Received: 2 March 2020 | Accepted: 9 March 2020
DOI: 10.1002/jmv.25757

REVIEW

JOURNAL OF MEDICAL VIROLOGY WILEY

COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis

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Funding information
Natural Science Foundation of Gansu Province, Grant/Award Number: 18JR3RA366

Abstract

The aim of this study was to analyze the clinical data, discharge rate, and fatality rate of COVID-19 patients for clinical help. The clinical data of COVID-19 patients from December 2019 to February 2020 were retrieved from four databases. We statistically analyzed the clinical symptoms and laboratory results of COVID-19 patients and explained the discharge rate and fatality rate with a single-arm meta-analysis. The available data of 1994 patients in 10 literatures were included in our study. The main clinical symptoms of COVID-19 patients were fever (88.5%), cough (68.6%), myalgia or fatigue (35.8%), expectoration (28.2%), and dyspnea (21.9%). Minor symptoms include headache or dizziness (12.1%), diarrhea (4.8%), nausea and vomiting (3.9%). The results of the laboratory showed that the lymphocytopenia (64.5%), increase of C-reactive protein (44.3%), increase of lactic dehydrogenase (28.3%), and leukocytopenia (29.4%) were more common. The results of single-arm meta-analysis showed that the male took a larger percentage in the gender distribution of COVID-19 patients 60% (95% CI [0.54, 0.65]), the discharge rate of COVID-19 patients was 52% (95% CI [0.34,0.70]), and the fatality rate was 5% (95% CI [0.01,0.11]).

KEYWORDS
2019-nCoV, clinical characteristics, COVID-19, discharge rate, fatality rate, meta-analysis

1 | INTRODUCTION

Since December 2019, there has been an increasing number of unexplained cases of pneumonia in Wuhan, a city of 11 million people in China's Hubei province, which has quickly spread to other cities as well as abroad. The Chinese Health Authorities have carried out very appropriate and prompt response measures: (a) The Chinese government has been dealing with the epidemic in strict accordance with notice no. 1 of the national health commission that pneumonia caused by the new coronavirus shall be included in the management of categories B infectious disease, and the prevention and control measures of groups A infectious disease shall be taken[1]; (b) The government decided to close down Wuhan, Hubei province, and launched a primary public health emergency response in several provinces and cities across

Li Long-quan, Huang Tian, and Wang Yong-qing contributed equally to this work.
This article was accepted after peer review. However, it has not been independently validated. Readers are encouraged to exercise independent judgment.
[Correction added after online publication on 9 April 2020: Updates have been made in published article after revision based on a reader's comments]

the country. At the same time, the World Health Organization has recently declared the COVID-19 as a public health emergency of international concern (PHEIC).[2] On January 3, 2020, the SARS-CoV-2 was identified in samples of bronchoalveolar lavage fluid from a patient in Wuhan,[3] which is recognized as typical of a lineage B betacoronavirus. It has an envelope, the particles are round or oval, often polymorphic, and the diameter is 60 to 140 nm. Its genetic characteristics are significantly different from SARS-COV and MERS-COV. The current research showed that it had more than 85% homology with bat SARS-like coronavirus (bat-SL-COVZC45). When isolated and cultured in vitro, the SARS-CoV-2 can be found in human respiratory epithelial cells in about 96 hours, while it took about 6 days in Vero E6 and Huh-7 cell lines,[4] and it has been identified as the cause of COVID-19. The study found that SARS-CoV-2 had the characteristics of human-to-human transmission, and the R0 was estimated at 3.77,[5] which was significantly higher than the MERS-COV. According to the official report, the virus may have the characteristics of aerosol transmission, that is, the potential for aerosol transmission in a relatively closed environment exposed to high concentrations of aerosols for a long time.[6] The identification and control of suspected COCID-19 patients as early as possible were crucial to controlling the further spread of the epidemic by managing the source of infection and cutting off the transmission route. At present, there is however very limited clinical information of the COVID-19. Therefore, in our study, the clinical data of nearly 3 months from December 2019 to now were retrieved and collected in a large sample to discover and reveal the clinical symptoms, laboratory test data, and epidemiological characteristics of COVID-19 patients, so as to provide help for clinical and epidemic prevention and control of the disease. The data were analyzed by using Microsoft Excel and STATA 15.0 (STATA Corporation, College Station, SE).

