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Which criteria were used to describe patients with COVID-19? A systematic review and meta analysis of clinical, laboratory, and imaging features

Alireza Amanollahi[1], Sahar Sotoodeh Ghorbani[1], Hamed Basir Ghafouri[2], Sima Afrashteh[3,4], Seyed Saeed Hashemi Nazari[5]*

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Abstract

Background: The unknowingness of COVID-19 compared to other respiratory diseases and gaining an overview of its diagnostic criteria led to this study, which was designed to summarize the signs and symptoms along with the clinical tests that described these patients.

Methods: PubMed\MEDLINE, Web of Science, Core Collection, Scopus, and Google Scholar were systematically searched on September 27, 2020. After screening, we selected 56 articles based on clinical characteristics and laboratory and imaging findings in confirmed COVID-19 patients as eligibility criteria. To evaluate risk of bias, the Newcastle Ottawa scale, for publication bias, Egger's test, and for heterogeneity, I2 and tau test were used; and finally, random-effects models were used for pooled estimation.

Results: Pooled estimates for frequently clinical symptoms were as follows: fever (78% [95% CI, 74-82]), cough (60% [95% CI, 57-63]), and fatigue (31% [95% CI, 26-36]); and they were as follows for laboratory findings in lymphocyte (1.02 [95% CI, 0.92-1.12]), CRP (19.64 [95% CI, 13.96- 25.32]), and platelet count (175.2 [95% CI, 165.2-185.2]); they were as follows for imaging findings in bilateral pneumonia (64% [95% CI, 56-72]), and ground glass opacity (60% [95% CI, 48-7]). Also, in the subgroup analysis, bilateral pneumonia with 18% and fatigue with 15%, had the highest difference in values between the groups.

Conclusion: According to Forest plots, the CI and dispersion among studies were smaller in laboratory findings than in symptom and imaging findings, which might indicate a high alignment in the laboratory findings among studies.

Keywords: COVID-19, Clinical Signs, Imaging and Laboratory Findings, Meta-Analysis

Conflicts of Interest: None declared
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Introduction

Novel coronavirus (nCoV-2019, now known as SARS-CoV-2) are significant pathogens that infect humans and vertebrates. In humans, they work by affecting humans' hepatic, central nervous, gastrointestinal, and respiratory

Corresponding author: Dr Seyed Saeed Hashemi Nazari, saeedh_1999@sbmu.ac.ir

1. Department of Epidemiology, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran
2. Trauma and Injury Research Center, Iran University of Medical Sciences, Tehran, Iran
3. Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran
4. Department of Public Health, School of Public Health, Bushehr University of Medical Sciences, Bushehr, Iran
5. Prevention of Cardiovascular Disease Research Center, Department of Epidemiology, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

↑What is "already known" in this topic:
Researchers' excitement about publishing findings related to patients with coronavirus 2019 (COVID-19), along with the enthusiastic of journals for their publication, led to the rapidly publication of a number of articles in the early months of the COVID-19 pandemic by any design and in any form. This study pooled the results of the descriptive information of patients with this disease.

→What this article adds:
Health policymakers, medical professionals, and health and people in the community need to know more precise information about the signs of the disease and the changes made by the virus on clinical indexes.

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systems (1). In just 2 months, the virus spread from Wuhan to all of China and 33 other countries (2). In humans, the coronavirus is found in a range of viruses that cause colds as well as severe acute respiratory illnesses, especially severe acute respiratory syndrome (SARAS,) and Middle East respiratory syndrome (MERS), with a mortality rate of 10% and 37%, respectively (3, 4). The US Centers for Disease Control and Prevention has named it the novel Corona Virus 2019 (2019-n COV) (5). Coronavirus 2019 (COVID-19) is highly contagious and spreads rapidly from person to person (6). The outbreak of COVID-19 was announced by the World Health Organization on March 11, 2020, a public health emergency of international concern (7). People infected with COVID-19 were mainly those with a history of mild to moderate respiratory syndromes (80.9%), the elders or people with diseases like cancer, diabetes, respiratory disease, and immune deficiency, and cardiovascular disease are more likely to develop severe (13.8 %) to critical (4.7%) form of the disease (8, 9). The evidence collected to date has revealed that the disease can be transmitted from person to person, both in hospital and family settings (10-14). The most common symptoms were fever, cough, and fatigue (15-17). Most patients present with abnormalities of chest computed tomography (CT) findings, such as ground-glass opacity and patchy bilateral shadowing (16-18). Qian et al reported the most common symptoms were fever (71.43%), cough (60.44%), and fatigue (43.96%). While Liao et al reported the common symptoms at admission were dry cough (81.0%), fever (69.1%), and fatigue (19%) (19, 20). COVID-19 broadly spread throughout the world and, with 1,288,504 cases, 70,570 deaths, and 272,074 recovered, it was found to be highly prevalent in China, Italy, United States, Spain, Iran, Germany, and France until April 6, 2020 (21). Huang et al first reported 41 cases of novel coronavirus-infected pneumonia who were mainly exposed to the Huanan seafood wholesale market. fever, nonproductive cough, dyspnea, myalgia, fatigue, normal or decreased leukocyte counts, and radiographic evidence of pneumonia were among clinical manifestations observed in these cases. In its severe form, the patients were complaining of Organ dysfunction (eg, acute respiratory distress syndrome, shock, acute kidney injury, and acute cardiac injury), or they could die (22). The current study was done to systematically assess and estimate the clinical, laboratory, and imaging features related to COVID-19.

