4	294/2191	23.71 (6.53 to 58.01)	98.62	<0.001
		Multicentre	n = 2	29/ 675	4.30 (0.40 to 33.37)	0	
	Joint pain/ Arthralgia	Single-centre	n = 7	264/2969	8.03 (4.64 to 13.55)	86.94	0.116
		Multicentre	n = 2	173/ 991	15.45 (0.11 to 96.89)	97.19	
	Muscle pain/ Myalgia	Multicentre	n = 4	103/ 839	13.72 (6.26 to 27.48)	89.49	0.508
		Single-centre	n = 8	275/3943	10.23 (4.03 to 23.63)	97.97	
Neurocognitive	Other cognitive impairment	Single-centre	n = 2	118/ 264	40.19 (0.00 to 100.00)	99	0.017
		Multicentre	n = 1	4/ 177	2.26 (0.85 to 5.86)	NA	

	Confusion	Multicentre	n = 1	10/ 451	2.22 (1.20 to 4.07)	NA	0.419
		Single-centre	n = 1	23/ 767	3.00 (2.00 to 4.47)	NA	
	Memory impairment	Multicentre	n = 2	50/ 253	19.76 (3.21 to 64.68)	8.97	0.821
		Single-centre	n = 3	101/ 633	16.93 (0.58 to 87.62)	97.39	
Neurological and neuromuscular	Walking/ Gait abnormality	Multicentre	n = 2	29/ 675	4.30 (0.40 to 33.37)	0	0.766
		Single-centre	n = 1	5/ 134	3.73 (1.56 to 8.65)	NA	
	Tremors	Multicentre	n = 2	17/ 586	2.98 (0.00 to 99.96)	94.5	0.615
		Single-centre	n = 1	25/ 538	4.65 (3.16 to 6.79)	NA	
	Headache	Single-centre	n = 6	95/3217	2.82 (0.69 to 10.88)	96.4	<0.001
		Multicentre	n = 4	65/ 884	7.35 (5.00 to 10.68)	37.26	
		Online survey	n = 1	67/ 434	15.44 (12.34 to 19.15)	NA	
	Smell disturbance	Multicentre	n = 6	197/1196	17.21 (13.03 to 22.38)	68.78	0.235
		Single-centre	n = 11	443/3935	12.49 (7.13 to 20.97)	95.97	
		Online survey	n = 2	202/ 537	27.06 (0.04 to 99.70)	96.07	
	Taste disturbance	Single-centre	n = 10	383/3825	12.21 (6.16 to 22.76)	97.3	0.793
		Multicentre	n = 5	143/1061	14.27 (10.13 to 19.73)	65.8	
		Online survey	n = 2	161/ 537	18.21 (0.00 to 99.91)	95.82	
	Tingling/ Paraesthesia	Single-centre	n = 1	4/ 122	3.28 (1.24 to 8.41)	NA	<0.001
		Multicentre	n = 1	29/ 135	21.48 (15.36 to 29.21)	NA	
	Decreased sensation or sensibility	Multicentre	n = 1	20/ 135	14.81 (9.76 to 21.85)	NA	0.060
		Single-centre	n = 1	10/ 134	7.46 (4.06 to 13.31)	NA	
Other	Hair loss	Multicentre	n = 1	14/ 118	11.86 (7.15 to 19.04)	NA	0.630
		Single-centre	n = 4	549/2692	14.99 (3.66 to 45.01)	95.58	
	Skin rash	Single-centre	n = 3	60/1923	3.53 (0.75 to 15.11)	82.97	0.112
		Multicentre	n = 1	7/ 451	1.55 (0.74 to 3.22)	NA	
Psychological and social	Care dependency	Single-centre	n = 2	146/2378	5.16 (0.00 to 99.97)	99.18	0.621
		Multicentre	n = 1	14/ 177	7.91 (4.74 to 12.91)	NA	
	PTSD	Multicentre	n = 2	54/ 706	7.65 (1.35 to 33.36)	0	0.653
		Single-centre	n = 4	275/1351	9.73 (1.74 to 39.56)	95.56	
	Sleep disorder	Single-centre	n = 7	665/3162	15.96 (6.78 to 33.15)	95.15	0.119
		Multicentre	n = 2	77/ 280	27.41 (2.84 to 82.98)	77.28	
	Depression	Single-centre	n = 5	474/3527	8.06 (3.47 to 17.62)	97.89	0.979

		Multicentre	n = 1	11/ 135	8.15 (4.57 to 14.11)	NA	
	Anxiety	Single-centre	n = 6	626/3416	18.92 (7.55 to 40.00)	97.66	0.870
		Multicentre	n = 1	24/ 135	17.78 (12.21 to 25.16)	NA	
Systemic	Dizziness	Single-centre	n = 3	124/2572	3.55 (1.05 to 11.30)	87.17	0.138
		Online survey	n = 1	29/ 434	6.68 (4.68 to 9.45)	NA	
		Multicentre	n = 1	9/ 135	6.67 (3.50 to 12.32)	NA	
	Sweat or night sweats	Multicentre	n = 1	35/ 145	24.14 (17.87 to 31.76)	NA	0.894
		Single-centre	n = 1	127/ 538	23.61 (20.21 to 27.38)	NA	
	Fever	Single-centre	n = 4	22/2621	0.98 (0.06 to 14.94)	94.58	<0.001
		Online survey	n = 1	22/ 434	5.07 (3.36 to 7.58)	NA	
		Multicentre	n = 2	3/ 569	0.53 (0.00 to 89.24)	0	
	Fatigue	Single-centre	n = 10	1781/4352	36.55 (25.00 to 49.88)	98.57	0.067
		Multicentre	n = 5	297/1150	24.28 (17.14 to 33.19)	78.24	
		Online survey	n = 2	129/ 537	24.02 (8.05 to 53.30)	0	
Upper respiratory	Other respiratory symptoms	Single-centre	n = 2	240/ 660	32.43 (2.22 to 91.02)	88.57	<0.001
		Multicentre	n = 1	13/ 451	2.88 (1.68 to 4.90)	NA	
	Nasal congestion	Online survey	n = 1	23/ 434	5.30 (3.55 to 7.85)	NA	0.690
		Multicentre	n = 2	27/ 569	4.75 (0.41 to 37.90)	25.27	
	Sore throat	Single-centre	n = 3	103/2327	5.38 (1.20 to 20.94)	90.55	0.538
		Multicentre	n = 2	24/ 569	4.22 (0.31 to 38.40)	0.31	

Supplement 7: Subgroup analysis: Continents

Classification	Symptom	Subgroup	N Studies	Event/total	Proportion% (95% CIs)	Heterogeneity (%)	P value
Cardiopulmonary	Cough	Europe	n = 11	267/3074	9.71 (4.88 to 18.39)	94.92	0.057
		Asia	n = 4	146/1839	7.64 (4.60 to 12.44)	79.54	
		North America	n = 1	1/ 118	0.85 (0.12 to 5.77)	NA	
	Chest pain	Asia	n = 3	157/2840	4.11 (0.23 to 44.11)	97.52	0.097
		Europe	n = 7	135/1920	6.93 (2.77 to 16.31)	89.56	
		North America	n = 1	16/ 118	13.56 (8.48 to 20.99)	NA	
	Breathlessness/ Exertional dyspnoea	Europe	n = 13	868/3336	28.59 (18.52 to 41.35)	96.32	0.227
		Asia	n = 4	328/1839	16.53 (7.91 to 31.34)	95.25	
		Middle East	n = 2	70/ 230	22.35 (0.00 to 99.99)	97.16	
		North America	n = 1	31/ 118	26.27 (19.13 to 34.93)	NA	
	Other cardiovascular symptoms	Europe	n = 1	1/ 767	0.13 (0.02 to 0.92)	NA	0.009
		Asia	n = 2	78/1185	4.20 (0.00 to 99.97)	97.68	
	Palpitations	Asia	n = 4	387/3380	12.04 (7.03 to 19.85)	93.93	0.168
		Europe	n = 3	82/1280	8.10 (1.14 to 40.21)	95.9	
		North America	n = 1	7/ 118	5.93 (2.85 to 11.92)	NA	
	Excessive sputum/ Expectoration	Asia	n = 3	81/1192	6.56 (1.54 to 23.96)	90.08	0.238
		Europe	n = 3	32/ 757	4.23 (1.99 to 8.76)	0	
Gastrointestinal	Stomach/ Abdominal pain	Europe	n = 3	22/1310	1.61 (0.22 to 10.84)	80.31	0.011
		Asia	n = 1	8/ 117	6.84 (3.46 to 13.08)	NA	
	Loss of appetite	Asia	n = 2	166/1772	13.98 (0.06 to 97.66)	96.44	0.088
		Europe	n = 1	36/ 134	26.87 (20.05 to 34.99)	NA	
	Diarrhoea	Europe	n = 6	49/1495	2.37 (0.80 to 6.77)	80.93	0.055
		Asia	n = 3	133/2312	7.38 (2.34 to 20.91)	89.09	
		North America	n = 1	8/ 118	6.78 (3.43 to 12.97)	NA	
	Nausea or Vomiting	Europe	n = 2	20/ 586	3.92 (0.00 to 98.84)	92.31	0.004
		Asia	n = 1	21/ 117	17.95 (12.00 to 25.97)	NA	
		North America	n = 1	8/ 118	6.78 (3.43 to 12.97)	NA	
Musculoskeletal	Impaired mobility	Asia	n = 2	135/2162	5.63 (0.46 to 43.57)	82.31	<0.001
		Europe	n = 3	126/ 577	16.90 (2.10 to 65.88)	92.96	

