

PREVALENCE OF DIABETES, HYPERTENSION AND CARDIOVASCULAR DISEASE IN PATIENTS WITH COVID-19: A SYSTEMATIC REVIEW AND META-ANALYSIS

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ABSTRACT

Background and aim: Right now, there is small data on the prevalence of predominant chronic diseases. In addition, it is important for healthcare providers to know the underlying diseases in COVID-19 infected patients. The aim of present systematic review and meta-analysis was conducted on the Prevalence of diabetes, Hypertension and cardiovascular diseases in patients with COVID-19.

Method: MEDLINE, PubMed, Cochrane Library, Embase, ISI, google scholar were the electronic databases that used to perform a systematic literature between 2010 to march 2020. Endnote X9 software was used for managing the electronic titles. Searches were performed using these keywords: "COVID-19 OR novel coronavirus OR 2019-nCoV OR Corona Virus Disease", "diabetes", "Hypertension", "cardiovascular disease". The present systematic review was done based on the main consideration of PRISMA Statement–Preferred Reporting Items for Systematic Reviews and Meta-analysis

Result: The result of the electronic and manual search was a total of 168 potentially relevant titles and abstracts but finally nine studies were included. Meta-analysis reported that 0.19 (95% CI: 0.06-0.13) of SARS-CoV-2 cases were Diabetes (fig4). Regarding the I2 index, which was calculated to be 66.9% and the Chi-square test, there was significant heterogeneity between the resources (P=0.01).

Conclusion: Hypertensions were the most prevalent underlying diseases in COVID-19 patients.

KEYWORDS: diabetes, Hypertension, cardiovascular disease, COVID-19, Corona Virus Disease

I. INTRODUCTION

From the emergence of 2019 novel coronavirus (2019-nCoV) infection in Wuhan, China in December 2019 (1), it has quickly spread over China and numerous other nations(2). Until now it has affected more than 43,000 patients in 28 countries/regions and became a major global wellbeing concern. February 11, 2020, the World Health Organization (WHO) reported a named the epidemic disease caused by 2019-nCoV: Corona Virus Disease (COVID-19). The International Committee on Taxonomy of Infections ,for the virus itself, has renamed the already temporarily name of 2019-nCoV as severe acute respiratory syndrome coronaviruse-2, SARS-CoV-2(3). Although early studies reported some relations between a single local angle and wild animal market and most cases of infection, which shown possible animal-to-human transmission, increasingly, it has been demonstrated in the studies that human-to-human transmission of the SARS-CoV-2 can occur through droplets or direct contact (2, 4). In addition, concurring to a study, the assumed of its hospital-related transmission was suspected in 41% of patients(4). According to the evidences on the rapidly increasing incidence of infections (5)and the possibility of transmission by asymptomatic carriers (6), the SARS-CoV-2 can be transmitted effectively among people and shows high potential for a pandemic(7, 8). In expansion to the high transmission efficiency of the SARS-CoV-2, the advancement and convenience of global travel may assist improve its worldwide spread (6). Based on the perception of information from the early episode in mainland China from January 10 to January 24, 2020, the trend in an

expanding rate largely follows exponential development, and the mean basic reproduction number (R0) was assessed to range from 2.24 (95% confidence interval : 1.96-2.55) to 3.58 (95% CI: 2.89-4.39), related with 2- to 8-fold increments within the reporting rate(5). The clinical symptoms of patients with pneumonia caused by SARS-CoV-2 (SARS-CoV-2 pneumonia) in Wuhan(9). The most common underlying diseases were cardiovascular disease and hypertension, followed by diabetes mellitus. The most common symptom was fever (92.8%, n = 258), followed by a cough (69.8%, n = 194), dyspnea (34.5%, n = 96), myalgia (27.7%, n = 77), a cerebral pain (7.2%, n = 20), and the runs (6.1%, n = 17) (10). Right now, there is rare data about the prevalence of predominant chronic diseases. In addition, it is important for healthcare laborers to know about the underlying diseases in COVID-19 infected patients . The aim of present systematic review and meta-analysis was conducted on the prevalence of diabetes, Hypertension and cardiovascular disease in patients with COVID-19.

METHODS

Search strategy

MEDLINE, PubMed, Cochrane Library, Embase, ISI, google scholar were used as electronic databases to do a systematic literature between 2010 to march 2020. Electronic title management was done by a commercially available software program (Endnote X9). Searches were performed with keywords, “COVID-19 OR novel coronavirus OR 2019-nCoV OR Corona Virus Disease”, “diabetes”, “Hypertension”, ”cardiovascular disease”. Regarding the main consideration of PRISMA Statement–Preferred Reporting Items for Systematic Reviews and Meta-analysis the present systematic review was performed.