Methods

To describe the symptoms, and laboratory, and imaging findings of patients with COVID-19, we designed a descriptive systematic review and meta-analysis of the articles published with this subject. The results of the study were reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline (23).

Eligibility Criteria

Eligible criteria were diagnosis characteristics of COVID-19 reported in the literature since the outbreak of the disease.

Because of the newness of the disease, the time limit was not considered and all retrieved studies were for year 2020. There was no restriction on the type of study design, and any observational or descriptive studies with clinical and diagnostic features on COVID-19 were included. Also, the trials that described the characteristics of the patients in the baseline tables were selected. To this aim we selected only the articles in English.

Exclusion criteria were as follows: studies with a sample size of <10 (case report) or special groups, such as children, death, specific groups or patients, et cetera; and review articles.

Information Sources and Search

Online search was done by 1 author (S.S.) for COVID-19 characteristic articles in PubMed\MEDLINE, Web of Science, Core Collection, Scopus, and Google Scholar; moreover, these reference lists were searched for selected articles. We limited studies in human studies and English language. The final time to search for articles was September 27, 2020.

The terms of search strategies were as follows: (clinical characteristics[tiab] OR clinical features [tiab] OR radiology findings[tiab] OR imaging findings [tiab] OR laboratory findings[tiab] OR laboratory test[tiab]) AND (Cov*[tiab] OR COVID*[tiab] OR COVID-19[tiab] OR novel coronavirus[tiab]).

Study Selection and Data Collection

After retrieving articles from Biomedical databases and eliminating duplicated articles, the screening and data collection process was conducted independently by 2 authors (A.A. and S.S.) based on inclusion criteria (title and abstract). Some disagreements were resolved by the team manager (S.H.).

Data extraction was performed similar to study selection, in which 2 authors independently extracted clinical signs and symptoms, laboratory, and imaging finding. This information was used to confirm COVID-19 patients reported in articles. No blinding was done for the reviewers in terms of journals title, articles, and authors.

Data Items

We extracted information on the studies' characteristics, population, clinical signs (fever, cough, headache, diarrhea, etc), laboratory (lymphocytes, C reactive protein (CRP), platelet count, neutrophils, white blood cells (WBC), etc), and imaging (ground-glass opacity, bilateral pneumonia, consolidation, etc). Those variables that were reported more in the studies were selected for meta-analysis; also, some of the laboratory findings were removed from the meta-analysis because of classified reporting (normal and abnormal) in a number of articles.

Risk of Bias of Individual Studies

Risk of bias was performed independently by 2 authors (A.A. and S.A.) for all studies. The Newcastle Ottawa scale was used to evaluate risk of bias in cross- sectional studies (Additional file). In case of disagreements, they

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Table 1. Characteristics of included studies and quality of assessment