		Middle East	n = 1	62/ 127	48.82 (40.25 to 57.46)	NA	
	Joint pain/ Arthralgia	Asia	n = 3	326/2733	12.25 (3.07 to 38.13)	97.8	0.295
		Europe	n = 6	111/1227	8.03 (4.01 to 15.42)	88.36	
	Muscle pain/ Myalgia	Europe	n = 9	294/2471	14.02 (7.27 to 25.34)	96.38	<0.001
		Asia	n = 2	63/2193	3.11 (0.16 to 38.54)	83.96	
		North America	n = 1	21/ 118	17.80 (11.90 to 25.76)	NA	
Neurocognitive	Other cognitive impairment	Europe	n = 2	118/ 264	40.19 (0.00 to 100.00)	99	0.017
		North America	n = 1	4/ 177	2.26 (0.85 to 5.86)	NA	
	Memory impairment	North America	n = 1	20/ 118	16.95 (11.20 to 24.82)	NA	0.898
		Europe	n = 4	131/ 768	18.19 (3.02 to 61.38)	96.14	
Neurological and neuromuscular	Walking/ Gait abnormality	Europe	n = 2	12/ 269	4.46 (0.11 to 66.56)	0	0.796
		Asia	n = 1	22/ 540	4.07 (2.70 to 6.11)	NA	
	Tremors	Europe	n = 2	17/ 586	2.98 (0.00 to 99.96)	94.5	0.615
		Asia	n = 1	25/ 538	4.65 (3.16 to 6.79)	NA	
	Headache	Asia	n = 1	33/1655	1.99 (1.42 to 2.79)	NA	0.005
		Europe	n = 9	187/2762	5.30 (2.12 to 12.66)	92.94	
		North America	n = 1	7/ 118	5.93 (2.85 to 11.92)	NA	
	Smell disturbance	Europe	n = 15	602/3615	15.35 (9.88 to 23.06)	96.43	0.027
		Asia	n = 1	176/1655	10.63 (9.24 to 12.21)	NA	
		North America	n = 2	49/ 295	16.74 (1.75 to 69.42)	65.9	
		Middle East	n = 1	15/ 103	14.56 (8.97 to 22.76)	NA	
	Taste disturbance	Asia	n = 1	120/1655	7.25 (6.10 to 8.60)	NA	<0.001
		Europe	n = 13	510/3370	14.25 (8.44 to 23.06)	96.81	
		North America	n = 2	49/ 295	16.74 (1.75 to 69.42)	65.9	
		Middle East	n = 1	8/ 103	7.77 (3.93 to 14.77)	NA	
Other	Hair loss	North America	n = 1	14/ 118	11.86 (7.15 to 19.04)	NA	0.005
		Asia	n = 2	513/2193	24.69 (5.86 to 63.32)	90.76	
		Europe	n = 2	36/ 499	8.21 (0.00 to 99.89)	96.66	
	Skin rash	Asia	n = 1	47/1655	2.84 (2.14 to 3.76)	NA	0.952
		Europe	n = 3	20/ 719	2.75 (0.30 to 20.89)	86.08	
Psychosological and social	Care dependency	Asia	n = 1	25/1611	1.55 (1.05 to 2.29)	NA	<0.001
		North America	n = 1	14/ 177	7.91 (4.74 to 12.91)	NA	

		Europe	n = 1	121/ 767	15.78 (13.36 to 18.53)	NA	
	Reduced quality of life	Europe	n = 1	28/90	31.11 (22.42 to 41.37)	NA	<0.001
		North America	n = 1	53/ 177	29.94 (23.66 to 37.09)	NA	
		Asia	n = 1	259/ 540	47.96 (43.77 to 52.18)	NA	
	Low mood/ Dysphoria	Europe	n = 2	53/ 360	0.86 (0.00 to 100.00)	0	0.868
		Asia	n = 1	9/ 538	1.67 (0.87 to 3.18)	NA	
	PTSD	Europe	n = 5	322/1937	9.93 (3.21 to 26.84)	96.87	0.322
		Middle East	n = 1	7/ 120	5.83 (2.81 to 11.73)	NA	
	Sleep disorder	Asia	n = 2	532/2193	22.00 (2.69 to 74.18)	94	0.486
		Europe	n = 7	210/1249	17.09 (7.01 to 36.03)	94.68	
	Depression	Asia	n = 2	390/2155	10.38 (0.00 to 99.83)	98.62	0.506
		Europe	n = 4	95/1507	6.80 (3.99 to 11.37)	71	
	Anxiety	Asia	n = 2	402/2155	12.63 (0.02 to 98.99)	98.36	0.320
		Europe	n = 5	248/1396	21.85 (8.03 to 47.22)	97.39	
Systemic	Dizziness	Asia	n = 2	115/2193	4.21 (0.08 to 71.53)	89.39	0.764
		Europe	n = 3	47/ 948	4.76 (1.43 to 14.71)	75.61	
	General malaise	Europe	n = 1	25/ 134	18.66 (12.93 to 26.16)	NA	<0.001
		Asia	n = 1	267/ 538	49.63 (45.42 to 53.85)	NA	
	Sweat or night sweats	Europe	n = 1	35/ 145	24.14 (17.87 to 31.76)	NA	0.894
		Asia	n = 1	127/ 538	23.61 (20.21 to 27.38)	NA	
	Fever	Europe	n = 5	44/1851	1.91 (0.36 to 9.62)	90.51	0.011
		Asia	n = 1	2/1655	0.12 (0.03 to 0.48)	NA	
		North America	n = 1	1/ 118	0.85 (0.12 to 5.77)	NA	
	Fatigue	Europe	n = 8	605/2014	34.68 (25.12 to 45.66)	93	0.382
		North America	n = 2	60/ 295	20.71 (0.25 to 96.48)	91.68	
		Asia	n = 4	1436/3380	31.33 (10.49 to 63.98)	99.42	
		Middle East	n = 3	106/ 350	28.07 (6.94 to 67.15)	93.59	
Upper respiratory	Other respiratory symptoms	Europe	n = 2	43/ 573	8.88 (0.00 to 99.98)	97.85	0.029
		Asia	n = 1	210/ 538	39.03 (35.00 to 43.22)	NA	
	Nasal congestion	Europe	n = 2	42/ 885	4.75 (0.66 to 27.08)	0	0.343
		North America	n = 1	8/ 118	6.78 (3.43 to 12.97)	NA	
	Sore throat	Asia	n = 2	86/2193	3.92 (1.00 to 14.17)	8.33	0.165

	Europe	n = 2	38/ 585	7.48 (0.06 to 91.61)	90.13
	North America	n = 1	3/ 118	2.54 (0.82 to 7.59)	NA

Supplement 8: Subgroup analysis: Follow-up timing

Classification	Symptom	Subgroup	N Studies	Event/total	Proportion% (95% CIs)	Heterogeneity (%)	P value
Cardiopulmonary	Cough	< 4 months	n = 14	374/4483	8.35 (4.56 to 14.81)	94.34	0.669
		> 4 months	n = 2	40/548	7.30 (0.97 to 38.82)	0	
	Chest pain	> 4 months	n = 1	75/1655	4.53 (3.63 to 5.65)	NA	0.311
		< 4 months	n = 10	233/3223	6.55 (2.97 to 13.84)	91.52	
	Breathlessness/ Exertional dyspnoea	< 4 months	n = 15	1142/4562	28.92 (20.29 to 39.41)	96.15	0.075
		> 4 months	n = 5	155/961	15.41 (5.74 to 35.30)	95.81	
	Palpitations	> 4 months	n = 1	154/1655	9.31 (8.00 to 10.80)	NA	0.863
		< 4 months	n = 7	322/3123	9.71 (5.42 to 16.78)	94.42	
	Excessive sputum/ Expectoration	> 4 months	n = 1	11/114	9.65 (5.42 to 16.59)	NA	0.069
		< 4 months	n = 5	102/1835	4.95 (2.64 to 9.09)	85.74	
Gastrointestinal	Weight loss	> 4 months	n = 1	47/434	10.83 (8.23 to 14.12)	NA	<0.001
		< 4 months	n = 1	50/134	37.31 (29.55 to 45.79)	NA	
	Loss of appetite	> 4 months	n = 1	138/1655	8.34 (7.10 to 9.77)	NA	<0.001
		< 4 months	n = 2	64/251	25.50 (5.15 to 68.31)	0	
	Diarrhoea	< 4 months	n = 8	85/1836	3.53 (1.41 to 8.59)	84.4	0.371
		> 4 months	n = 2	105/2089	5.03 (1.46 to 15.89)	0	
Musculoskeletal	Impaired mobility	> 4 months	n = 3	241/1953	24.29 (2.15 to 82.41)	99.05	0.108
		< 4 months	n = 3	82/913	8.07 (0.95 to 44.49)	96.49	
	Joint pain/ Arthralgia	> 4 months	n = 1	154/1655	9.31 (8.00 to 10.80)	NA	0.986
		< 4 months	n = 8	283/2305	9.35 (5.22 to 16.17)	94.04	
	Muscle pain/ Myalgia	< 4 months	n = 11	339/3127	12.95 (7.31 to 21.91)	96.15	<0.001
		> 4 months	n = 1	39/1655	2.36 (1.73 to 3.21)	NA	
Neurocognitive	Other cognitive impairment	< 4 months	n = 2	118/264	40.19 (0.00 to 100.00)	99	0.017
		> 4 months	n = 1	4/177	2.26 (0.85 to 5.86)	NA	
Neurological and neuromuscular	Headache	> 4 months	n = 3	113/2269	6.11 (0.65 to 39.33)	97.98	0.620
		< 4 months	n = 8	114/2266	4.42 (1.60 to 11.59)	92.68	
	Smell disturbance	< 4 months	n = 13	367/2994	13.26 (8.37 to 20.37)	94.8	0.166
		> 4 months	n = 6	475/2674	19.96 (11.27 to 32.87)	97.79	
	Taste disturbance	> 4 months	n = 6	364/2674	15.36 (7.94 to 27.63)	97.61	0.580

		< 4 months	n = 11	323/2749	12.61 (6.95 to 21.81)	96.44	
Other	Hair loss	< 4 months	n = 4	204/1155	12.72 (3.10 to 39.89)	95.98	0.181
		> 4 months	n = 1	359/1655	21.69 (19.77 to 23.74)	NA	
	Skin rash	> 4 months	n = 1	47/1655	2.84 (2.14 to 3.76)	NA	0.952
		< 4 months	n = 3	20/719	2.75 (0.30 to 20.89)	86.08	
Psychological and social	Care dependency	> 4 months	n = 2	39/1788	3.38 (0.00 to 98.56)	95.89	0.006
		< 4 months	n = 1	121/767	15.78 (13.36 to 18.53)	NA	
	Reduced quality of life	< 4 months	n = 2	287/630	40.64 (2.65 to 94.52)	88.36	0.119
		> 4 months	n = 1	53/177	29.94 (23.66 to 37.09)	NA	
	PTSD	< 4 months	n = 5	322/1937	9.93 (3.21 to 26.84)	96.87	0.322
		> 4 months	n = 1	7/120	5.83 (2.81 to 11.73)	NA	
	Sleep disorder	> 4 months	n = 1	437/1655	26.40 (24.34 to 28.58)	NA	0.130
		< 4 months	n = 8	305/1787	17.20 (8.21 to 32.54)	94.08	
	Depression	> 4 months	n = 1	367/1617	22.70 (20.72 to 24.80)	NA	<0.001
		< 4 months	n = 5	118/2045	6.16 (3.99 to 9.40)	71.69	
	Anxiety	> 4 months	n = 1	367/1617	22.70 (20.72 to 24.80)	NA	0.492
		< 4 months	n = 6	283/1934	18.10 (7.16 to 38.77)	97.51	
Systemic	Dizziness	> 4 months	n = 2	130/2089	6.22 (2.06 to 17.34)	0	0.011
		< 4 months	n = 3	32/1052	3.20 (1.08 to 9.12)	68.78	
	Fever	< 4 months	n = 5	23/1535	1.26 (0.22 to 7.01)	90.73	0.762
		> 4 months	n = 2	24/2089	0.79 (0.00 to 100.00)	96.18	
	Fatigue	< 4 months	n = 10	890/3243	32.50 (23.93 to 42.42)	94.57	0.608
		> 4 months	n = 7	1317/2796	28.61 (16.00 to 45.73)	98.47	
Upper respiratory	Nasal congestion	> 4 months	n = 1	23/434	5.30 (3.55 to 7.85)	NA	0.690
		< 4 months	n = 2	27/569	4.75 (0.41 to 37.90)	25.27	
	Sore throat	> 4 months	n = 1	69/1655	4.17 (3.31 to 5.25)	NA	0.655
		< 4 months	n = 4	58/1241	4.84 (1.76 to 12.65)	85.28	