Selection criteria

Inclusion criteria

1. Randomized controlled trials studies, non-randomized controlled trials, controlled clinical trials, prospective and retrospective cohort studies, case-control studies, case studies, clinical reports, cross-sectional studies.
2. Clinical characteristics
3. Epidemiological information
4. All language

Exclusion criteria

1. In vitro studies and reviews.
2. Information was not reported
3. Animal studies

Data Extraction and method of analysis

In this study NEWCASTLE-OTTAWA quality assessment scale for cross sectional studies was used. The subsequent data were extracted from the research included: study, years, sex, Sample size, range and mean of age, hypertension, diabetes mellitus, and cardiovascular disorders. Overall prevalence with 95% confidence interval and chi-square and I² were used to evaluate the heterogeneity that in case of considerable heterogeneity , random effect model was used which was defined as I²>75%. Forest plots in meta-analysis assessed using Comprehensive Meta-Analysis Stata.16 software ().

RESULTS

Doing the electronic and manual search it was found a total of 168 potentially relevant titles and abstracts. At the first stage of study selection, considering the title and abstract 97 publications were excluded. The complete full texts of the remaining 56 publications were thoroughly evaluated at the second phase and 47 papers were excluded at this stage because they did not meet the inclusion criteria. Finally, a total of nine publications with the required inclusion criteria were selected for this systematic review (Figure 1). Table 1 showed individual studies in this meta-analysis.