Study	Country	Age	Number of patients		Score of quality assessment
			Male	Female	
Barillari MR et al (24)	Italy	42.1 ± 12.3	147	147	**********
Cao C et al (25)	Chain	49.3 ± 14.5	74	83	********
Cao J et al (26)	Chain	53 ± 8.66	53	49	**********
Cao M et al (27)	Chain	50.1 ± 16.3	101	97	*******
Chang D et al (28)	Chain	37.1 ± 4.1	10	3	*******
Chen N et al (15)	Chain	55.5 ± 13.01	67	32	*******
Cheng Z et al (29)	Chain	50.36 ± 15.5	8	3	********
De Vitro A et al (30)	Italy	72.5 ± 6.06	56	31	********
Docherty AB et al (31)	UK	76.5 ± 13.3	7715	5097	**********
Escalera-Antezana JP et al (32)	Bolivia	36.5 ± 5.17	6	6	******
Fan Z et al (33)	Chain	50 ± 8.10	73	75	*******
Feng Y et al (34)	Chain	52.5 ± 7	271	205	**********
Guan WJ et al (17)	Chain	46.75 ± 6.63	640	459	**********
Halvatsiotis P et al (35)	Greece	65 ± 4.9	72	18	*******
Hu Z et al (36)	Chain	33.73 ± 8.65	8	16	**********
Huang C et al (22)	Chain	49.24 ± 4.91	30	11	**********
Huang Y et al (37)	Chain	56.24 ± 17.14	14	20	*******
Jin X et al (38)	Chain	45.22 ± 14.23	331	320	**********
Kui L et al (39)	Chain	55.01 ± 19.83	61	76	*******
Kwok KO et al (40)	Hong Kong	59.8 ± 13.4	9	5	******
Lei Y et al (41)	Qinghai-Tibetan plateau	39.3 ± 18.3	39	28	******
Li J et al (42)	Chain	45 ± 12.08	9	8	*******
Li X et al (43)	Chain	75.3 ± 13	10	15	*******
Li Y et al (44)	Chain	40.8 ± 17.1	125	127	**********
Li YK et al (45)	Chain	48.46 ± 8.6	13	12	**********
Lian J et al (46)	Chain	45.48 ± 9.32	406	381	**********
Liao J et al (20)	Chain	10-35 range	24	22	*******
Liu H et al (47)	Chain	35.57 ± 10.41	5	50	*******
Liu K et al (48)	Chain	53.12 ± 10.11	31	24	**********
Liu X et al (49)	Chain	42.5 ± 7	63	41	**********
Liu Y et al (50)	Chain	54.7 ± 6.63	59	50	********
Pan L et al (51)	Chain	52.9 ± 16	107	97	**********
Qian GQ et al (19)	Chain	48.3 ± 6.11	37	54	**********
Shahriarirad R et al (52)	Iran	53.75 ± 16.58	71	42	**********
Shi H et al (53)	Chain	49.5 ± 11	42	39	**********
Tian S et al (54)	Chain	47.5 ± 26.84	127	135	**********
Wan S et al (55)	Chain	46.2 ± 5.5	72	63	**********
Wang D et al (16)	Chain	55.5 ± 7.5	75	63	**********
Wang L et al (56)	Chain	40.5 ± 7.6	10	8	*******
Wang R et al (57)	Chain	38.76 ± 13.8	71	54	********
Wang Z et al (58)	Chain	45.25 ± 7.8	32	37	********
Wu J et al (59)	Chain	49.10 ± 15.42	39	41	*******
Wu J et al (60)	Chain	44 ± 11	42	38	*******
Xu T et al (61)	Chain	43.44 ± 11.85	25	26	**********
Xu X et al (62)	Chain	51.04 ± 19.64	39	51	*********
Xu XW et al (18)	Chain	41.5 ± 5.8	35	27	*********
Xu YH et al (63)	Chain	43.9 ± 16.8	29	21	**********
Yang W et al (64)	Chain	45.11 ± 13.35	81	68	*******
Zhang G et al (65)	Chain	53.9 ± 8	108	113	********
Zhang JJ et al (66)	Chain	56.5 ± 17.9	71	69	**********
Zhang X et al (67)	Chain	45.4 ± 14.1	328	317	**********
Zhao D et al (68)	Chain	44.75 ± 8.35	11	8	*******
Zhao X et al (69)	Chain	44 ± 11.7	43	37	*******
Zheng X et al (70)	Chain	50.94 ± 15.9	23	29	**********
Zhou F et al (71)	Chain	56.3 ± 6.07	119	72	**********
Zhu W et al (72)	Chain	40 ± 7.5	56	65	**********

were resolved by the team manager (S.H,). Risk of bias score is shown in Table 1.

Synthesis of Results

CI of overall estimates in this article for clinical signs, laboratory finding, and imaging was 95%. The Egger test was used to assess for publication bias with $p<0.05$. To estimate heterogeneity, I^2 and τ^2 testes were used. Also, meta-regression was used to find the actual source of heterogeneity. Heterogeneity shows whether the overall value is real, and it also shows the eligibility of combining results. Existence of several subgroups in a study and the inability to combine the results are 2 reasons of heterogeneity. In this study, we used 2 indicators: I^2 (percentage of variability in the effect sizes, which is not caused by sampling error) and τ^2 (between-study variance in meta-analysis) for measure heterogeneity. Finally, the pooled estimate in meta-analyses was performed with random-effects with Stata version 14 (Stata Corop) and with comment metan (weighted mean for continuous variable) and

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metaprop (for the binomial variable), by cconsidering the sample size as the weight of each study.

Additional Analyses

According to the findings of Table 3, there was no homogeneity in some items**.** Using meta-regression and applying the age variable in the model, all variances among studies were removed, indicating that heterogeneity was due to differences in the mean age of the studies. By examining the mean and median age of studies, age 49 (mean ≤49, mean age >49) was considered as the cutoff point as a subgroup in the subgroup analysis.

Results

Study Selection and Characteristics

Finally, after deleting duplicate articles, we screened articles based on the title and full-text in accordance with objectives of the study. A total of 56 articles entered the meta-analysis (Fig. 1) that mentioned the minimal signs and symptoms of patients with COVID-19. Out of 56 articles, 41 had laboratory findings and 38 had imaging findings. The demographic information of these articles was shown along with the risk of bias score in Table 1. Except for 8 articles, others were from China's population. Also, all studies were published before September 27, 2020. The frequency of the items examined in patients with COVID-19 in the reviewed articles is shown in Table 2. Based on articles' reporting fever (98.21%), cough (91.1%), diarrhea (78.58%), fatigue (64.28%,), headache (62.5%), lymphocyte (95.12%), CRP (78.05%), platelet count, and alanine aminotransferase (ALT) (75.61%), aspartate aminotransferase (AST) (73.17%), and bilateral pneumonia (76.3%), ground-glass opacity (GGO) (60.5%), unilateral pneumonia, and consolidation (31.6%) had the highest reporting for describing patients in articles (Table 2).