2 | DATA AND METHODS

2.1 | Literature search and selection

We conducted a comprehensive systematic literature search of online databases, including PubMed, Embase, Web of Science, WanFang Data, and CNKI, from December 2019 to February 2020 to identify all case studies. The search terms and relative variants were as follows: COVID-19; 2019-nCoV; clinical characteristics; discharge rate; fatality rate; meta-analysis. We also reviewed the references of included articles to guarantee the comprehensiveness and accuracy of our research. All the search results were evaluated according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The inclusion criterions for the 10 articles were as follows: study population: patients with diagnosed COVID-19; study design: case studies; outcomes measure: at least one outcome reported among clinical symptoms, laboratory results, discharge data, and death data.

Abstracts from conferences and commentary articles were excluded.

2.2 | Data extraction and quality assessment

Data extraction and the evaluation of literature quality were conducted independently by two investigators (L.Q.L. and T.H.). Microsoft Excel database was used to record all available information, including baseline details, clinic data, discharge rate, and fatality rate. Any disagreement was resolved by another investigator (Y.Q.W.).

2.3 | Bias risk assessment

The MINORS (Table 1)[7] was used to assess bias risk.

2.4 | Statistical analysis of data

Microsoft Excel was used to analyze the clinical symptoms and Laboratory results. Single-arm meta-analysis was performed using Stata 15.0 software. Heterogeneity among studies was tested using the Cochran Chi-square test and I^2, When $I^2 < 50\%$, a fixed-effects model was used, while when $I^2 > 50\%$, a random-effects model was selected. If there was statistical heterogeneity among the results, a further sensitivity analysis was conducted to determine the source of heterogeneity. After the significant clinical heterogeneity was excluded, the randomized effects model was used for meta-analysis. Funnel plot and Egger test were used to detect the publication bias. $P < .05$ was considered as statistically significant (two-sided).

TABLE 1 Bias risk assessment

Study	①	②	③	④	⑤	⑥	⑦	⑧	Score
Guan WJ	2	2	2	2	2	0	0	0	10
Chang D	2	2	2	2	2	1	2	0	13
Huang CL	2	2	2	2	2	1	2	0	13
Wang DW	2	2	2	2	2	1	2	0	13
Li Q	2	2	2	2	2	0	0	0	10
Chen NS	2	2	2	2	2	1	1	0	12
Wang ZW	2	2	2	2	2	1	2	0	13
Liu K	2	2	2	2	2	0	0	0	10
Chen L	2	2	2	2	2	1	2	0	13
Zhang MQ	2	2	2	2	2	0	0	0	10

Note: ① A clearly stated aim; ② Inclusion of consecutive patients; ③ Prospective collection of data; ④ Endpoints appropriate to the aim of the study; ⑤ Unbiased assessment of the study endpoint; ⑥ Follow-up period appropriate to the aim of the study; ⑦ Loss to follow-up less than 5%; ⑧ Prospective calculation of the study size. The items are scored 0 (not reported), 1 (reported but inadequate), or 2 (reported and adequate). The global ideal score being 16 for noncomparative studies.

3 | RESULTS

3.1 | Research selection and quality assessment

Based on a previous search strategy, 354 studies were searched from the online database. After deleting duplicate records, a total of 231 records were retained. Then, 210 articles were excluded by looking at the titles and abstracts, and 11 of the remaining 21 articles were deleted for various reasons. The last 10 articles were included in the meta-analysis (Figure 1). The characteristics and demographic data of the included studies are shown in Tables 2-4.

3.2 | Clinical data

The study of clinical data included 10 studies, a total of 1995 cases. By summarizing the clinical data (Tables 3 and 4), we found that the main clinical symptoms of COVID-19 patients were fever (88.5%), cough (68.6%), myalgia or fatigue (35.8%), expectoration (28.2%), and dyspnea (21.9%). Minor symptoms include headache or dizziness (12.1%), diarrhea (4.8%), nausea and vomiting (3.9%). The results of the clinical examination showed that the lymphocytopenia (64.5%), increase of C-reactive protein (CRP) (44.3%), increase of lactic dehydrogenase (LDH) (28.3%), and leukocytopenia (29.4%) were more common. The overall performance was consistent with the respiratory virus infection.

3.3 | Sex distribution

A total of nine studies were included.[8-17] The results of the randomized effects model meta-analysis showed that in the sex distribution of this disease men accounted for 60% (95% CI [0.54,0.65]) of COVID-19 patients (Figure 2A), which was higher than women. The sensitivity analysis (Supporting Information Materials) showed that there was no study that greatly interfered with the results of this meta-analysis, suggesting that the study was stable. A funnel plot was drawn to test the publication bias (Figure 2B). Publication bias test results: Egger's test ($P = .312 > .1$) indicated that there was no publication bias.