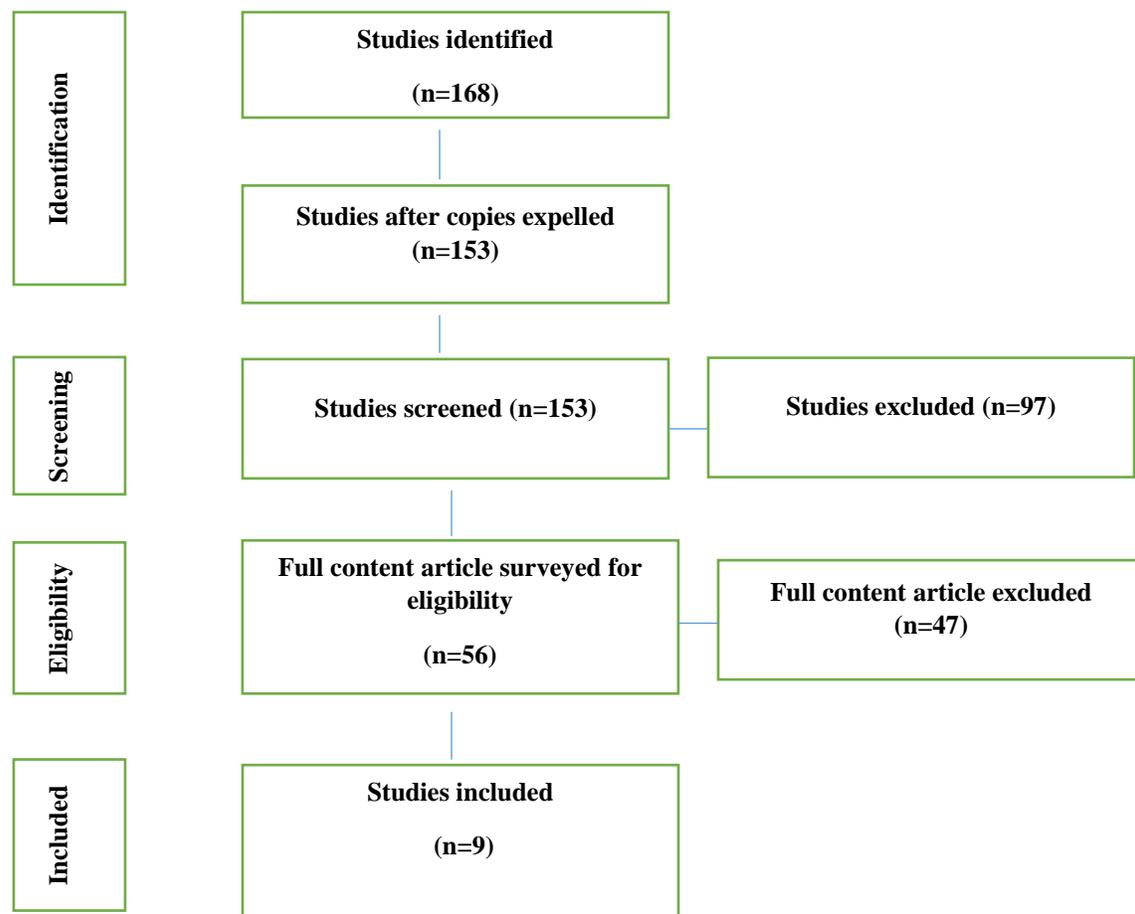


Figure 1. Study Attrition Diagram

Six studies were included that evaluation hypertension among patients with COVID-19, Number of patients were 894 male and 702 female in total were 1596 with the age range of 20-87 years. Meta-analysis reported that 0.16 (95% CI: 0.10-0.25) of SARS-CoV-2 infected cases had hypertension (fig2). It was also the most prevalent underlying disease in COVID-19 cases. According to the I2 index, which was calculated to be 88.4%, and the Chi-square results, heterogeneity between the studies was high and significant (P=0.00).

Eight studies on evaluation of cardiovascular disease in COVID-19 patients were included that, included 1021 male and 778 female and totally 1799 cases with the age range of 20-87 years. Meta-analysis reported that in patients with history of cardiovascular disease the pooled prevalence of SARS-CoV-2 infection was 0.12 (95% CI: 0.04-0.23) (fig3). According to the I2 index, which was calculated as 95.9% and high, and the Chi-square results, there was significant heterogeneity between the studies (P=0.00).

Six studies evaluated diabetes among patients with COVID-19 including 915 males and 705 females that in total were 1620 cases with the age range of 20-87 years. Meta-analysis reported that 0.19 (95% CI: 0.06-0.13) of SARS-CoV-2 cases were Diabetic (fig4). Regarding the I2 index of 66.9% and the Chi-square results, there was significant heterogeneity between the studies

(P=0.01).

Table1. Studies included systematic review and meta-analysis.

Study/year	Sample size		range and mean of age	Hypertension (n)	cardiovascular disease (n)	Diabetes (n)
	Male	female				
Huang et al.2020 (1)	30	11	Range: 41-58		6	8
Chen et al. 2020 (9)	67	32	Mean: 55.5 ±13.1		40	
Wang et al. 2020(4)	78	63	Range: 42-68	43	20	14
Li et al.2020 (11)	9	8	Range: 22-65	1		
Guan et al.2020 (12)	640	459	Range: 35-58	164	27	81
Xu et al.2020 (13)	35	27	Range: 32-52	5	1	1
Zhang et al.2020 (14)	71	69	Range: 25-87	42	7	17
Wu et al.2020 (15)	39	41	Mean: 46.1 ± 15.4		25	
Liu et al.2020 (16)	61	76	Range: 20-83	13	10	14