Synthesis of Results and Risk of Bias

Evaluation of Clinical Factors: In total, out of 56 articles, 55 examined the prevalence of fever in patients, the pool estimate for fever was 78% (95% CI, 74-82), with heterogeneity test I^2=97.89% and the egger publication bias test (p=0.146). This amount for cough was 60% (95% CI, 57-63), with heterogeneity test I^2=91.53% and the egger publication bias test (p<0.001), diarrhea 9% (95% CI, 7–11), with heterogeneity test I^2=95.29% and the egger publication bias test (p=0.98), for fatigue 31% (95% CI, 26–36), with heterogeneity test I^2=97.64% and the egger publication bias test (p=0.48), and headache 12% (95% CI, 10–15), with heterogeneity test I^2 = 90.31% and the egger publication bias test (p≤0.001) (Table 3, Fig. 2).

Evaluation of Laboratory Factors: The mean pooled estimate for lymphocyte was 1.13 (95% CI, 0.95-1.31), with heterogeneity test I^2=0.0% and the egger test for publication bias (p=0.26; CRP, 18.73; 95% CI, 12.63-24.84), I^2=85.2% and the egger test (p=0.40); platelet count was 180.85 (95% CI, 161.20-200.50; I^2=0.0%; egger test [p=17]); ALT was 26.69 (95% CI, 19.62- 33.77; I^2=0.0%, egger test [p=0.06]); AST was 28.25 (95% CI, 22.77-33.74; I^2=30.4%; egger test [p=0.15]); creatinine was

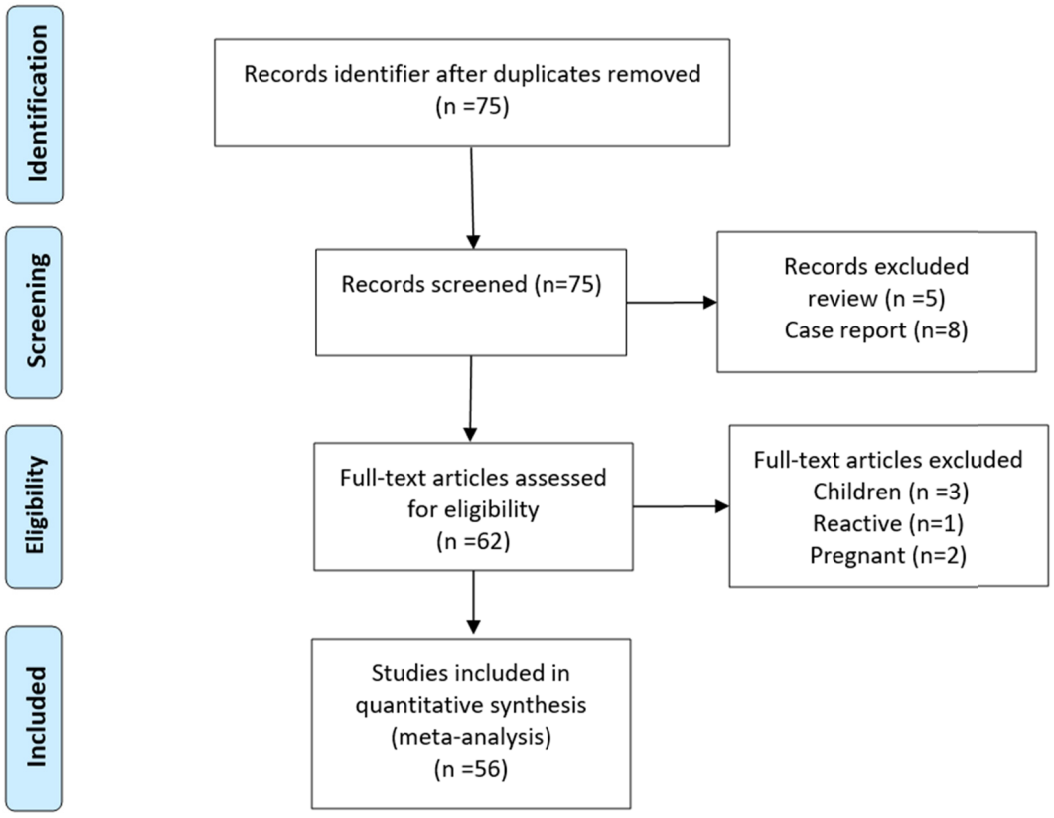

Fig. 1. PRISMA flow diagram of the study selection

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Table 2. Signs, laboratory and imaging findings