Supplement 9: Meta-regression: % Female

Classification	Symptom	N Studies	Constant (SE)	Beta (SE)	R^2	P value
Cardiopulmonary	Breathlessness/ Exertional dyspnoea	20	-0.23 (0.79)	-1.93 (1.71)	0.07	0.258
	Chest pain	11	-2.13 (1.85)	-1.27 (4.11)	0.01	0.758
	Cough	16	-2.43 (1.12)	0.02 (2.32)	0.00	0.994
Gastrointestinal	Diarrhoea	10	-3.9 (1.46)	1.46 (2.87)	0.00	0.612
Systemic	Fatigue	17	-0.08 (0.61)	-1.58 (1.29)	0.09	0.222
Musculoskeletal	Muscle pain/ Myalgia	12	-0.37 (1.33)	-3.97 (3.05)	0.13	0.194
Neurological and neuromuscular	Headache	11	-6.29 (1.27)	6.7 (2.46)	0.43	0.007
	Smell disturbance	19	-4.07 (0.53)	4.95 (1.08)	0.56	<0.001
	Taste disturbance	17	-4.29 (0.63)	5.04 (1.27)	0.51	<0.001

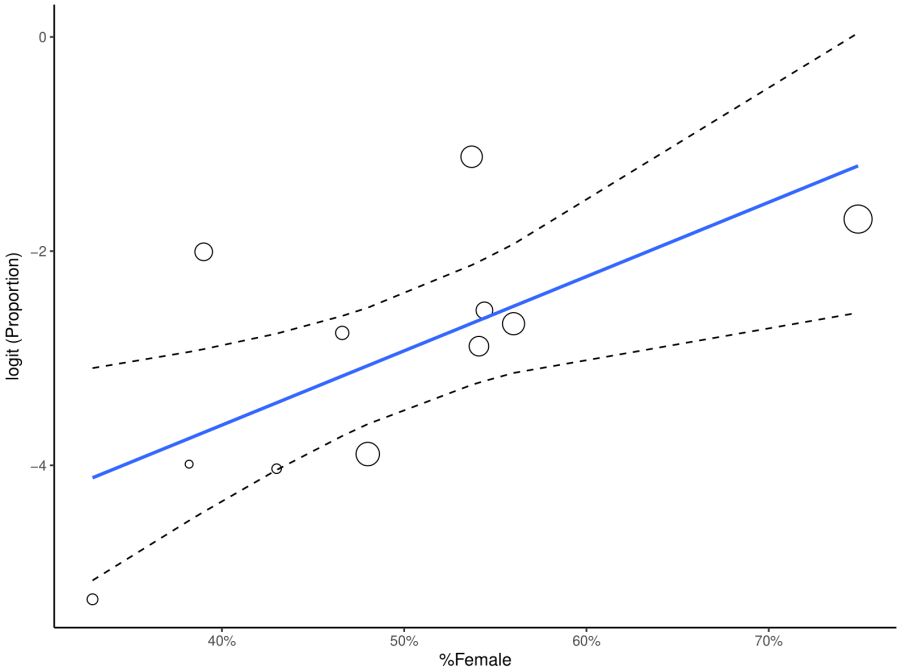


Figure 13. Metaregression on percentage of female. Neurological and neuromuscular (Headache)

The bubble plot presents the association between the proportions of females and people experienced headache (p<0.05). Each circle represents the value of an individual study, and the size of each circle is proportional to the study weight by inverse-variance weighting.

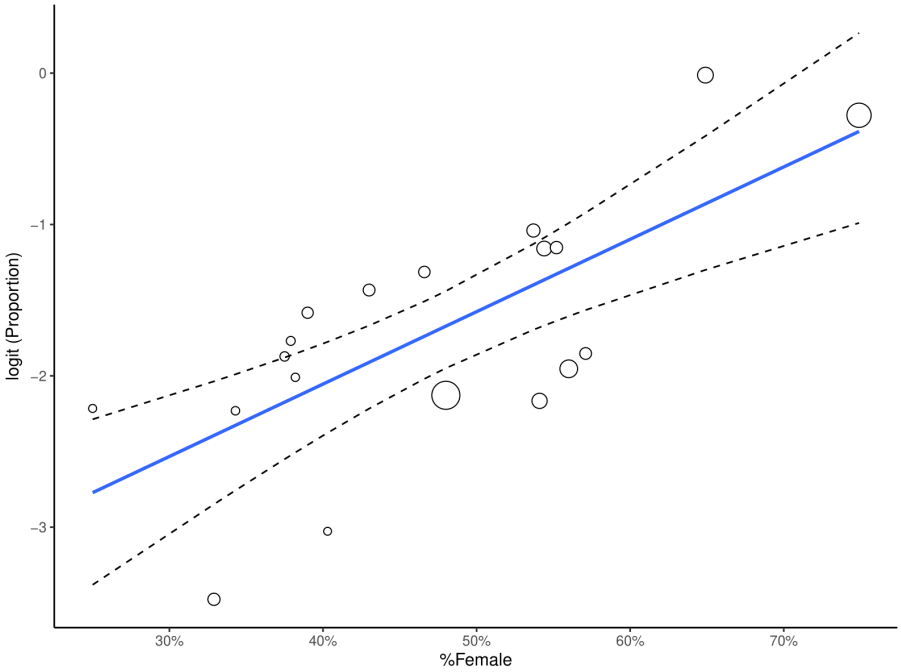


Figure 14. Metaregression on percentage of female. Neurological and neuromuscular (Small disturbance).

The bubble plot presents the association between the proportions of females and people experienced smell disturbance (p<0.05). Each circle represents the value of an individual study, and the size of each circle is proportional to the study weight by inverse-variance weighting.

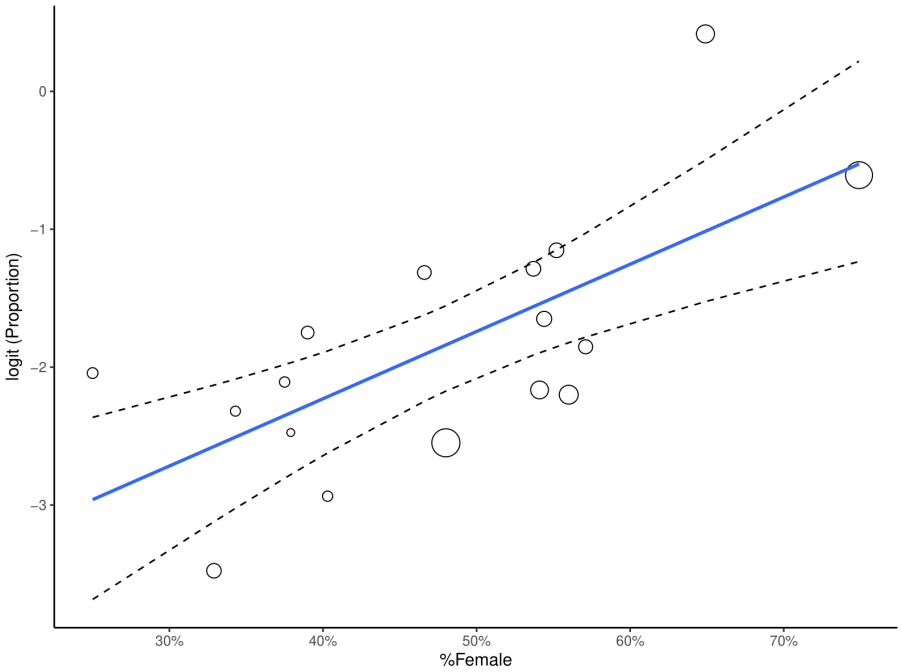


Figure 15. Metaregression on percentage of female. Neurological and neuromuscular (Taste disturbance).

The bubble plot presents the association between the proportions of females and people experienced taste disturbance (p<0.05). Each circle represents the value of an individual study, and the size of each circle is proportional to the study weight by inverse-variance weighting.

Supplement 10: Meta-regression: % ICU patients

Classification	Symptom	N Studies	Constant (SE)	Beta (SE)	R^2	P value
Cardiopulmonary	Breathlessness/ Exertional dyspnoea	14	-1.03 (0.31)	1.02 (0.89)	0.09	0.254
	Cough	11	-2.25 (0.63)	-0.75 (2.73)	-0.01*	0.783
Systemic	Fatigue	11	-0.67 (0.29)	0.4 (0.81)	0.02	0.620
Musculoskeletal	Muscle pain/ Myalgia	11	-2.71 (0.46)	4.19 (2.12)	0.27	0.048
Neurological and neuromuscular	Smell disturbance	14	-2.24 (0.26)	1.32 (1.3)	0.08	0.311
	Taste disturbance	12	-2.45 (0.25)	1.72 (1.23)	0.16	0.161

*poor fitting

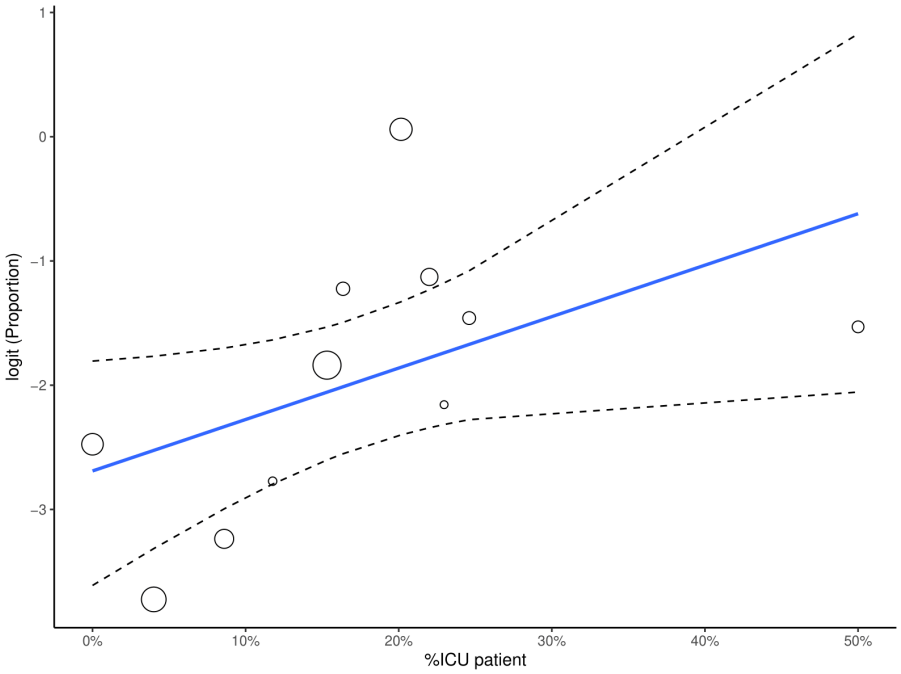


Figure 16. Metaregression on percentage of ICU patients. Musculoskeletal (Muscle pain/ Myalgia).