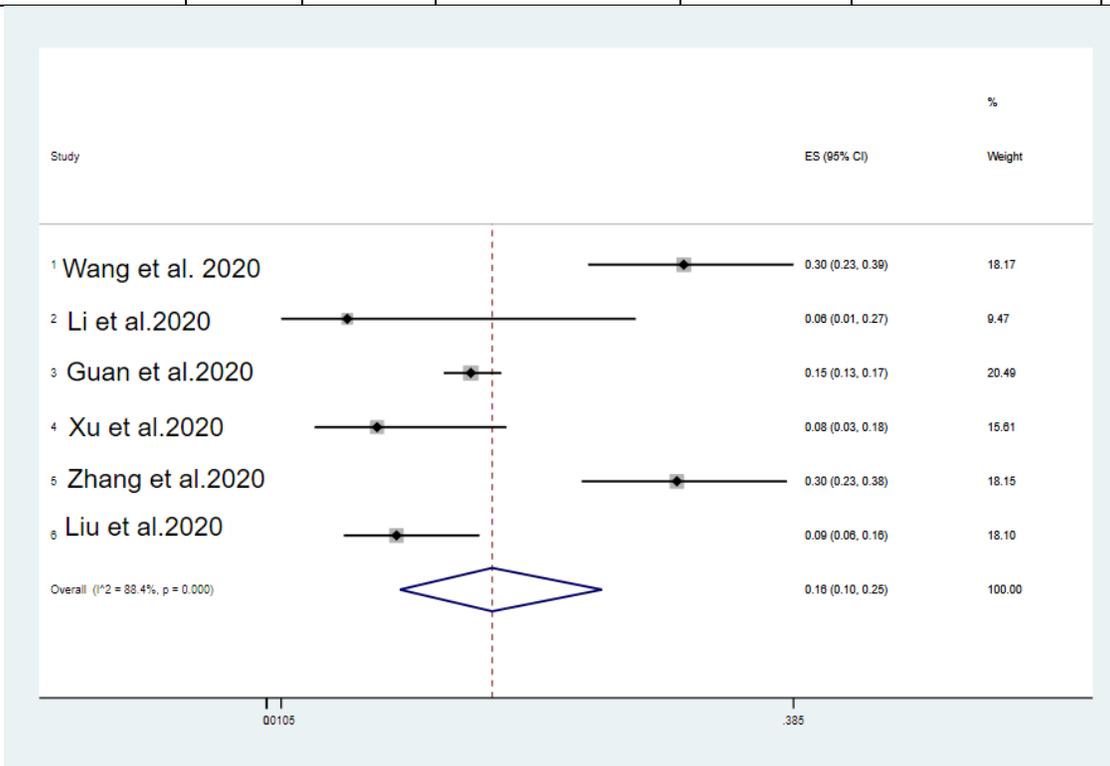


Figure2. Forest plots showed Prevalence of hypertension among patients with COVID-19

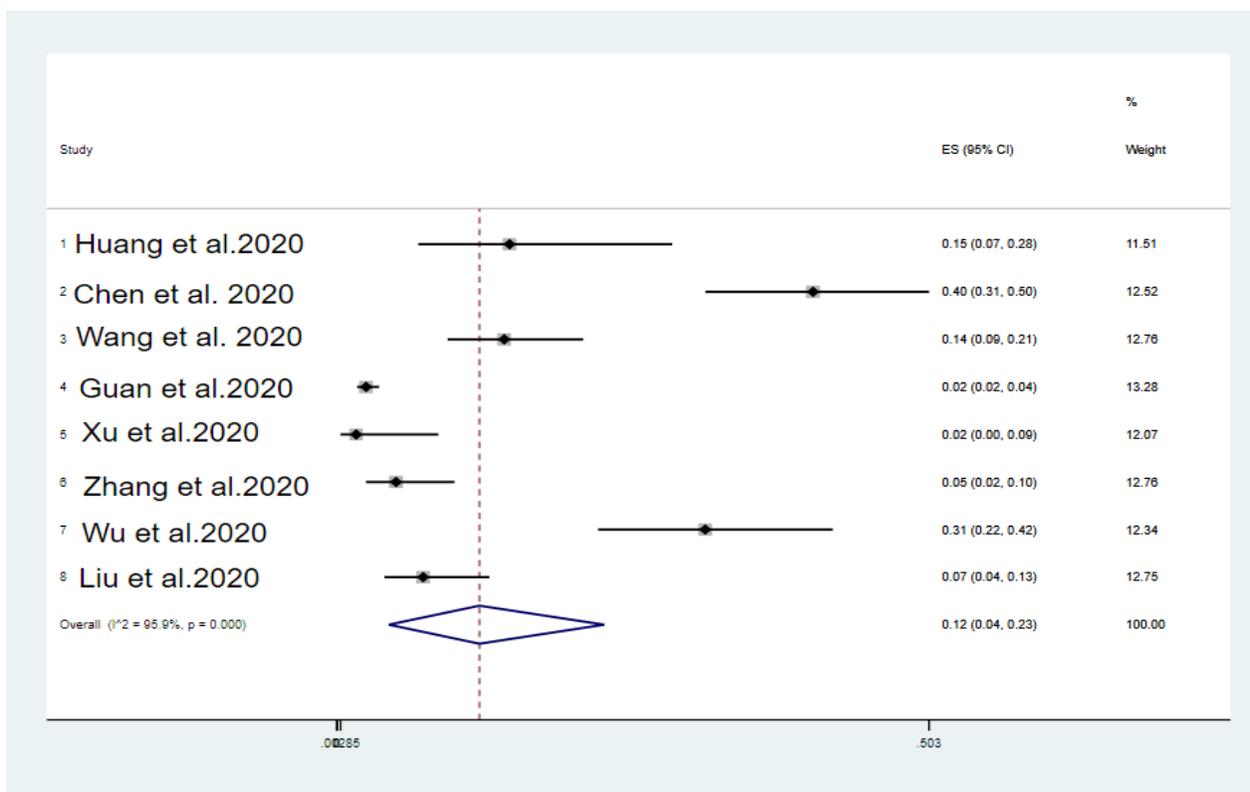


Figure3. Forest plots showed Prevalence of cardiovascular disease among patients with COVID-19