3.4 | Fatality rate

A total of eight studies were included,[8-11,13-16] with 1560 cases. The results of the random effects model meta-analysis showed that the fatality rate of the COVID-19 patients was 5% (95% CI [0.01, 0.11]) (Figure 2C). The sensitivity analysis (Supporting Information Materials) showed that Guan et al's study had impact on the results of this meta-analysis. A funnel plot was drawn to test the publication bias (Figure 2D). Publication bias test results: Egger's test ($P = 0.133 > 0.1$) indicated that there was no publication bias.

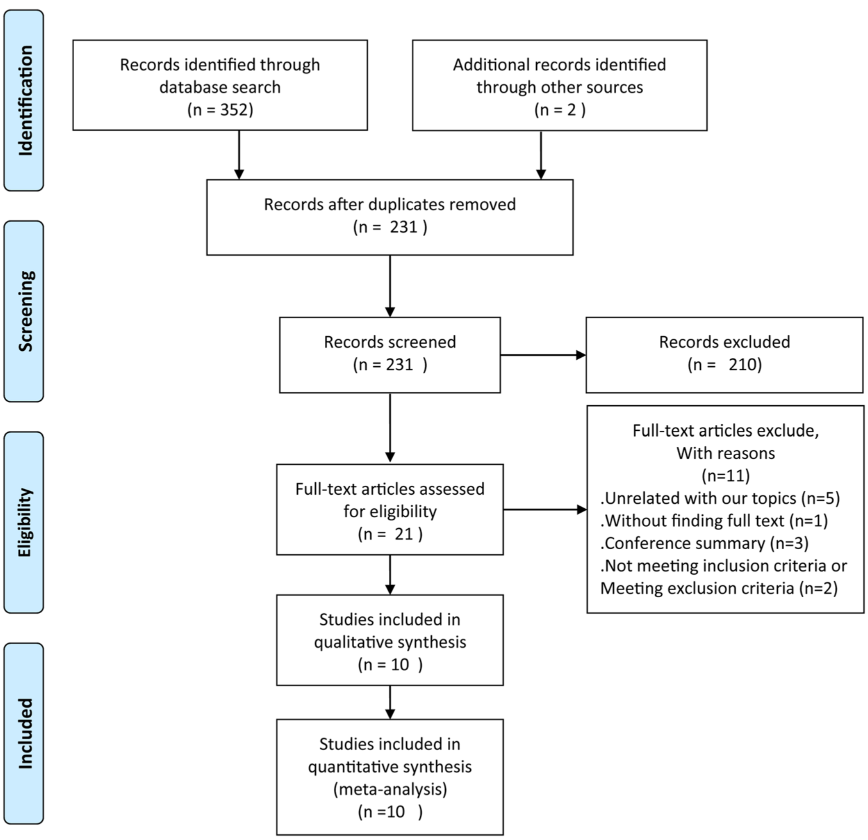

FIGURE 1 A flow diagram of the inclusion criteria of studies eligible for meta-analysis

TABLE 2 Demographics of the included studies

Study	Year	Country	Number of patients	Age (median), y	Sex (male %)	Discharge rate (%)	Fatality rate (%)
Guan[8]	2020	China	1099	47	58.1%	…	15 (1.36%)
Chang[9]	2020	China	13	34	77.0%	13 (100%)	0 (0.0%)
Huang[10]	2020	China	41	49	73.0%	28 (68.3%)	6 (14.6%)
Wang[11]	2020	China	138	56	54.3%	47 (34.1%)	6 (4.3%)
Li[12]	2020	China	425	59	56.0%	…	…
Chen[13]	2020	China	99	55.5	68.0%	31 (31.0%)	11 (11.0%)
Wang[14]	2020	China	4	…	75.0%	2 (50%)	0 (0.0%)
Liu[15]	2020	China	137	57	44.5%	44 (32.1%)	16 (11.7%)
Chen[16]	2020	China	29	56	72.0%	…	2 (6.9%)
Zhang[17]	2020	China	9	36	55.6%	…	…

Note: Discharge (fatality)rate = discharged (fatal) patients number/total patients number.