The bubble plot presents the association between the proportions of ICU patients and patients experienced muscle pain/myalgia ($p<0.05$). Each circle represents the value of an individual study, and the size of each circle is proportional to the study weight by inverse-variance weighting.

Supplement 11: Sensitivity analysis: versus removing high risk of bias studies

Classification	Symptom	Main results			Main results after removing high risk of bias studies		
		N Studies	n/Total	Prop (95% CIs)	N Studies	n/Total	Prop (95% CIs)
Cardiopulmonary	Other cardiovascular symptoms	n = 3	79/1952	1.38 (0.01 to 67.44)	n = 2	71/1305	1.37 (0.04 to 32.38)
	Palpitations	n = 8	476/4778	9.67 (5.95 to 15.34)	n = 7	413/4131	9.65 (5.39 to 16.66)
	Excessive sputum/ Expectoration	n = 6	113/1949	5.46 (3.19 to 9.19)	n = 4	88/1326	6.22 (2.62 to 14.05)
	Cough	n = 16	414/5031	8.17 (4.85 to 13.44)	n = 11	265/3207	7.42 (3.38 to 15.55)
	Chest pain	n = 11	308/4878	6.36 (3.15 to 12.42)	n = 8	275/3939	7.33 (3.25 to 15.68)
	Breathlessness/ Exertional dyspnoea	n = 20	1297/5523	25.06 (17.86 to 33.97)	n = 14	992/3596	28.85 (19.67 to 40.16)
Gastrointestinal	Weight loss	n = 2	97/568	20.99 (8.09 to 44.51)	n = 1	50/134	37.31 (29.12 to 46.08)
	Stomach/ Abdominal pain	n = 4	30/1427	2.33 (0.54 to 9.42)	n = 2	7/859	0.81 (0.39 to 1.70)
	Loss of appetite	n = 3	202/1906	17.49 (4.13 to 51.04)	n = 2	174/1789	15.09 (6.35 to 31.80)
	Diarrhoea	n = 10	190/3925	4.00 (2.07 to 7.57)	n = 6	140/2751	4.68 (2.49 to 8.66)
	Nausea or Vomiting	n = 4	49/821	6.69 (1.64 to 23.59)	n = 2	20/253	7.91 (5.16 to 11.93)
Musculoskeletal	Impaired mobility	n = 6	323/2866	14.42 (4.67 to 36.73)	n = 5	257/2662	12.00 (3.02 to 37.39)
	Joint pain/ Arthralgia	n = 9	437/3960	9.39 (5.72 to 15.03)	n = 6	378/3215	10.79 (5.21 to 21.00)
	Muscle pain/ Myalgia	n = 12	378/4782	11.29 (6.17 to 19.75)	n = 10	320/4209	11.14 (5.35 to 21.75)
Neurocognitive	Other cognitive impairment	n = 3	122/441	17.77 (0.08 to 98.23)	n = 3	122/441	17.77 (0.08 to 98.23)
	Confusion	n = 2	33/1218	2.71 (1.93 to 3.79)	n = 1	23/767	3.00 (1.91 to 4.47)
	Concentration impairment	n = 2	66/254	25.98 (20.96 to 31.73)	n = 1	34/134	25.37 (18.26 to 33.61)
	Memory impairment	n = 5	151/886	17.94 (5.26 to 46.25)	n = 4	110/766	14.93 (2.77 to 51.97)
Neurological and neuromuscular	Tingling/ Paraesthesia	n = 2	33/257	9.12 (2.21 to 30.87)	n = 1	29/135	21.48 (14.88 to 29.37)
	Visual disturbance	n = 2	28/586	4.78 (3.32 to 6.83)	n = 1	9/135	6.67 (3.09 to 12.28)
	Smell disturbance	n = 19	842/5668	15.17 (10.75 to 20.97)	n = 13	513/4258	14.08 (8.87 to 21.62)
	Taste disturbance	n = 17	687/5423	13.52 (8.96 to 19.89)	n = 11	425/4013	13.44 (7.31 to 23.42)
	Tremors	n = 3	42/1124	3.53 (0.30 to 30.63)	n = 2	38/673	6.20 (3.68 to 10.26)
	Headache	n = 11	227/4535	4.88 (2.30 to 10.06)	n = 7	115/3298	4.19 (1.30 to 12.71)
Other	Hair loss	n = 5	563/2810	14.34 (5.33 to 33.23)	n = 4	539/2690	13.14 (3.17 to 41.12)

	Skin rash	n = 4	67/2374	2.83 (0.95 to 8.16)	n = 3	60/1923	3.53 (0.75 to 15.11)
Psychological and social	Sleep disorder	n = 9	742/3442	18.15 (9.61 to 31.63)	n = 8	705/3322	16.88 (8.18 to 31.65)
Systemic	Dizziness	n = 5	162/3141	4.50 (2.53 to 7.86)	n = 4	133/2707	4.02 (1.87 to 8.42)
	Fever	n = 7	47/3624	1.08 (0.24 to 4.66)	n = 5	23/2739	0.91 (0.11 to 7.18)
	Fatigue	n = 17	2207/6039	30.97 (23.91 to 39.03)	n = 12	1882/4555	33.24 (24.57 to 43.22)
Upper respiratory	Other respiratory symptoms	n = 3	253/1111	15.58 (0.68 to 83.17)	n = 1	210/538	39.03 (34.89 to 43.30)
	Nasal congestion	n = 3	50/1003	4.99 (2.73 to 8.92)	n = 1	8/118	6.78 (2.97 to 12.92)
	Sore throat	n = 5	127/2896	4.70 (2.42 to 8.91)	n = 4	106/2445	4.70 (1.73 to 12.10)

Supplement 12: Sensitivity analysis: versus statistical methods

Classification	Symptom	N Studies	n/Total	Main results	FTDAT/IV*
				Prop (95% CIs)	Prop (95% CIs)
Cardiopulmonary	Breathlessness/ Exertional dyspnoea	n = 20	1297/5523	25.06 (17.86 to 33.97)	26.68 (20.36 to 33.51)
	Palpitations	n = 8	476/4778	9.67 (5.95 to 15.34)	10.21 (6.76 to 14.26)
	Cough	n = 16	414/5031	8.17 (4.85 to 13.44)	9.52 (6.16 to 13.50)
	Chest pain	n = 11	308/4878	6.36 (3.15 to 12.42)	7.52 (4.29 to 11.52)
	Excessive sputum/ Expectoration	n = 6	113/1949	5.46 (3.19 to 9.19)	5.69 (3.23 to 8.75)
	Flushing	n = 1	26/538	4.83 (3.18 to 7.00)	4.83 (3.17 to 6.82)
	Newly diagnosed hypertension	n = 1	7/538	1.30 (0.52 to 2.66)	1.30 (0.49 to 2.46)
	Other cardiovascular symptoms	n = 3	79/1952	1.38 (0.01 to 67.44)	2.99 (0.00 to 12.59)
Gastrointestinal	Weight loss	n = 2	97/568	20.99 (8.09 to 44.51)	22.47 (3.00 to 52.50)
	Other stomach/ Abdominal discomfort	n = 1	21/117	17.95 (11.47 to 26.12)	17.95 (11.47 to 25.47)
	Loss of appetite	n = 3	202/1906	17.49 (4.13 to 51.04)	18.57 (6.35 to 35.21)
	Nausea or Vomiting	n = 4	49/821	6.69 (1.64 to 23.59)	7.69 (1.89 to 16.67)
	Diarrhoea	n = 10	190/3925	4.00 (2.07 to 7.57)	4.41 (2.65 to 6.57)
	Bloody stools / Haematochezia	n = 1	2/117	1.71 (0.21 to 6.04)	1.71 (0.03 to 5.08)
	Stomach/ Abdominal pain	n = 4	30/1427	2.33 (0.54 to 9.42)	2.63 (0.56 to 5.93)
Musculoskeletal	Impaired mobility	n = 6	323/2866	14.42 (4.67 to 36.73)	17.09 (7.35 to 29.77)
	Muscle pain/ Myalgia	n = 12	378/4782	11.29 (6.17 to 19.75)	13.09 (7.71 to 19.59)
	Joint pain/ Arthralgia	n = 9	437/3960	9.39 (5.72 to 15.03)	10.04 (6.33 to 14.46)
Neurocognitive	Concentration impairment	n = 2	66/254	25.98 (20.96 to 31.73)	25.98 (20.74 to 31.59)
	Memory impairment	n = 5	151/886	17.94 (5.26 to 46.25)	20.55 (6.54 to 39.62)
	Other cognitive impairment	n = 3	122/441	17.77 (0.08 to 98.23)	25.51 (0.00 to 79.72)
	Frontal release signs	n = 1	20/135	14.81 (9.29 to 21.95)	14.81 (9.27 to 21.35)
	Confusion	n = 2	33/1218	2.71 (1.93 to 3.79)	2.69 (1.84 to 3.69)
Neurological and neuromuscular	Abnormal reflex status	n = 1	31/135	22.96 (16.17 to 30.98)	22.96 (16.22 to 30.47)
	Other neurological diseases	n = 1	20/135	14.81 (9.29 to 21.95)	14.81 (9.27 to 21.35)
	Smell disturbance	n = 19	842/5668	15.17 (10.75 to 20.97)	16.48 (11.36 to 22.31)
	Taste disturbance	n = 17	687/5423	13.52 (8.96 to 19.89)	14.99 (9.76 to 21.09)
	Decreased sensation or sensibility	n = 2	30/269	10.90 (6.71 to 17.22)	10.88 (4.73 to 19.05)
	Tingling/ Paraesthesia	n = 2	33/257	9.12 (2.21 to 30.87)	10.74 (0.02 to 34.12)
	Muscle atrophy	n = 1	9/135	6.67 (3.09 to 12.28)	6.67 (2.98 to 11.58)
	Headache	n = 11	227/4535	4.88 (2.30 to 10.06)	6.12 (2.97 to 10.25)
	Slowness of movement/ Bradykinesia	n = 1	7/135	5.19 (2.11 to 10.39)	5.19 (1.98 to 9.67)
	Visual disturbance	n = 2	28/586	4.78 (3.32 to 6.83)	4.86 (2.79 to 7.43)
	Abnormal muscle tone	n = 1	6/135	4.44 (1.65 to 9.42)	4.44 (1.50 to 8.68)
	Tremors	n = 3	42/1124	3.53 (0.30 to 30.63)	4.12 (0.76 to 9.75)
	Walking/ Gait abnormality	n = 3	34/809	4.20 (2.02 to 8.53)	4.11 (2.80 to 5.63)