Item	Frequency (%)
Clinical Signs (56)	
Fever	55 (98.21)
Cough	51 (91.1)
Diarrhea	44 (78.58)
Fatigue	36 (64.28)
Headache	35 (62.5)
Myalgia or fatigue	22 (39.28)
Sore throat	21 (37.5)
Dyspnea	20 (35.71)
Sputum	18 (32.14)
Vomiting	18 (32.14)
Muscle ache	16 (28.57)
Nausea	16 (28.57)
Shortness of breath	15 (26.78)
Expectoration	14 (25)
Dizziness	13 (23.21)
Chest pain	12 (21.42)
Hemoptysis	9 (16.07)
Anorexia	8 (14.28)
Chest tightness	8 (14.28)
Chill	4 (7.14)
Rash	4 (7.14)
Laboratory findings (41)	
Lymphocyte	39 (95.12)
C reactive protein	32 (78.05)
Platelet count	31 (75.61)
Alanine aminotransferase	31 (75.61)
Aspartate aminotransferase	30 (73.17)
Creatinine	28 (68.3)
Neutrophils	28 (68.3)
White Blood Cell	28 (68.3)
Lactate dehydrogenase	27 (65.85)
Hemoglobin	24 (58.84)
Creatine kinase	23 (56.1)
Total bilirubin	22 (53.66)
Procalcitonin	20 (48.78)
D dimer level	19 (46.34)
Albumin	19 (46.34)
Prothrombin time	16 (39.02)
Blood urea nitrogen	15 (36.58)
Activated partial thromboplastin time	15 (36.58)
Monocytes	12 (29.26)
Leucocytes	12 (29.26)
Eosinophils	11 (26.83)
Imaging findings (38)	
Bilateral pneumonia	29 (76.31)
Ground-glass opacity	23 (60.52)
Unilateral pneumonia	12 (31.58)
Consolidation	12 (31.58)
Left lower lobe	5 (13.16)
Right lower lobe	4 (10.52)
Right middle lobe	4 (10.52)
Left upper lobe	4 (10.52)
Right upper lobe	4 (10.52)
Pleural effusions	3 (7.89)
Local patchy shadowing viral pneumonia	3 (7.89)

68.89 (95% CI, 62.28-75.50; I^2 = 0.0%; egger test [p=0.011]); neutrophils was 3.52 (95% CI, 2.86-4.19; I^2=0.0%; egger test [p=0.001]); WBC was 5.72 (95% CI, 4.92-6.52; I^2 = 2.9%; egger test [p=0.06) (Table 3, Fig. 3).

Imaging Findings: Results showed a pooled prevalence of bilateral pneumonia of 64% (95% CI, 56-72; I^2=99.46%; egger publication test [p=0.24]); it was 60% for ground glass opacity (95% CI, 48-72; I^2=99.66%; egger test [p=0.74]); it was 24% for unilateral pneumonia (95% CI, 17-31; I^2=93.47%; egger test [p=0.42]); and for consolidation, it was 31% (95% CI, 18-46; I^2=94.67%; egger test [p=0.18]) (Table 3, Fig. 4).

Additional Analyses: According to the results (Table 3), some variables had high values of homogeneity. Hence, all the observed homogeneity was eliminated by applying age in the meta-regression model. Finally, by subgroup analyses, the pooled estimation of each subgroup was expressed, along with the overall pooled estimation. The highest difference was between subgroups: in bilateral pneumonia with 18%, fatigue 15%, and unilateral pneumonia 13%, and the mean difference was 12.73 in CRP.

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Table 3. Pooled estimate, publication bias and heterogeneity test in overall and subgroup

Variable	Number of studies	Pooled estimation (95 % CI)	Heterogeneity test		Publication bias value
			I^2 (%)	T^2	
Fever	55	0.78 (0.74- 0.82)	97.89	0.02	0.146
Mean age>49		0.81 (0.75- 0.85)			
Mean age <=49		0.76 (0.69- 0.82)	0.0		
Cough	51	0.60 (0.57- 0.63)	91.53	0.01	< 0.001
Mean age>49		0.60 (0.55- 0.65)			
Mean age <=49		0.60 (0.55- 0.64)	0.0		
Diarrhea	44	0.09 (0.07- 0.11)	95.29	0.01	0.98
Mean age>49		0.08 (0.06- 0.12)			
Mean age <=49		0.10 (0.06- 0.14)	0.0		
Fatigue	36	0.31 (0.26- 0.36)	97.64	0.02	0.48
Mean age>49		0.40 (0.30- 0.50)			
Mean age <=49		0.25 (0.20- 0.31)	0.0		
Headache	35	0.12 (0.10- 0.15)	90.31	0.00	< 0.001
Mean age>49		0.11 (0.07- 0.15)			
Mean age <=49		0.13 (0.10- 0.17)	0.0		
Lymphocyte	39	1.13 (0.95- 1.31)	0.0	0.00	0.26
CRP	32	18.73 (12.63- 24.84)	85.2	150.50	0.4
Mean age>49		26.58 (16.38- 36.79)			
Mean age <=49		13.85 (6.26- 21.45)	0.0		
Platelet count	31	180.85 (161.20- 200.50)	0.0	0.00	0.17
ALT	31	26.69 (19.62- 33.77)	0.0	0.00	0.06
AST	30	28.25 (22.77- 33.74)	30.4	11.56	0.15
Creatinine	28	68.89 (62.28- 75.50)	0.0	0.00	0.01
Neutrophils	28	3.52 (2.86- 4.19)	0.0	0.00	0.001
WBC	28	5.72 (4.92- 6.52)	2.9	0.03	0.06
Bilateral Pneumonia	29	0.64 (0.56- 0.72)	99.46	0.02	0.24
Mean age>49		0.74 (0.64- 0.83)			
Mean age <=49		0.55 (0.47- 0.62)	0.0		
GGO	23	0.60 (0.48- 0.72)	99.66	0.12	0.74
Mean age>49		0.63 (0.44- 0.81)			
Mean age <=49		0.57 (0.42- 0.71)	0.0		
Unilateral Pneumonia	12	0.24 (0.17- 0.31)	93.47	0.01	0.42
Mean age>49		0.31 (0.07- 0.62)			
Mean age <=49		0.21 (0.18- 0.23)	0.0		
Consolidation	12	0.31 (0.18- 0.46)	94.67	0.03	0.18
Mean age>49		0.32 (0.19- 0.45)			
Mean age <=49		0.31 (0.10- 0.57)	0.0		

