

# Prevalence and Clinical Characteristics of Individuals Tested for Coronavirus Disease in Ndokwa-West Local Government Area of Delta State, Nigeria

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## ABSTRACT

**Background:** The coronavirus disease 2019 (Covid-19) outbreak has presented challenges to nations, communities, families, and the health system. Despite the availability of national and other similar data on patients' clinical characteristics in Nigeria, the study area still lacks local data documenting patients' clinical characteristics and their association with patients' outcomes.

**Aim:** To investigate the Prevalence and Clinical Characteristics of individuals tested for Coronavirus Disease 2019 in Ndokwa-West Local Government Area of Delta State, Nigeria.

**Methodology:** A retrospective cohort study was conducted among 1133 individuals who undertook the RT-PCR Covid-19 test from 2020 to August 2021 in Ndokwa-West Local Government Area of Delta State Nigeria. Bivariate and multivariate logistic regression analyses were performed to document patients' clinical characteristics vs outcomes.

**Results:** About one-third of the patients, 382(33.7%) were aged 56-65 years, and the majority, 878 (77.5%) were males. The prevalence of Covid-19 was 5.9%. Signs and symptoms presented were running nose 272(24.0%), cough 185(16.3%), nausea 109(9.6%) and 768(67.8%) presented with comorbidity and other severe life-threatening illnesses 566(50.0%) respectively. Predictors of patients outcomes were age (OR=2.369 95% CI=0.679-8.260), sex (OR=2.250 95% CI=0.134-3.801), comorbidity (OR=3.518 95% CI=1.864-4.632) and other severe life-threatening illness (OR=2.357 95% CI=4.021-8.604).

**Conclusion:** The prevalence of Covid-19 was low, and the associated clinical characteristics presented were running nose, cough, nausea, and comorbidity. The study findings have presented data that would help improve the care of Covid-19 patients in the study area and beyond

**Keywords:** Comorbidity, Covid-19, Polymerase Chain Reaction, Prevalence, Retrospective Study



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## INTRODUCTION

The Coronavirus Disease 2019 (Covid-19) outbreak has resulted in severe health consequences for both developed and developing countries around the world.<sup>[1]</sup> According to the World Health Organisation, as at 13 October, 2021 there were 240,061, 454 confirmed cases of Covid-19 and 4,887, 600 mortality.<sup>[2]</sup> Most of these confirmed cases were majorly from countries in the Americas, Europe and South-East Asia. However, the infection rate in countries in Africa is not as high compared with countries like India, the United States of America and Brazil. Over 6 million confirmed cases of Covid-19 have been reported in Africa.<sup>[2]</sup> In Nigeria and Delta State, one of the Southern States in Nigeria, there have been over 200,000 and 3000 confirmed cases of Covid-19, respectively.<sup>[3]</sup> Most of the severe cases of morbidity and mortality associated with Covid-19 infection have been attributed to the existence of comorbidities such as hypertension, diabetes, cardiovascular diseases, respiratory system problems and other severe life-threatening illnesses. Studies have shown that Covid-19 patients with comorbidities are more likely to develop severe illness and suffer fatal outcomes than patients without comorbidity.<sup>[4-8]</sup> A systematic review reported the most prevalent clinical symptoms of Covid-19 among patients as fever, cough, fatigue and dyspnea and the most prevalent comorbidities as hypertension, diabetes, cardiovascular disease and respiratory system diseases.<sup>[4]</sup> Similarly, a national study in Nigeria highlighted the prevalent symptoms among Covid-19 patients as cough, fever, running nose, sore throat, and headache.<sup>[9]</sup> National and other studies from various cities

across Nigeria have reported the prevalence, and clinical characteristics of patients admitted in hospitals, isolation centres and referral centres.<sup>[9-12]</sup> However, limited information is present to describe the presenting clinical characteristics and outcomes of Covid-19 patients in Delta State and Ndokwa-West Local Government Area, which might vary from the reported national and other studies findings. Also, there is limited information on how patients' socio-demographic and common prevalent clinical characteristics are associated with patient outcomes in the study area. This study intends to fill this gap by providing local data on the prevalence and clinical characteristics of individuals tested for Covid-19 in Ndokwa-West Local Government Area of Delta State, Nigeria.