	Trigeminal neuralgia	n = 1	4/122	3.28 (0.90 to 8.18)	3.28 (0.71 to 7.33)
	Speech difficulty/ Dysarthria	n = 1	3/135	2.22 (0.46 to 6.36)	222 (0.28 to 5.56)
	Ear/ Hearing conditions	n = 1	5/451	1.11 (0.36 to 2.57)	1.11 (0.31 to 2.33)
	Lack of coordination/ Dysmetria	n = 1	2/135	1.48 (0.18 to 5.25)	1.48 (0.02 to 4.41)
	Seizures/ Cramps	n = 1	6/451	1.33 (0.49 to 2.87)	1.33 (0.44 to 2.63)
Other	Hair loss	n = 5	563/2810	14.34 (5.33 to 33.23)	15.86 (7.42 to 26.68)
	Skin rash	n = 4	67/2374	2.83 (0.95 to 8.16)	2.86 (1.29 to 4.96)
	Conjunctivitis	n = 1	8/451	1.77 (0.77 to 3.47)	1.77 (0.73 to 3.23)
Psychological and social	Reduced quality of life	n = 3	340/807	36.76 (18.43 to 59.93)	36.60 (23.89 to 50.32)
	Anxiety	n = 7	650/3551	18.73 (8.89 to 35.25)	20.39 (11.95 to 30.38)
	Sleep disorder	n = 9	742/3442	18.15 (9.61 to 31.63)	20.01 (12.32 to 28.99)
	PTSD	n = 6	329/2057	9.14 (3.66 to 21.04)	10.41 (3.36 to 20.59)
	Depression	n = 6	485/3662	8.06 (4.14 to 15.10)	8.72 (3.02 to 16.93)
	Care dependency	n = 3	160/2555	5.89 (0.46 to 45.96)	7.24 (0.36 to 21.24)
	Low mood/ Dysphoria	n = 3	62/898	1.79 (0.00 to 98.74)	7.49 (0.00 to 31.80)
Systemic	Weakness	n = 2	186/513	41.20 (25.43 to 59.01)	41.62 (19.16 to 66.08)
	General malaise	n = 2	292/672	32.68 (14.91 to 57.36)	33.47 (8.11 to 65.59)
	Fatigue	n = 17	2207/6039	30.97 (23.91 to 39.03)	31.75 (22.81 to 41.41)
	Sweat or night sweats	n = 2	162/683	23.72 (20.68 to 27.05)	23.68 (20.55 to 26.96)
	Dizziness	n = 5	162/3141	4.50 (2.53 to 7.86)	4.58 (2.80 to 6.76)
	Enlarged lymph nodes/ Lymphadenopathy	n = 1	4/451	0.89 (0.24 to 2.26)	0.89 (0.19 to 2.01)
	Fever	n = 7	47/3624	1.08 (0.24 to 4.66)	1.74 (0.28 to 4.14)
Upper respiratory	Other respiratory symptoms	n = 3	253/1111	15.58 (0.68 to 83.17)	19.30 (0.95 to 52.06)
	Voice change	n = 1	11/134	8.21 (4.17 to 14.21)	8.21 (4.08 to 13.53)
	Nasal congestion	n = 3	50/1003	4.99 (2.73 to 8.92)	4.89 (3.61 to 6.34)
	Sore throat	n = 5	127/2896	4.70 (2.42 to 8.91)	4.66 (2.94 to 6.74)

* FTDAT/IV: Freeman-Tukey Double arcsine transformation within inverse Variance Method

Supplement 13: Funnel plots

The following funnel plots present the proportion of people experienced with certain symptoms against the standard errors (Egger's method) or sample size (Peter's method) to assess potential publication bias and small study effects. Only symptoms reported 10 or more are presented here.

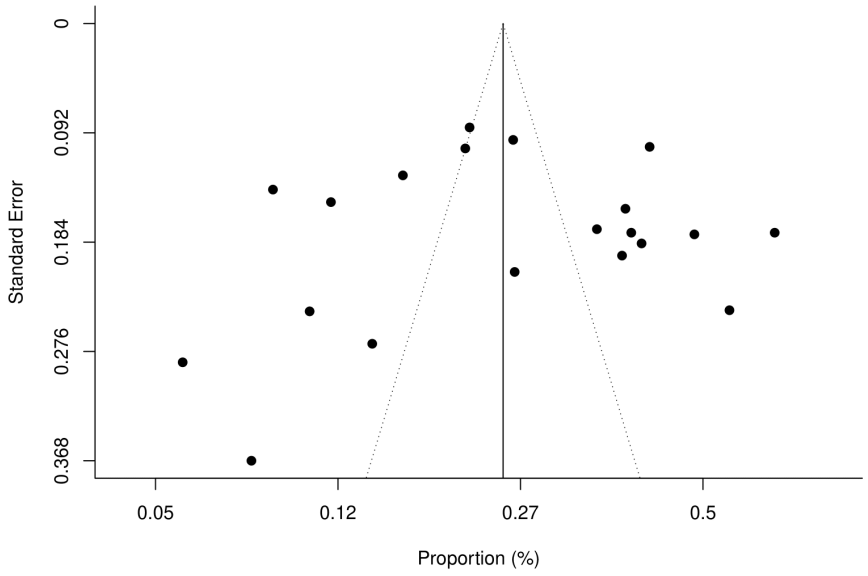


Figure 17. Funnel plot. Cardiopulmonary (Breathlessness or Exertional dyspnoea) by Egger's method

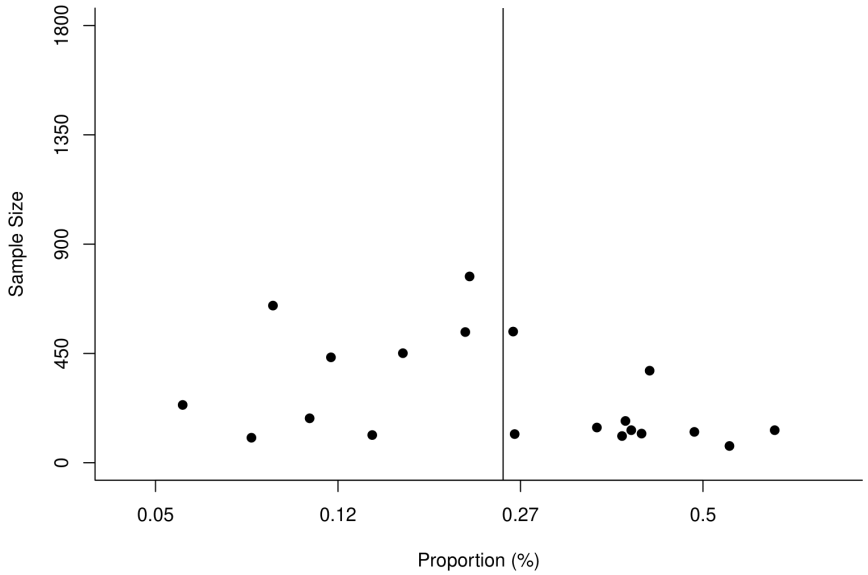


Figure 18. Funnel plot. Cardiopulmonary (Breathlessness or Exertional dyspnoea) by Peter's method