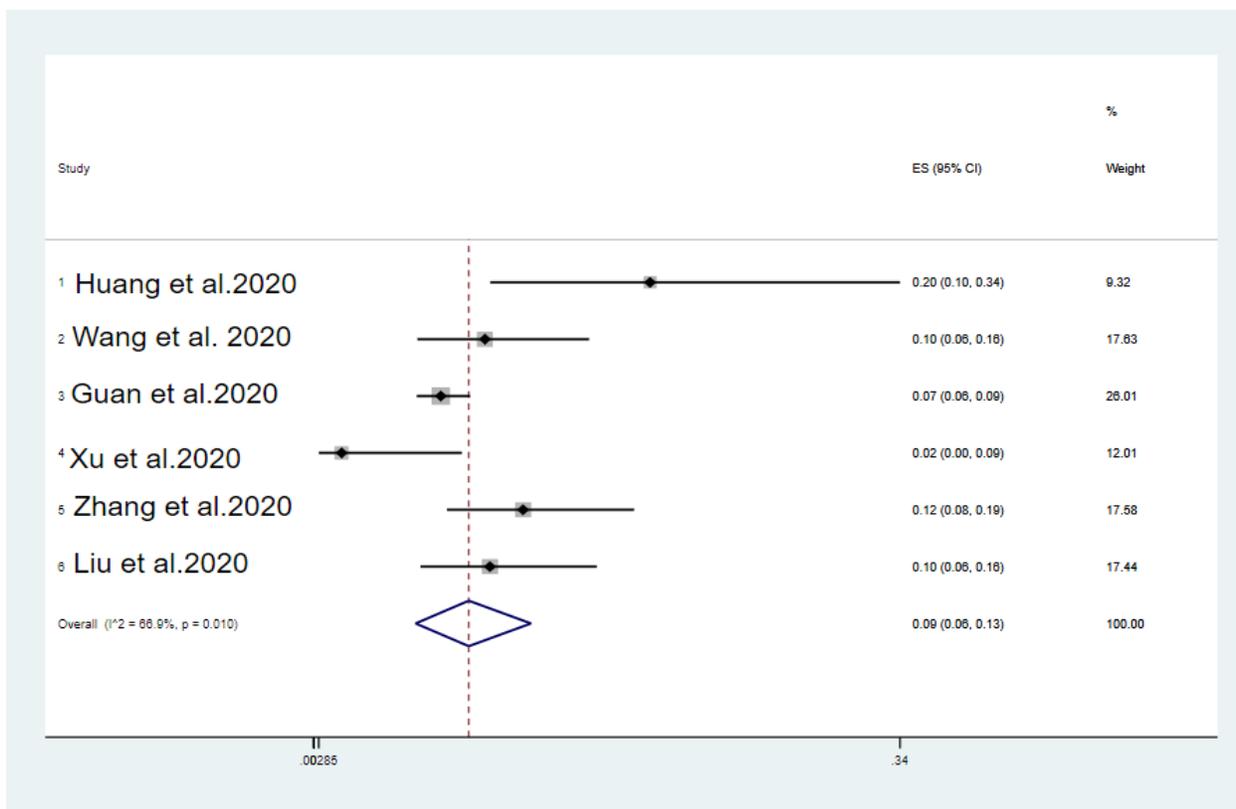


Figure4. Forest plots showed Prevalence of Diabetes among patients with COVID-19

DISCUSSION

To days the world is faced with covid-19 outbreak. Also this novel Corona virus converted to a major concern in the world. As reported covid-19 are pathogens causing viral respiratory Infections with big challenge, globally(17). After MERS and SARS it is the third contagious Coronavirus causes an epidemic in the 21st century (18). There are some key problems about this novel virus such as: diagnosis, mode of transmission, long incubation period (3 to 14 days),