## MATERIALS AND METHODS

### Study Settings

The study was conducted in Ndokwa-West Local Government Area of Delta State. Ndokwa-West is one of the local government areas of Delta North senatorial district and has its local government headquarters in Kwale or Utagbu-Ogbe.

### Study Design

The study adopted a retrospective cohort study design that involves the retrospective analysis of patients' data from April 2020 to August 2021.

### Study Population

The study population comprised all individuals who were investigated for Covid-19 using real-time PCR (RT-PCR) testing and captured on the Surveillance, Outbreak, Response, Management and Analysis System (SORMAS) from the April

2020 to August 2021 in Ndokwa-West Local Government Area of Delta State. Tested individuals with incomplete records were excluded from the study.

#### **Sample Size and Sampling Technique**

All 1133 patients who presented for Covid-19 (RT-PCR) test in Ndokwa-West Local Government Area from April 2020 to August 2021 were reviewed, extracted, and used for the study.

#### **Data Source**

The data was extracted from SORMAS. This is an electronic health surveillance database maintained by NCDC (Helmholtz Centre for Infection Research, 2019).<sup>[13]</sup> The SORMAS is domiciled in the Disease Surveillance and Notification office of the Ndokwa-West Local Government Area of Delta State.

#### **Data Collection**

Samples were collected from individuals who met the eligibility criteria of RT-PCR test of NCDC COVID-19 suspect case definition,<sup>[14]</sup> transported to Asaba, the states capital where the NCDC-certified laboratory for COVID-19 was located. A temperature range of of 2°C-4°C was maintained in line with the WHO guidelines,<sup>[15]</sup> and analyses were performed according to the NCDC guidelines for identifying and reporting suspected COVID-19 cases.<sup>[16]</sup> RT-PCR was used for the laboratory diagnosis of COVID-19. Laboratory results, patients' characteristics and clinical data were entered into the SORMAS by a designated public health officer at the Disease Surveillance and Notification office of the Ndokwa-West Local Government Area of Delta State.

#### **An instrument for data collection**

A designed proforma containing information on a number of individuals who were tested for Covid-19, socio-demographic characteristics, signs and symptoms, comorbidity, other severe life-threatening illness and patient outcome was used.

#### **Data analysis**

The data was analysed using SPSS version 23.0 and presented in frequency tables and percentages. Bivariate analysis was performed for socio-demographic, and other relevant clinical variables vs patient outcomes. Those significant in the Chi-Square analysis at level of significance  $P < 0.05$  were further subjected to multivariate analysis using logistic regression.

#### **Ethical Consideration**

Ethical clearance for the study was obtained from the Department of Public and Community Health, Novena University Ogume Delta State and the head of the Disease Surveillance and Notification office of the Ndokwa-West Local Government Area.

**RESULTS**

**Table 1: Socio-demographic characteristics of the patients**

Variables	Frequency (N=1133)	Percent
<b>Age (in years)</b>		
10-24	4	0.4
25-40	251	22.2
41-55	327	28.9
56-65	382	33.7
66-75	129	11.4
76-95	40	3.5
<b>Sex</b>		
Male	878	77.5
Female	255	22.5
<b>Marital Status</b>		
Married	1044	92.1
Single	89	7.9
<b>Occupation</b>		
Civil Servant	829	3.2
Retired	57	5.0
Self Employed/Business	247	21.8
<b>Educational Status</b>		
Educated	1126	99.4
Uneducated	7	0.6

According to table 1, about one-third 382(33.7%) of the patients were aged 56-65 years, while the majority, 878(77.5%), were males, and almost all were educated 1126(99.4%).