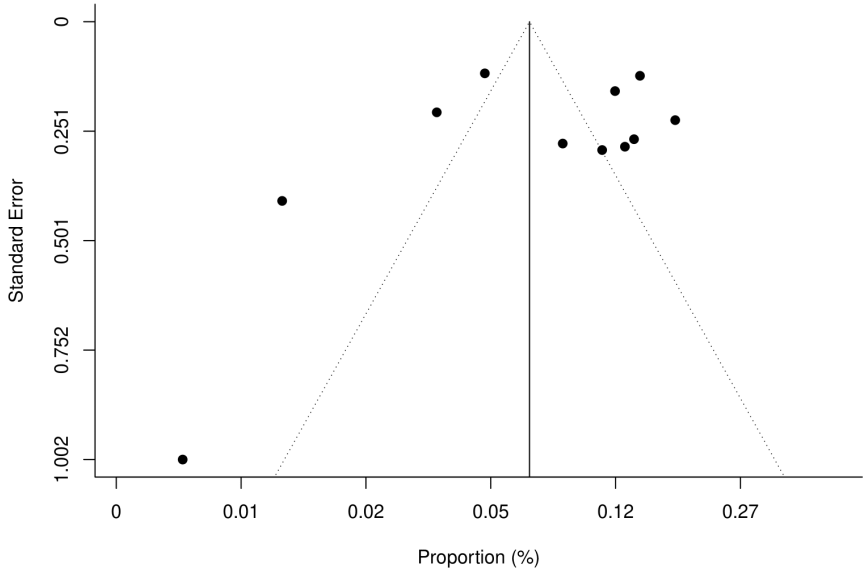


Figure 19. Funnel plot. Cardiopulmonary (Chest pain) by Egger's method

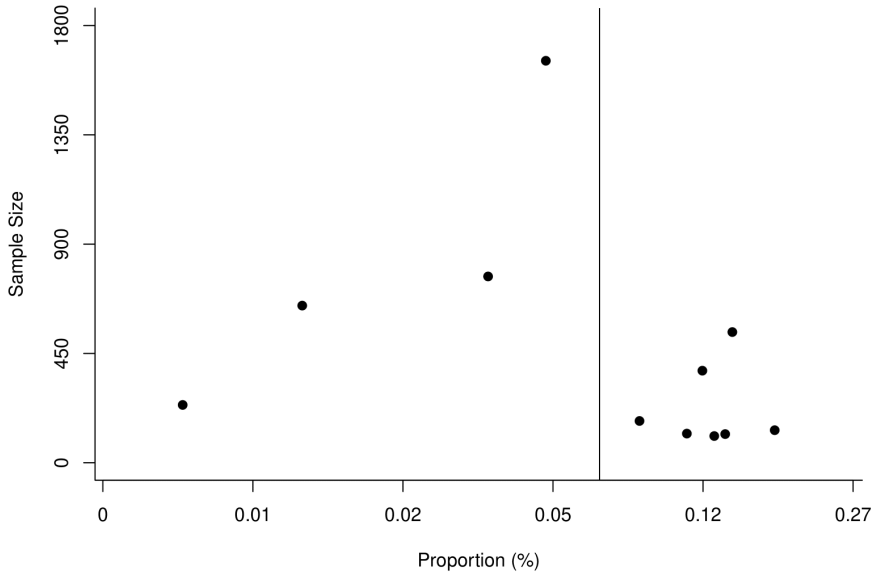


Figure 20. Funnel plot. Cardiopulmonary (Chest pain) by Peter's method

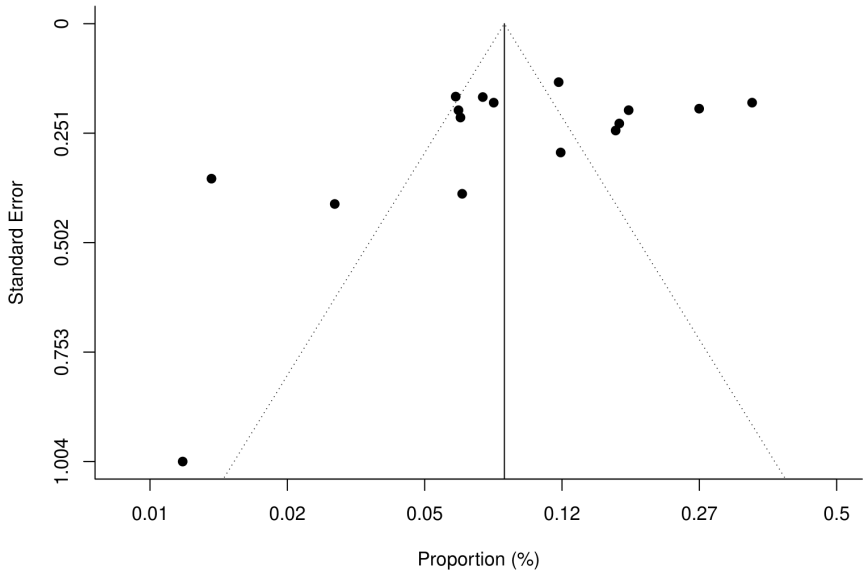


Figure 21. Funnel plot. Cardiopulmonary (Cough) by Egger's method

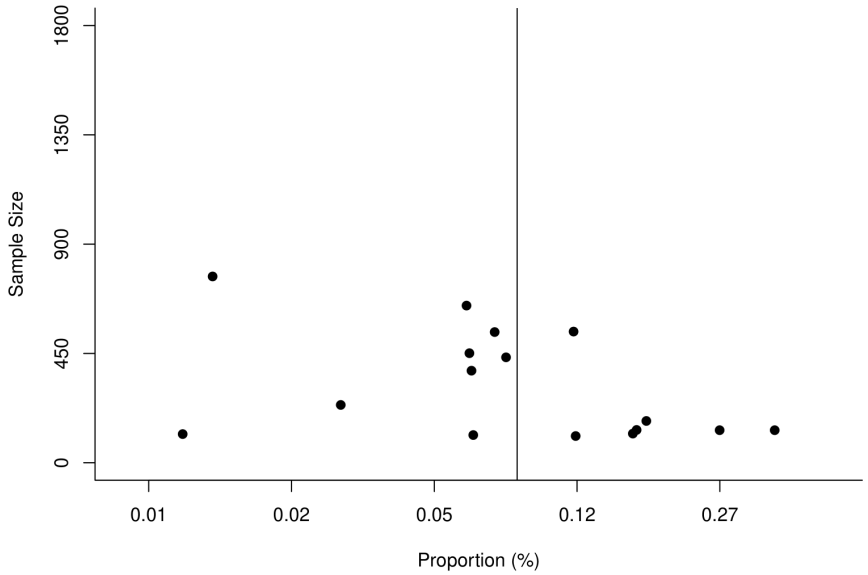


Figure 22. Funnel plot. Cardiopulmonary (Cough) by Peter's method

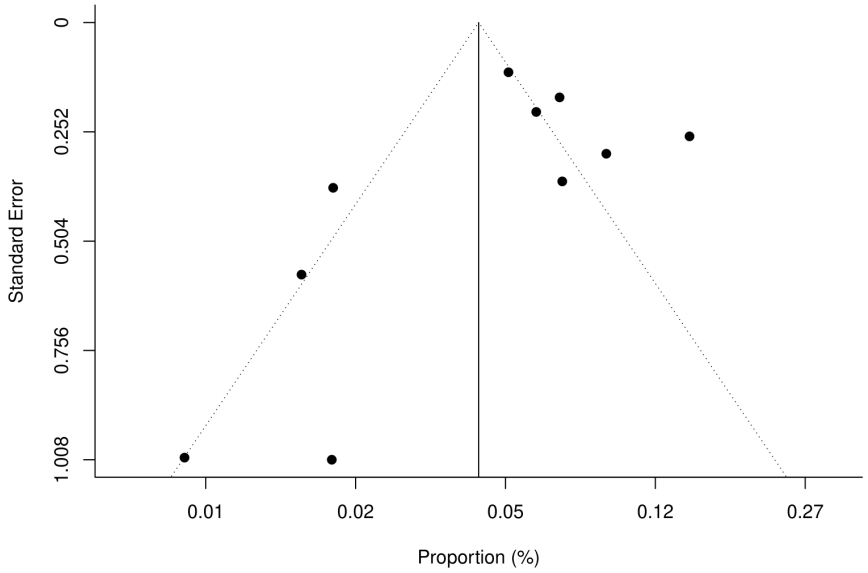


Figure 23. Funnel plot. Gastrointestinal (Diarrhoea) by Egger's method

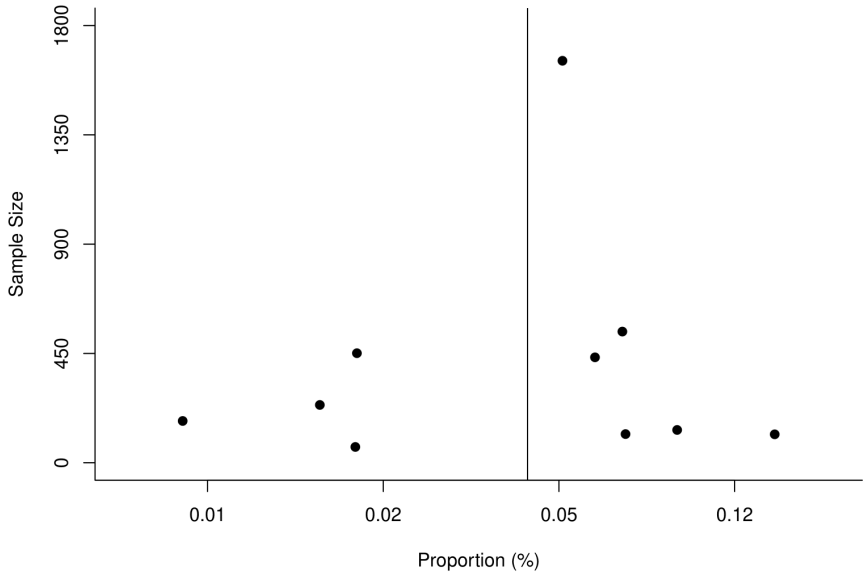


Figure 24. Funnel plot. Gastrointestinal (Diarrhoea) by Peter's method

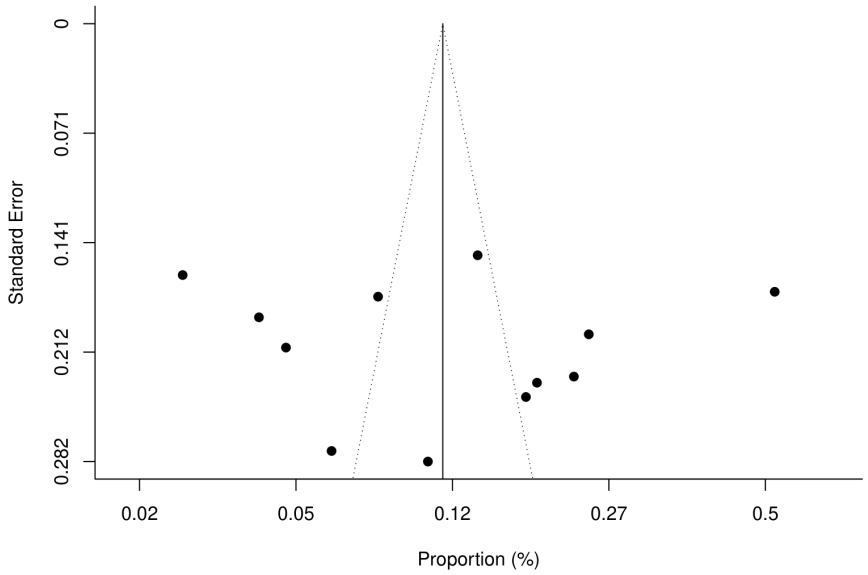


Figure 25. Funnel plot. Musculoskeletal (Muscle pain or Myalgia) by Egger's method

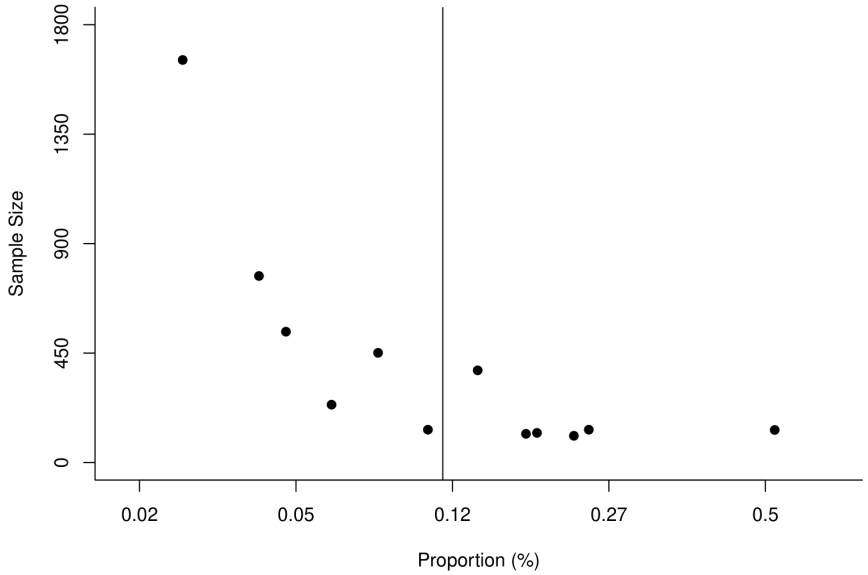


Figure 26. Funnel plot. Musculoskeletal (Muscle pain or Myalgia) by Peter's method

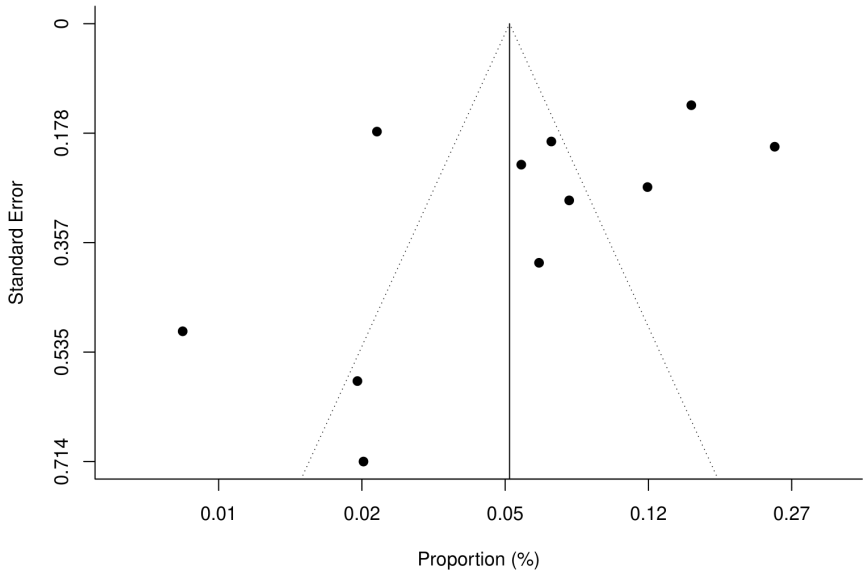


Figure 27. Funnel plot. Neurological and neuromuscular (Headache) by Egger's method