* CRP, C creative protein; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; WBC, white blood cells; GGO Ground Glass Opacity, pooled estimation for (lymphocyte, CRP, platelet count, ALT, AST, creatinine, neutrophils and WBC) is weighted mean and prevalence for other variables

Discussion

Efforts to identify the disease and inform the public about the speed of the COVID-19 spread led to the publication of articles with a small number of patients and weak methodological and clinical structure, which is the nature of any new phenomenon. Increasing accurate information over time provides a template and enough vision to identify the disease. To report these articles, 56 studies with 25,242 patients were reviewed. The first step in treating any disease is to describe its symptoms and characteristics, death rate, transmission power, pathogenicity, incubation period, its durability in environment, and reproductive number (73,74). Studies have been conducted to recognize the disease and identify its differences and similarities with other acute respiratory diseases (75-77).

Having a high age difference and being a man was reported in most studies. There was nearly 20 years of age difference in dead people versus survival of patients with this disease (26). The youngest person who died from COVID-19 was 55 years old (43), and 61.2% of patients were ≥65 years old (78). Men got the disease more than women, the higher number of men in both the ICU and the non-ICU wards (22) indicates that 52.9% of women survived and 23.5% died (26). With respect to sex differences, the higher percentage of the elderly group were men, but the proportion was equal in the young and middle-aged groups (48).

Severe/ critical clinical status was seen more in people over 60 years compared to those younger than 60 (46). Also, comorbidity was 44% in those with sever/ critical status, but comorbidity was 6.9% in the normal group (79). Among the patients with comorbid diseases, there was more cases of high blood pressure in those who were hospitalized and those who died compared with diabetes (26, 78). Clinical signs and symptoms in patients receiving ICU services were more likely than other patients (22). Of the clinical symptoms, only nausea and cough were significantly different in those patients with severe and mild symptoms (66).

In people who died from COVID-19, albumin, lymphocytes, red blood cells, hemoglobin less than normal, CRP, procalcitonin time, neutrophils, and WBC were higher than normal (43). On average, leucocytes, neutrophils, D-dimer level, ALT, AST, and CRP were higher in patients with severe clinical conditions than in patients with mild

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conditions (19). There was also a difference in patients hospitalized in ICU compared to non-ICU wards (22). Differences between studies were observed in x-ray findings, as the GGO was higher in younger people than in the elderly, bilateral pneumonia and consolidation were more common in the elderly (20). However, these findings differed in different age groups in the study of Lian J et al (46). The CT score in severe/ critical patients was higher than the normal range (p<0.001). Also, consolidation was seen in 88% of patients with severe/ critical condition, which was 53.4% compared to the normal group (p=0.003) In addition, lymph node enlargement, pleural effusion, and pericardial effusion were not seen in any of the patients in the normal condition, however, it was observed in patients with severe/ critical condition (79).