predicting the number of infected cases in the community, and insufficient protection resources due to its pandemic specification(19). As the various factors impact on transmission of SARS-CoV-2 its accurate transmission rate is unknown. Moreover, human to human transmission of the disease and its contagiousness have been indicated by infection of family clusters and healthcare workers, which causes more complicated conditions (20). The present systematic review and meta-analysis showed hypertension, cardiovascular diseases, and diabetes were the most prevalent underlying diseases in hospitalized COVID-19 patients. Huang et al.2020 (1) reported, less than half had diabetes (eight [20%]) and cardiovascular disease (six [15%]). The 2019-nCoV infection caused multiple serious respiratory disorders similar to severe acute respiratory syndrome coronavirus which is associated with ICU admission and high mortality. Also Chen et al. 2020 (9) showed Patients had clinical manifestations of fever (82 [83%] patients), cough (81 [82%] patients), shortness of breath (31 [31%] patients), muscle ache (11 [11%] patients), confusion (nine [9%] patients), headache (eight [8%] patients), sore throat (five [5%] patients), rhinorrhoea (four [4%] patients), chest pain (two [2%] patients), diarrhea (two [2%] patients), and nausea and vomiting (one [1%] patient). Examination of imaging showed bilateral pneumonia in 74 (75%) patients, multiple mottling and ground-glass opacity in 14 (14%) patients, and one (1%) patient had pneumothorax. acute respiratory distress syndrome was developed in 17 (17%) patients and, among them, in a short period of time 11 (11%) patients worsened and died of multiple organ failure. the Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia evaluated by Wang et al. 2020(4) in Wuhan, China, which showed presumed hospital-related transmission of 2019-nCoV was suspected in 41% of patients, 26% of patients received ICU care, and mortality was 4.3%. Some information by Li et al.2020 (11) provided that faster recovery and better therapeutic outcome may contributed to younger age, higher lymphocytes levels and monocytes levels at the diagnoses of 2019-nCoV.

During the first 2 months after the onset of the current outbreak, it was spread rapidly all around China and caused various degrees of disorders. Patients often presented no fever, and many of them have no abnormal radiologic findings. Clinical Characteristics of Coronavirus Disease 2019 have been evaluated in China by Guan et al.2020 (12). At the time of admission the radiologic and laboratory 975 CT scans were performed and according the results 86.2% revealed abnormal results and clinical outcomes among 173 patients with severe disease showed a primary composite end-point event in 43 patients (24.9%). the cumulative risk of the composite end point was 3.6% in all patients and among those with severe disease, it was 20.6%. Zhang et al.2020 (14) established the clinical and laboratory characteristics of 140 community-infected COVID-19 patients, identifying an approximately 1:1 female-male ratio. Despite of low prevalence of smokers and no allergic diseases and there was no self-report of drug hypersensitivity and urticaria by the patients, it was indicated that allergic diseases and smoking history may not be the susceptible factors of COVID-19. In the patients with typical symptoms and radiological changes the positive correlation of blood eosinophil and lymphocyte counts revealed that eosinopenia along with lymphopenia can be a useful indicator for COVID-19 diagnosis. Further investigations on the relationship between SARS-CoV-2 infection and allergic diseases with larger sample size are needed. Emami, et al. 2020(19) in a systematic review and meta-analysis reported hypertension, cardiovascular diseases, diabetes mellitus, smoking, chronic obstructive pulmonary disease (COPD), malignancy, and chronic kidney disease were among the most prevalent underlying diseases among hospitalized COVID-19 patients, respectively which in some cases is consistent with the results of the present study.

CONCLUSION

Meta-analysis is a method to obtain a weighted average of results from various studies. In addition to collaborate the effect sizes, meta-analysis can also be performed to estimate disease frequencies, such as incidence and prevalence, this meta-analysis with the aim of evaluating the prevalence showed hypertension, cardiovascular diseases, and diabetes were the most prevalent underlying diseases in COVID-19 patients that has spread rapidly since it was first

identified in Wuhan. It has also shown to have a wide spectrum of severity as some patients with Covid-19 do not have fever or radiologic abnormalities on initial presentation, which makes it difficult to diagnose. Studies in this area are essential and the 2019-nCoV infection shows a clustering onset that is more likely affect older males with comorbidities, and may lead to severe and even fatal respiratory diseases such as acute respiratory distress syndrome. In general, characteristics of patients who died were in line with the MuLBSTA score, as well as the early warning model of predicting mortality in viral pneumonia. It is suggested to do further investigations to explore the applicability of the MuLBSTA score in predicting the risk of mortality in 2019-nCoV. Infection and Major group's epidemiology, duration of human transmission, and clinical spectrum of disease need to be approved by more studies.

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