3.5 | Discharge rate

A total of six studies were included,[9-11,13-15] with 432 cases. The results of the randomized effects model meta-analysis showed that the discharge rate of the COVID-19 patients was 52% (95% CI [0.34,0.70]) (Figure 2E). The sensitivity analysis (Supporting Information Materials) showed that none of the literature had significantly interfered with the results of this meta-analysis. A funnel plot was drawn to test the publication bias (Figure 2F). Publication bias test results: Egger's test ($P = .104 > .1$) indicated that there was no publication bias.

4 | DISCUSSION

This meta-analysis included the latest studies from December 2019 to March 2019 to analyze the clinical characteristics of the novel coronavirus. Our study, which included 1994 patients, reflects the most recent data since the emergence of novel coronaviruses. Although all the studies were case studies and data of randomized controlled studies were lacking, most of our results had relatively low heterogeneity in terms of single-arm meta-analysis, and the sensitivity analysis also showed that the results were not affected by individual studies and there was no publication bias. Meta-analyses of randomized controlled trials are not necessarily superior to nonrandomized controlled trials in terms of the level of evidence.[18]

The main clinical symptoms of COVID-19 patients were fever (88.5%), cough (68.6%), myalgia or fatigue (35.8%), expectoration (28.2%), dyspnea (21.9%). In addition to common respiratory symptoms, the symptoms of headache or dizziness (12.1%) diarrhea (4.8%), nausea, and vomiting (3.9%) were also obvious in some patients. Up to 30% of patients with Middle East respiratory syndrome coronavirus (MERS-COV) also have diarrhea.[19] Moreover, MERS-COV was shown to survive in simulated fed gastrointestinal juice and have the ability to infect intestinal organoid models.[20] A recent study showed that nCOV was detected in stool samples of patients with abdominal symptoms.[21] Therefore, while paying great attention to patients with the respiratory system as the primary symptom, more attention should also be paid to patients with headaches, dizziness, diarrhea, anorexia, nausea, and vomiting. Fecal samples should be tested to exclude a potential alternative route of transmission that is unknown at this stage,[10] to minimize false negatives in the diagnosis.

Laboratory results showed that lymphocytopenia (64.5%), increase of CRP (44.3%), increase of LDH (28.3%), and leukocytopenia (29.4%), were more common. Overall, all of them were consistent with respiratory virus infection. The lymphocytopenia could be used as a reference index in the diagnosis of new coronavirus infections in the clinic. Studies have shown that the levels of inflammatory cytokines may be related to the severity of the disease,[10,16] which is expected to be an indicator of the severity of the disease. The data provided are not comprehensive enough, and the laboratory result values in different studies are not uniform, more studies are needed to confirm whether relevant indicators can provide clinical help.

The study suggested that males account for 60% [95%CI (0.54, 0.65)] in the gender distribution of COVID-19 patients. And a certain reason for it remains to be further explored. There are some studies that showed MERS-COV and SARS-COV have also been found to infect more males than females.[22,23] The reduced susceptibility of females to viral infections could be attributed to the protection from X chromosome and sex hormones, which play an essential role in innate and adaptive immunity.[24] But men should pay more attention to protective measures.

The included cases period was 1 January to 7 February, and our study suggested that the discharge rate of patients with COVID-19 during this period was 52%, with a fatality rate of 5%. The fatality rate of SARS-COV and MERS-COV is reported to be over 10% and 35%,[25,26] respectively. In comparison, COVID-19 has a lower fatality rate. Notably, 31.5% of the dead patients had one or more of the following cases: advanced age (>60 years), cancer, more underlying

TABLE 3 Clinical symptoms

Study	Fever	Cough	Expectoration	Dyspnea	Haemoptysis	Sore throat	Nasal congestion	Myalgia or fatigue	Headache or dizziness	Diarrhea	Nausea and vomiting	Other symptoms
Guan WJ	966 (87.9%)	744 (67.7%)	367 (33.4%)	204 (18.6%)	10 (0.9%)	153 (13.9%)	53 (4.8%)	419 (38.1%)	150 (13.6%)	41 (3.7%)	55 (5.0%)	134 (12.2%)
Chang D	12 (92.3%)	6 (46.2%)	…	…	…	…	1 (7.7%)	3 (23.1%)	3 (23.1%)	1 (7.7%)	…	…
Huang CL	40 (98.0%)	31 (76.0%)	11 (28.0%)	22 (55.0%)	2 (5.0%)	…	…	18 (44.0%)	3 (8.0%)	1 (3.0%)	…	…
Wang DW	136 (98.6%)	119 (86.2%)	37 (26.8%)	43 (31.2%)	…	24 (17.4%)	…	48 (34.8%)	9 (6.5%)	14 (10.1%)	5 (3.6%)	58 (42.0%)
Chen NS	82 (83.0%)	81 (82.0%)	…	31 (31.0%)	…	5 (5.0%)	4 (4.0%)	11 (11.0%)	8 (8.0%)	2 (2.0%)	1 (1.0%)	…
Wang ZW	49 (100.0%)	3 (75.0%)	…	…	…	…	1 (25.0%)	2 (50.0%)	2 (50.0%)	…	…	1 (25.0%)
Liu K	112 (81.8%)	66 (48.2%)	6 (4.4%)	26 (19.0%)	7 (5.1%)	…	…	44 (32.1%)	13 (9.5%)	11 (8.0%)	…	10 (7.3%)
Chen L	28 (97.0%)	21 (72.0%)	21 (72.0%)	17 (59.0%)	…	…	…	12 (41.0%)	2 (7.0%)	4 (14.0%)	…	…
Zhang MQ	8 (88.9%)	5 (55.6%)	…	…	…	4 (44.4%)	1 (11.1%)	4 (44.4%)	…	1 (11.1%)	…	1 (11.1%)