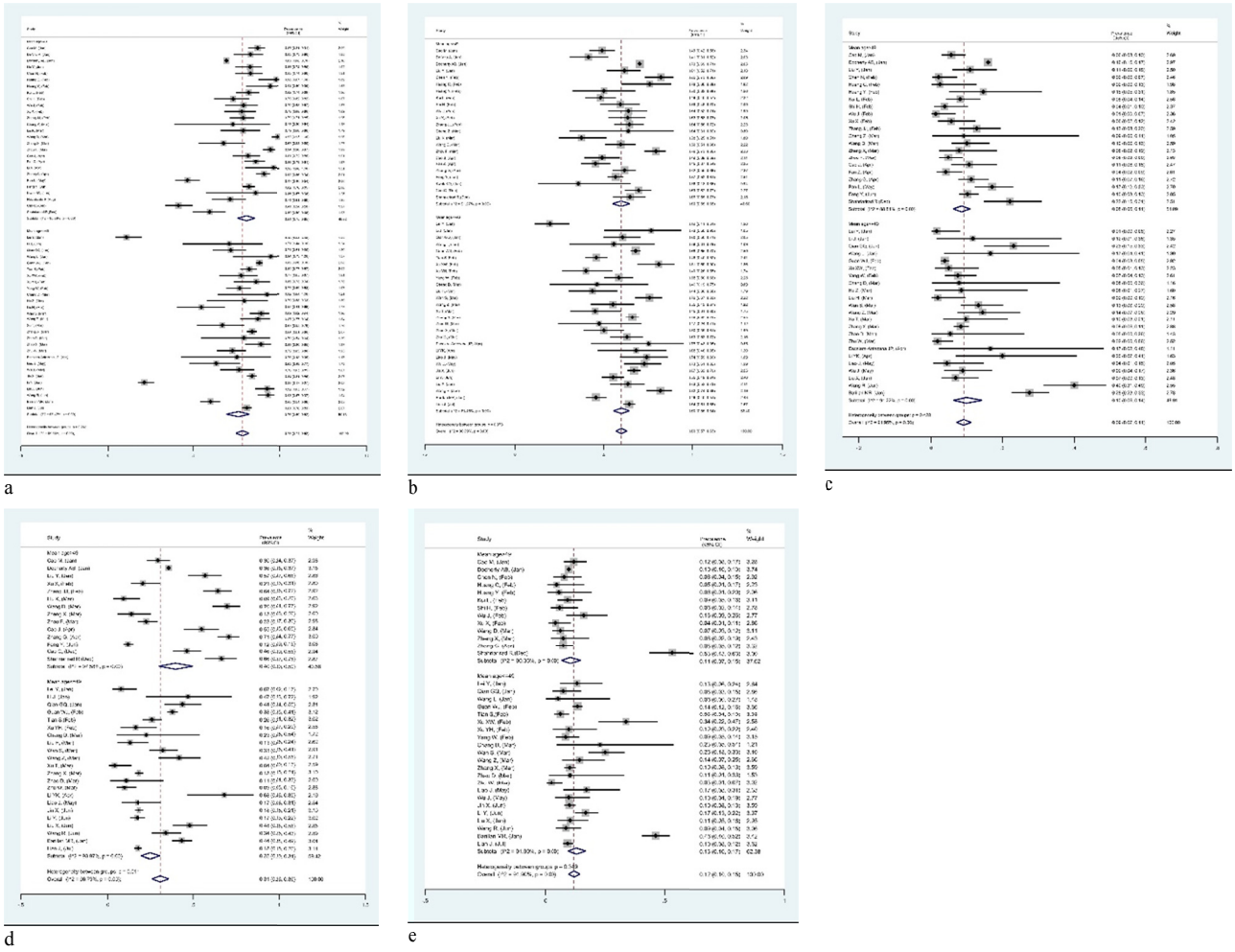

Fig. 2. Meta-analysis of clinical characteristics. a. fever, b. cough, c. diarrhea, d. fatigue, e. headache

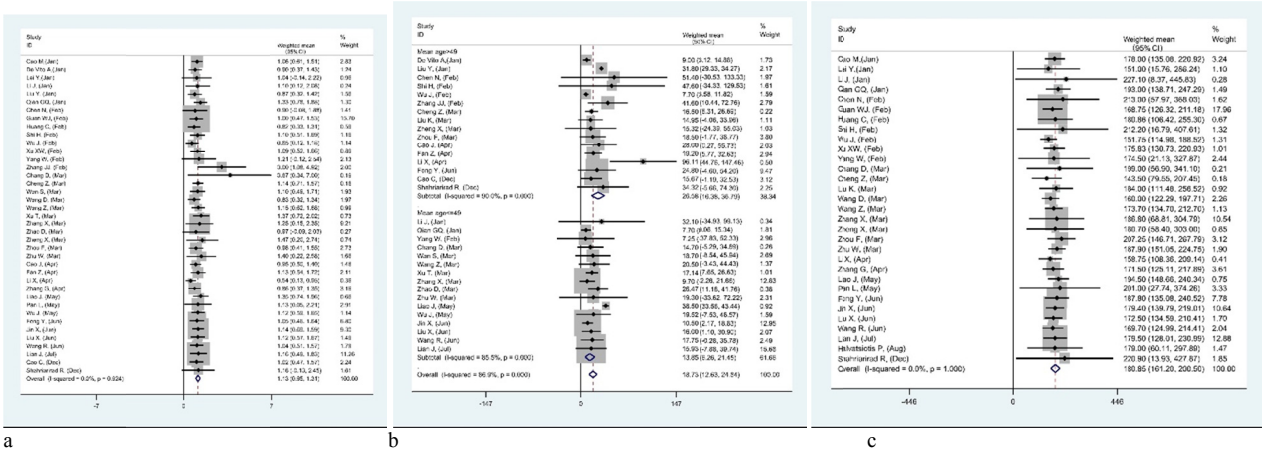

Fig. 3. Meta-analysis of laboratory findings. a. lymphocyte, b. CRP, c. platelet count, d. ALT, e. AST, f. creatinine, g. neutrophils, h. WBC