**Table 2: Signs and Symptoms presented by the patients**

Variable	Frequency (N=1133)	Percent
<b>Running Nose</b>		
Yes	272	24.0
No	861	76.0
<b>Cough</b>		
Yes	185	16.3
No	948	83.7
<b>Shortness of Breath</b>		
Yes	18	1.6
No	1115	98.4
<b>Vomiting</b>		
Yes	106	9.4
No	1027	90.6
<b>Nausea</b>		
Yes	109	9.6
No	1024	90.4
<b>Diarrhoea</b>		
Yes	78	6.9
No	1055	93.1

Running nose 272(24.0%), cough 185(16.3%), nausea 109(9.6%) and vomiting 106(9.4%) were part of the signs and symptoms presented by the patients

**Table 3: Comorbidity and other severe life-threatening illness**

Variable	Frequency (N=1133)	Percent
<b>Comorbidity</b>		
Yes	768	67.8
No	365	32.2
<b>Other severe life-threatening illness</b>		
Yes		
No	566	50.0
	567	50.0

In table 3, comorbidity and other severe life-threatening illness were presented by the majority 768(67.8%) and about half 566(50.0%) of the patients.

**Table 4: Bivariate analysis of socio-demographic characteristics and Outcomes among positive patients**

Variables	Outcomes of Positive Patients		$\chi^2$	df	Sig.
	Discharge	Death			
<b>Age (in years)</b>					
10-24	3(4.5%)	0(0.0%)	6.571	5	0.000
25-40	11(16.4%)	0(0.0%)			
41-55	25(37.4%)	0(0.0%)			
56-65	6(8.9%)	1(15%)			
66-75	13(19.4%)	0(0.0%)			
76-95	7(10.4%)	1(15%)			
<b>Sex</b>					
Male	45(67.2%)	2(3.0%)	3.694	1	0.035
Female	20(29.8%)	0(0.0%)			
<b>Marital Status</b>					
Married	63(94.0%)	2(3.0%)	2.359	1	0.307
Single	2(3.0%)	0(0.0%)			
<b>Occupation</b>					
Civil Servant	30(44.0%)	1(15%)	6.882	2	0.142
Retired	17(26.1%)	1(15%)			
Self Employed/Business	18(26.9%)	0(0.0%)			
<b>Travelled in the last 14 days before The covid19t est</b>					
Yes	18(31.3%)	2(3.0%)	1.941	1	0.03
No	47(65.7%)	0(0.0%)			

The outcome of patients that tested positive Out of the patients that tested positive to Covid-19, only 2(3.0%) died while 65(97.0%) recovered and were discharged. In table 4, the demographic characteristics that were significantly associated with patients outcomes were age (0.000), sex (0.035), and travelling in the last 14 days before taking the Covid-19 test (0.003).

**Table 5: Multivariate analysis of socio-demographic characteristics and Outcomes among positive patients**

Variables	Wald	df	Sig.	Exp(B)	95 CI	
					Lower	Upper
<b>Age (in years)</b>						
10-24	1.831	1	0.176	2.369	0.679	8.260
25-40						
41-55						
56-65						
66-75						
76-95						
<b>Sex</b>						
Male	0.317	1	0.573	2.250	0.134	3.801
Female						
<b>Travelled in the last 14 days prior to the covid-19 test</b>						
Yes	6.035	1	0.998	6.874	1.675	6.388
No						

In table 5, the demographic variables that predicted outcomes were age (OR=2.369 95% CI=0.679-8.260), sex (OR=2.250 95% CI=0.134-3.801) and traveling in the last 14 days prior to taking the Covid-19 test (OR=6.874 95% CI=1.675-6.388).