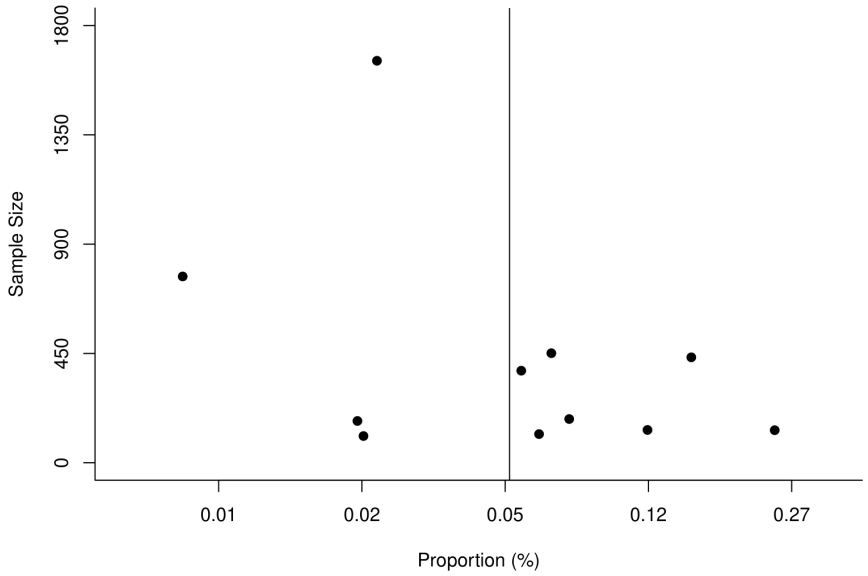


Figure 28. Neurological and neuromuscular (Headache) by Peter's method

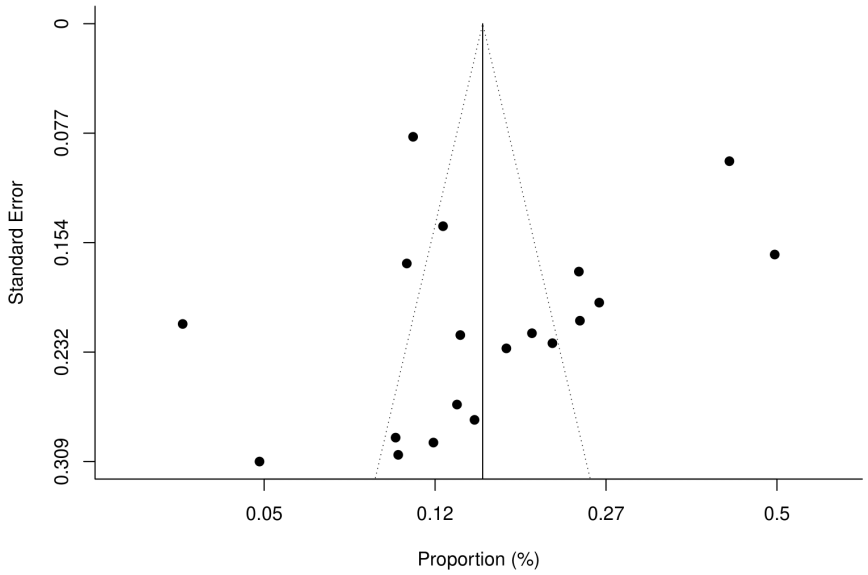


Figure 29. Funnel plot. Neurological and neuromuscular (Smell disturbance) by Egger's method

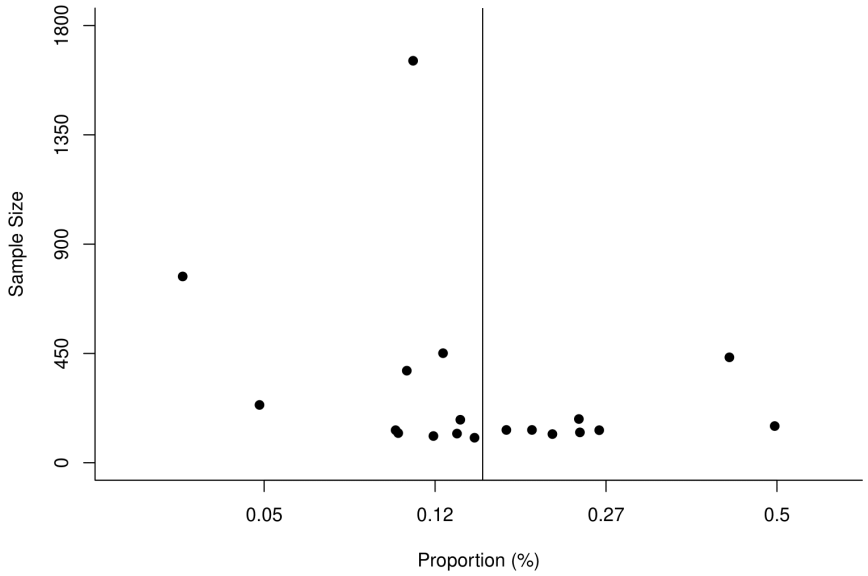


Figure 30. Neurological and neuromuscular (Smell disturbance) by Peter's method

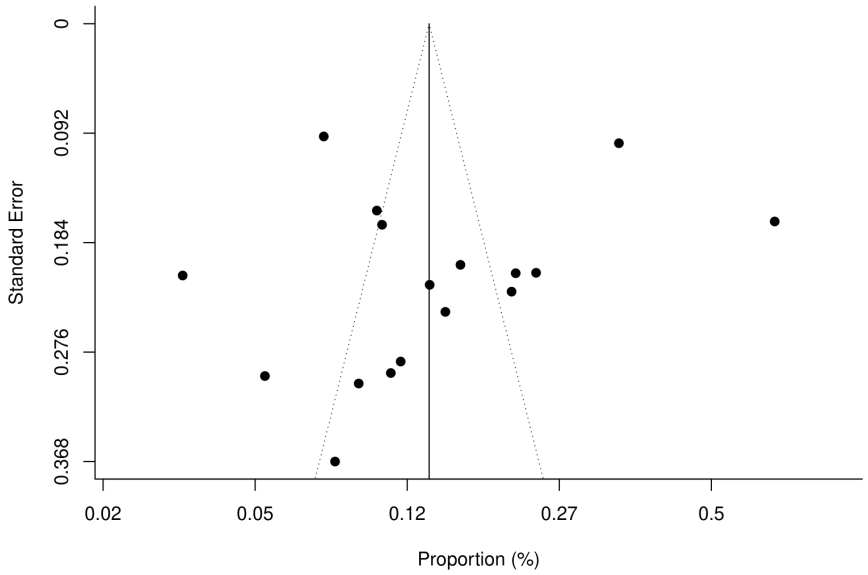


Figure 31. Funnel plot. Neurological and neuromuscular (Taste disturbance) by Egger's method

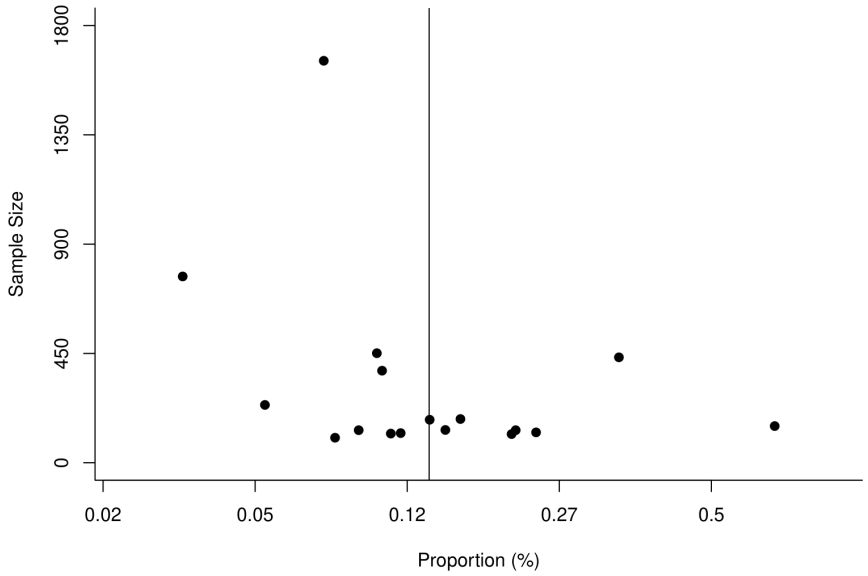


Figure 32. Funnel plot. Neurological and neuromuscular (Taste disturbance) by Peter's method