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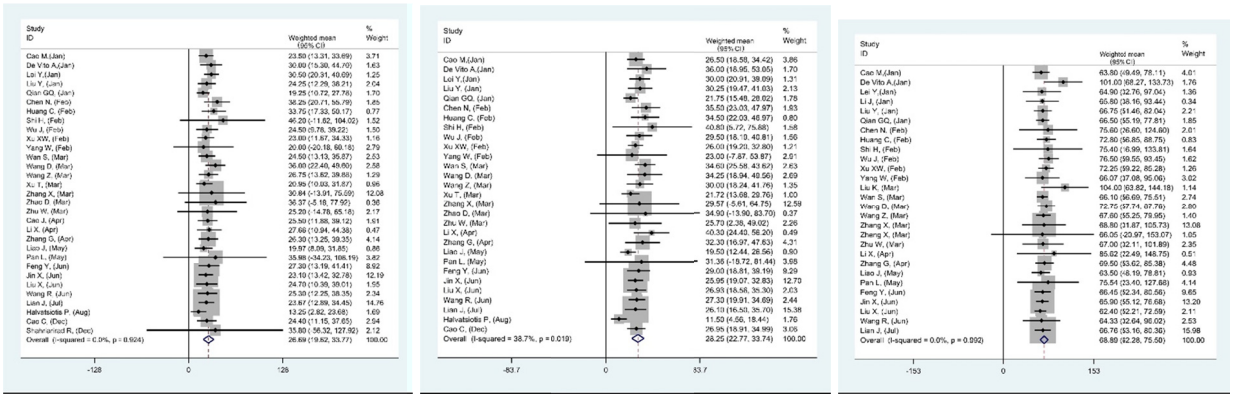
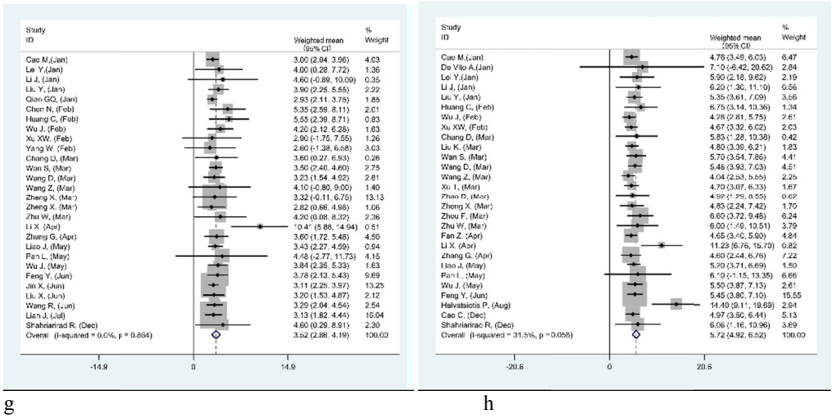
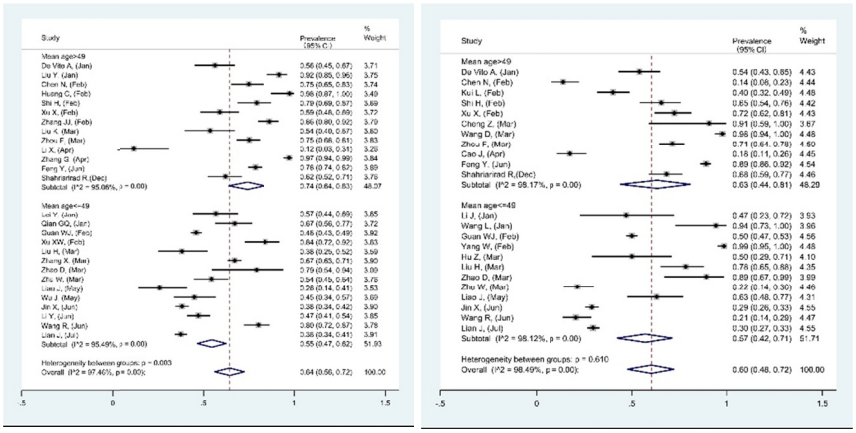


d e f

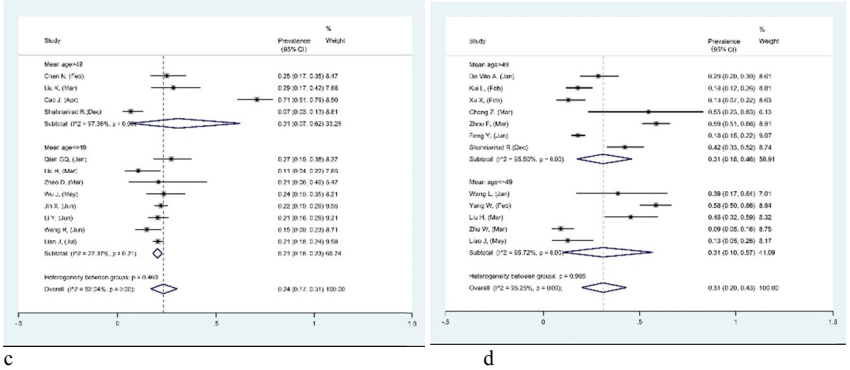


g h

Fig. 3. Ctd



a b



c d

Fig. 4. Meta-analysis of imaging findings. a. bilateral pneumonia, b. GGO, c. unilateral pneumonia, d. consolidation

This study has some limitations. First, mentioning the severity of the disease in some articles can lead to different results. Because the severity of COVID-19 is not stated in most articles, and this is one of the limitations of our

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study, using the results of this study to evaluate the clinical condition of this disease may be confusing for patients with mild and critical clinical conditions.

Another limitation of this study is that most of the articles evaluated Chinses patients in China and by publishing the results of other countries and other races, we can obtain a general overview of this disease in the world.

Conclusion

Because of the detection ability of laboratory kits, and also the agreement in using laboratory tests for COVID-19 compared to other methods, less extensive scattering between studies with wide CIs was observed in laboratory findings than in clinical symptoms and imaging findings. Thus, patients' clinical signs can be used instead of patients' characteristics.

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Conflict of Interests

The authors declare that they have no competing interests.

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