**Table 7: Multivariate analysis of Co-morbidity, signs and symptoms and outcome among the positive patients**

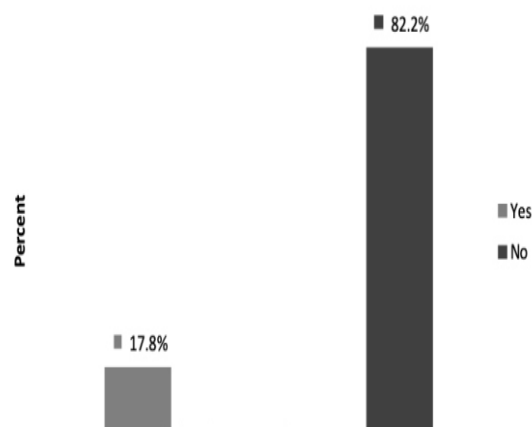
Variables	Wald	df	Sig.	Exp(B)	95 CI	
					Lower	Upper
<b>Comorbidity</b>						
Yes	5.643	1	0.246	3.518	1.864	4.632
No						
<b>Nausea</b>						
Yes	0.023	1	0.880	0.806	0.048	7.442
No						
<b>Other severe life-Threatening illness</b>						
Yes	8.224	1	0.001	2.357	4.021	8.604
No						

As shown in table 7, predictors of patients outcomes were comorbidity (OR=3.518, 95% CI=1.864-4.632) and other life-threatening illnesses (OR=2.357, 95% CI=4.021-8.604).

**Table 6: Bivariate analysis of Co-morbidity, signs and symptoms and outcome among the positive patients**

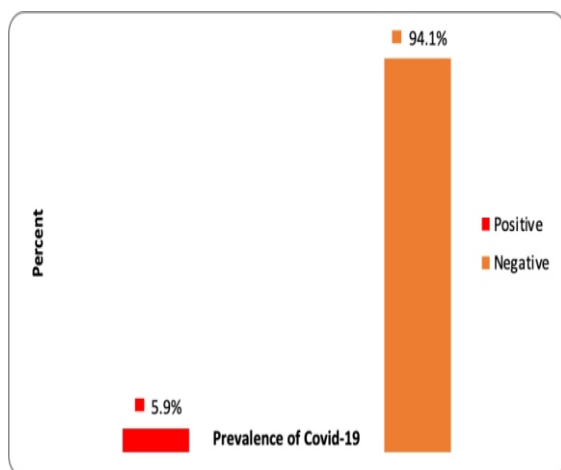
Variables	Outcomes of Positive Patients		$\chi^2$	df	Sig.
	Discharge	Death			
<b>Comorbidity</b>					
Yes	52(77.6%)	2(3.0%)	1.496	1	0.013
No	13(19.4%)	0(0.0%)			
<b>Running Nose</b>					
Yes	19(28.4%)	2(3.0%)	0.400	1	0.527
No	46(68.6%)	0(0.0%)			
<b>Cough</b>					
Yes	55(82.0%)	2(3.0%)	2.723	1	0.531
No	10(15.0%)	0(0.0%)			
<b>Shortness of breath</b>					
Yes					
No	10(14.9%)	2(3.0%)	1.362	1	0.548
<b>Vomiting</b>	55(82.1%)	0(0.0%)			
Yes	9(13.4%)	1(1.5%)	1.362	1	0.158
No	56(83.6%)	1(1.5%)			
<b>Nausea</b>					
Yes	29(43.3%)	1(1.5%)	0.880	1	0.023
No	36(53.7%)	1(1.5%)			
<b>Diarrhoea</b>					
Yes	10(14.9%)	2(3.0%)	0.362	1	0.548
No	55(82.1%)	0(0.0%)			
<b>Other severe life-Threatening illness</b>					
Yes	42(67.2%)	2(3.0%)	1.078	1	0.042
No	23(29.9%)	0(0.0%)			

According to table 6, the bivariate analysis of symptoms that were significantly associated with outcomes of patients who tested positive to Covid-19 was comorbidity (0.013), nausea (0.023) and other severe life-threatening illness (0.042).