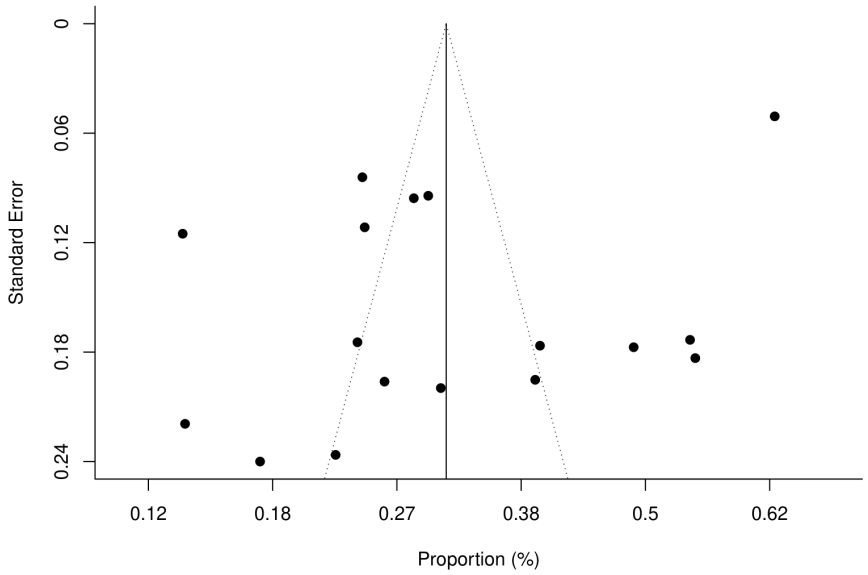


Figure 33. Funnel plot. Systemic (Fatigue) by Egger's method

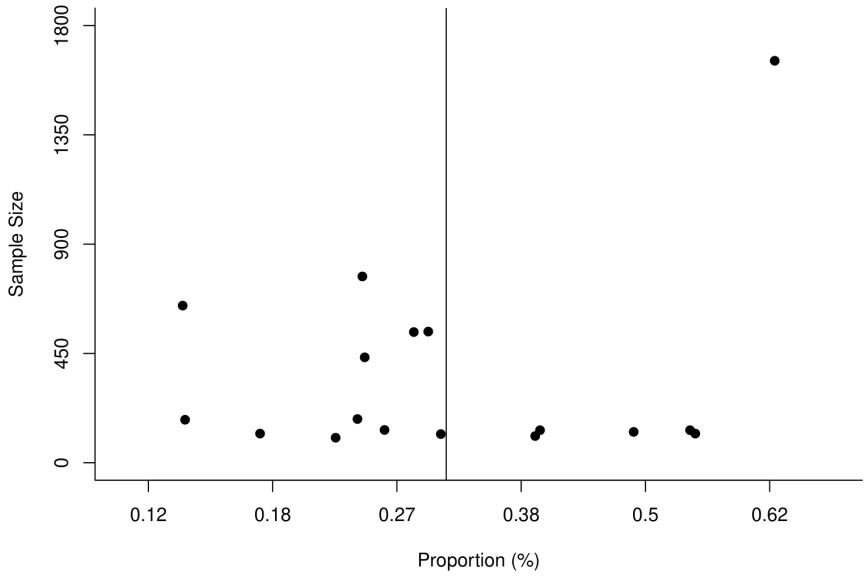


Figure 34. Funnel plot. Systemic (Fatigue) by Peter's method

Supplement 14: Risk factors

Study	Category	Risk factor	Associated with	Method	P Value/ CI
Nguyen et al.	Sex	Female sex	Persistent symptoms	Chi-squared or the Fisher exact test	p = 0.02
Mazza et al.	Sex	Female sex	Persistence of depressive symptomatology	Multivariate GLM analysis	(Wilks' λ = 0.92; F = 5.76; p = 0.003)
	Comorbidities	Previous psychiatric diagnosis			(Wilks' λ = 0.93; F = 5.29; p = 0.006)
	Severity	Presence of psychopathology at one-month			(Wilks' λ = 0.82; F = 15.16; p < 0.001)
Parentes-Arias et al.	Age	<60 years	Olfactory dysfunction	Multivariable-adjusted ORs	p = 0.028
	Sex	Female sex			p = 0.003
	Comorbidities	1 comorbidity			p = 0.031
Xiong et al.	Sex	Female sex	Covid-19 sequelae	Multivariable logistic regression model	Physical decline/fatigue (p < 0.01) Postactivity polypnoea (p= 0.04) Alopecia (p < 0.01)
	Severity	Dyspnea during hospitalisation	Physical decline/fatigue, postactivity polypnoea and resting heart rate increases	Univariate analysis	Physical decline/fatigue (p=.02) Postactivity polypnoea (p=.01) Resting heart rate increases (p=.01)
Sykes et al.	Sex	Female sex	Persistent symptoms	Chi-Square and Mann–Whitney U testing	Anxiety (p=0.001),low mood (p=0.031), myalgia (p=0.022), fatigue (p=0.004), sleep disturbance (p=0.009), and memory impairment (p=0.001)
Taboada et al.	Age	Age	Limitations in the functional status (grade II-IV of PCSF)	Multivariate logistic regression model	(OR = 2.600, 95% CI: 1.192–5.671)
	Severity	Length of hospital stay			(OR = 1.049, 95% CI: 1.009–1.090)
	Severity	Admission to ICU / mechanical ventilation			P < 0.001
Qu et al.	Sex	Female sex	Poor QoL scores	Logistic regression	(OR: 1.79, 95% CI: 1.04–3.06)
	Age	Older age (≥60 years)			(OR: 2.44, 95% CI: 1.33–4.47)
	Severity	Physical symptom after discharge			(OR: 40.15, 95% CI: 9.68–166.49)
Einvik et al.	Sex	Female sex	Symptoms of post-traumatic stress	Multivariable linear regression	NR
	Ethnicity	Born outside Norway			

	Severity	Dyspnoea during COVID-19			
Gherlone et al.	Comorbidities	COPD	Dry mouth	Multivariable analysis	(OR= 9.10, 95% CI: 1.8 -68.49)
Stavem et al.	Severity	Number of symptoms (10–23)	Symptoms at follow-up	Multivariable negative binomial regression analysis	(OR= 4.16, 95% CI:2.57 to 6.72, p<0.001)
	Comorbidities	≥2			(OR=2.52, 95%CI: 1.58 to 4.02, p<0.001)
Baricich et al.	Severity	ICU admission	Physical impairment	Multivariable logistic regression model	(OR: 3.1, 95%CI: 1.3-7.9, p=0.01)
	Age	Age	walking ability (SPPB)		p <0.02
	Comorbidities	Number or comorbidities	walking ability (SPPB) 2MWT		p <0.01 p <0.04
	Sex	Male gender	SPPB total score		p <0.01
Jacobson et al.	Ethnicity	Latin ethnicity	lower expected 6-MWT	Multivariate analysis	(-7.40 [-11.55-{-3.25}], p=0.001
	Comorbidities	BMI			(-0.52 [-0.81-{-0.22}], p=0.001)
	Severity	Persistence of symptoms at follow up	Shortness of breath		P=0.004
Petersen et al.	Age	Individuals in age group 50-66 compared with the youngest groups: 0-17 years 18-34 years	Persistent symptoms	Age-stratified analysis	p=0.003 p=0.001
Alharthy et al.	Severity	Increased incidence of dyspnoea and fever prior to hospital admission, decreased ICU admission PaO2/FiO2 ratio < 100, longer duration of mechanical ventilation, increased inflammatory biomarkers such as lactate dehydrogenase, ferritin, and D-dimers on ICU admission, and significant lung abnormalities detected by LUS	Persistent symptoms	Continuous variables using the Wilcoxon rank sum or the student's t-test. Categorical variables were examined using the Fisher's exact test or the Chi square test	p < 0.05

Anastasio et al.	Severity	Pneumonia and ARDS	Shortness of breath	Pearson's correlation coefficient and Cox regression were used	Patients who developed ARDS showed higher SBP (p=0.05) and DBP (p=0.02) and lower SpO2 during 6 MWT (p=0.004), FVC (p=0.004) and TLC (p<0.001). Patients without ARDS showed higher SR (p<0.001), RV (p<0.001), TLC (p<0.001) and RV/TLC (p=0.05).
Han et al.	Severity	Higher baseline CT lung involvement score (>=18 out of a possible score of 25)	Fibrotic-like changes in the lung at 6 months	Multivariate analysis	(OR: 4.2, 95%CI: 1.2-14)
Blanco et al.	Severity	Severity of the disease	DLCO <80% and a lower serum lactate dehydrogenase level	Multivariate analysis	DLCO<80% (OR 5.92; 95%CI 2.28–15.37; p < 0.0001) Serum lactate dehydrogenase (OR 0.98; 95%CI 0.97–0.99)
Lerum et al.	Severity	ICU admission	Persistent CT abnormalities and problems in usual activities	Mann–Whitney U-tests or Chi-squared tests	p=.031
Bellan et al.	Severity	Higher DLCO	Decreased risk of physical impairment	Univariate analysis and logistic regression models	(OR, 0.96 [95% CI, 0.94-0.98]; P < .001)
	Comorbidities	COPD	Increase risk of physical impairment		(OR, 12.70 [95% CI, 1.41-114.85]; P = .02)
Sonnweber et al.	Severity	Age, gender, and pre-existing diseases such as cardiovascular diseases, pulmonary diseases, diabetes mellitus type 2, and malignancy	Persistence of symptoms, patient performance status, and CT findings at follow-up	Friedman's or Wilcoxon signed-rank test	p=0.042 to p<0.001
Mendez et al.	Sex	Female sex	Impaired DLCO	Linear regression analysis	0.002
	Severity	ICU patients	Pulmonary embolism		p<0.001
		D-dimer levels	Impaired DLCO		p= 0.011
Blanco et al.	Severity	Lower serum LDH levels	Impaired DLCO	Multivariate analysis	OR 0.98; 95% CI 0.97-0.99; p 0.002
Qin et al.	Severity	Higher TSS of the chest and ARDS lymphocyte count, MPA diameter on admission and ARDS	Impaired DLCO	Univariable analysis	TSS>10.5 (OR: 10.5; 95%CI: 2.5-44.1; P=0.001) ARDS (OR: 4.6; 95%CI: 1.4-15.5; P=0.014)
		Long hospital stay	Lung sequelae		

Rass et al.	Severity	ICU patients	New neurological diseases	Chi-square or Kruskal-Wallis test	P=0.001
	Age	Elderly	Neurological signs	NR	NR
Weng et al.	Severity	Less severe (Lower frequency of supplemental oxygen therapy (79% vs 94%; p=0·016), and lower frequency of ICU admission	Gastrointestinal sequelae	Univariable and multivariable logistic regressions	p=0·016
		Treated more often with proton pump inhibitors (PPIs) and corticosteroids and were less frequently treated with enteral nutrition			PPI (p=0.000) Corticosteroids (p=0.024) Enteral nutrition (p=0.007)
Arnold et al.	Severity	Severe cases	Lower physical score	Mann Whitney-U and Kruskal Wallis tests for continuous data and Fisher's exact test or Chi-squared testing for categorical data.	NR
Sibila et al.	Sex	Male gender	Spirometric abnormalities 3 months after discharge,=	NR	Reduced FEV1: (76.9% vs 51.2%, p = 0.005) Reduced FVC: (76.3% vs 51.6%, p = 0.008)
	Comorbidities	Cardiovascular disease and diabetes			Reduced FEV1: Cardiovascular disease (34.2% vs 9.4%, p = 0.001) Diabetes (28.9% vs 12%, p = 0.02) Reduced FVC: Cardiovascular disease (29.7% vs 11.0%, p = 0.009)
Huang et al.	Severity	Participants with severity scale 5–6	Higher risk of lung diffusion impairment, anxiety or depression, and fatigue or muscle weakness	Multivariable analysis	OR 4·60 (95% CI 1·85–11·48) for diffusion impairment, OR 1·77 (1·05–2·97) for anxiety or depression, and OR 2·69 (1·46–4·96) for fatigue or muscle weakness
	Sex	Female sex			

ARDS: Acute respiratory distress syndrome; BMI: Body mass index; CT: Computerised Topography; DCLO: diffusing capacity for carbon monoxide; ICU: Intensive care unit; LDH: Lactate dehydrogenase; LUS: lung ultrasound; MWT: minute walking test; NR: Not reported; OR: Odds Ratio; PCSF: post covid functional status; QoL: Quality of life; SPPB: Short Physical Performance Battery test; TSS: Toxic shock syndrome