Note: Data were described as *n* and (*n*/*N* %), where *n* is the total number of patients with related symptom, and *N* is the total number of patients with available data. Other symptoms are: chillness; conjunctival congestion; anorexia; abdominal pain; constipation; heart palpitations, etc.

TABLE 4 The results of clinical examination

Study	Leukocytes		Lymphocytes decreased	PLT decreased	CRP increased	PCT increased	LDH increased	ALT increased	AST increased	TB increased	CK increased	Crea increased	D-dimer increased
	Increased	Decreased											
Guan WJ	58 (5.9%)	330 (33.7%)	731 (82.1%)	315 (36.2%)	481 (60.7%)	35 (5.5%)	277 (41.0%)	158 (21.3%)	168 (22.2%)	76 (10.5%)	90 (13.7%)	12 (1.6%)	260 (46.4%)
Huang CL	12 (30.0%)	10 (25.0%)	26 (63.0%)	2 (5.0%)	…	…	29 (73.0%)	…	15 (37.0%)	…	13 (33.0%)	4 (10.0%)	…
Chen NS	24 (24.0%)	9 (9.0%)	35 (35.0%)	12 (12.0%)	…	…	75 (76.0%)	28 (28.0%)	35 (35.0%)	18 (18.0%)	13 (13.0%)	3 (3.0%)	36 (36.0%)
Wang ZW	1 (25.0%)	0 (0.0%)	1 (25.0%)	…	…	…	…	…	…	…	…	…	…
Liu K	26 (19.0%)	51 (37.2%)	99 (72.3%)	…	115 (83.9%)	…	…	…	…	…	…	…	…
Chen L	6 (21%)	17 (58%)	20 (69.0%)	5 (17.0%)	27 (93.0%)	…	20 (69.0%)	5 (17.0%)	7 (24.0%)	1 (3.0%)	…	2 (7.0%)	…
Zhang MQ	1 (11.1%)	…	2 (22.2%)	…	2 (22.2%)	…	…	…	…	…	…	…	…

Note: Data were described as n, and (n/N %), where *n* is the total number of patients with related abnormal laboratory results, *N* is the total number of patients with available data.
Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; Crea, creatinine; CRP, C-reactive protein; CK, creatinine kinase; LDH, lactic dehydrogenase; PCT, procalcitonin; PLT, platelets; TB, total bilirubin.

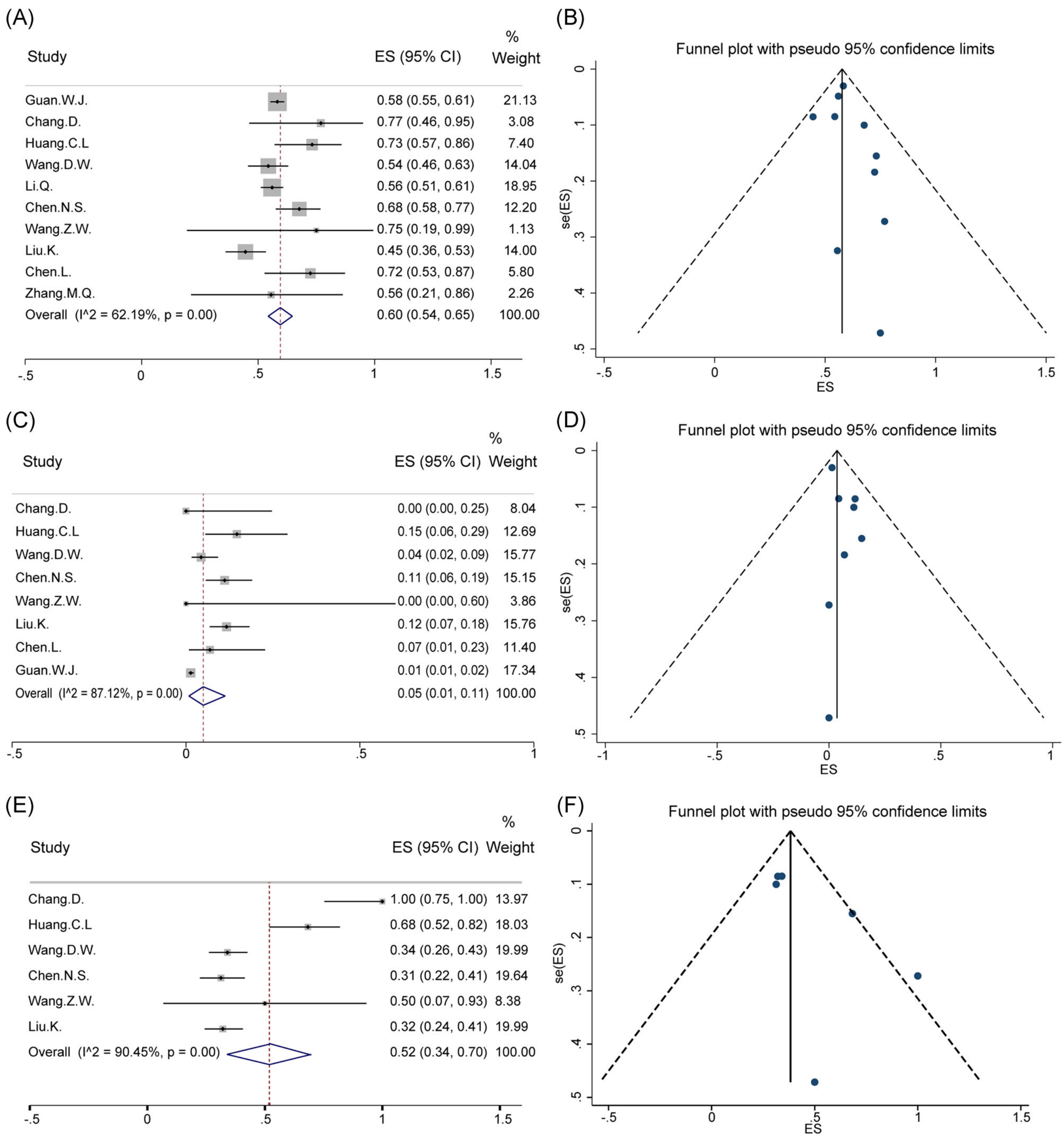

FIGURE 2 Forest plot of all the outcomes. (A, C, E) sex distribution; fatality rate; discharge rate. Funnel plot (B, D, F) sex distribution; fatality rate; discharge rate

diseases, or major infections. Guo et al[15,27] found that the fatality rate of patients with viral pneumonia increased when they had a basic disease and mixed bacterial infection, which was consistent with the results of our study.

Owing to the lack of awareness of the virus in the early stage of this disease, inadequate medical protection, and treatment measures, the high infectivity of the virus led to a dramatic increase in the number of patients, which reflects a lack of medical resources. As a result, the patient discharge rate is relatively low. Recently, it was reported that Remdesivir clinical effect is visible, clinical III trials are ongoing in the domestic, and survivors plasma treatment for heavy, severe cases has shown definite curative effect.[6] We should believe that these treatments will significantly reduce the mortality of such patients soon. Limited by the number and quality of included studies, more extensive and large-scale studies are required to identify the clinical features of the disease.

ACKNOWLEDGMENT

This study was supported by the Gansu Provincial COVID-19 Science and Technology Major Project, China, the Key Program of the Natural Science Foundation of Gansu Province, China (18JR3RA366).

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

SW-m: methodology; ZH-y: validation; LY: formal analysis; HT-b: investigation; WZ-p: data curation; LL-q, HT, and WY-q: original draft preparation; WY-p: writing review and editing.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Li L-q, Huang T, Wang Y-q, et al. COVID-19 patients' clinical characteristics, discharge rate, and fatality rate of meta-analysis. *J Med Virol*. 2020;92:577–583. https://doi.org/10.1002/jmv.25757