**Figure 1: Proportion of patients that travelled in the last 14 days before the Covid-19 test.**

Most 931(82.2%) had not travelled in the last 14 days before the Covid-19 test, while 202(17.8%) had travelled in the last 14 days prior to the Covid-19 test.



**Figure 2: Prevalence of Covid-19 among the Covid-19 tested patients , 67(5.9%) of the patients were Covid-19 positive, while 1066(94.1%) were Covid-19 negative.**

## DISCUSSION

Most of the patients were between ages 25-95 years. Also, the majority of the patients were males. This was similar to that of previous studies in Nigeria, where more males were tested for Covid-19.<sup>[9,12]</sup> This could be attributed culturally to the busy nature and activities of males who are major 'bread winners' in their respective families, so, therefore, they are more likely to interact with others. In addition, less than 20% of the respondents affirmed to have travelled in the last 14 days prior to the test. This was similar to the report of a national study where the majority of the patients affirmed not to have travelled in the last 14 days prior to taking the Covid-19 test.<sup>[9]</sup>

According to the study's finding, 5.9% of the patients who were recommended for the Covid-19 test in Ndokwa-West Local Government Area of Delta State were confirmed positive. This reported

prevalence was lower than that of a study in Lagos Nigeria, which reported 14.6%.<sup>[11]</sup> The observed variation in the two studies might be due to the locations of the two studies, while Lagos is more of an urban metropolitan area and thus more likely to record more Covid-19 cases than the current study area which is more of rural and semi-urban areas. This shows Covid-19 prevalence is probably more in urban areas than in rural areas in Nigeria. Therefore, priority on Covid-19 testing and preventive measures should focus on urban metropolitan cities than rural areas. Furthermore, the observed prevalence also varies with the incidence of Covid-19 in the first 30 days (3.7%), 60 days (12.2%) and 100 days with incidence of 16.3%.<sup>[17]</sup> Also, the prevalence was far lower than that of China, which reported a 62.0% prevalence of Covid-19 within the first three months of the outbreak.<sup>[18]</sup> In contrast, the prevalence was higher than that of a study in the United States which reported a prevalence of 1.7% out of the 5, 203 participants.<sup>[19]</sup>

According to the World Health Organisation, common symptoms of Covid-19 include fever, tiredness, dry cough, nasal congestion, running nose, sore throat and diarrhoea.<sup>[20]</sup> This was corroborated with the study where the signs and symptoms presented by the patients were running nose, cough, shortness of breath, vomiting, nausea and diarrhoea. This finding was similar to that of other studies in China and the United States.<sup>[21-23]</sup> Other studies in Nigeria also reported a similar trend of signs and symptoms.<sup>[9,11,12]</sup>

The majority of the patients reported comorbidity and other severe life-threatening illness. The implication is that most of the patients that tested positive for Covid-19 would report more morbidity and mortality because previous studies have shown that Covid-19 patients with comorbidities are more



likely to develop severe illness and suffer fatal outcomes than patients without comorbidity.<sup>[4-8]</sup>

This finding was similar to that of a previous study in Nigeria, where the patients reported comorbidities.<sup>[10]</sup> Other studies also reported comorbidities among Covid-19 patients.<sup>[24-27]</sup>

The prevalence of mortality among Covid-19 confirmed patients was 3.0%. This was slightly lower than that of a previous study in Lagos State which reported 3.3% but was higher than the national rate of 2.0%.<sup>[10]</sup> The observed variation with the national rate might be because the national study focus was larger comprising all the states of the federation and therefore is more likely to show variation in morbidity and mortality rate than the current study whose focus was on a particular local government area.

Demographic predictors of outcomes among positive patients were age, sex, and travel in the last 14 days before taking the Covid-19 test. The finding was similar to that of a national study in Nigeria where age was a predictor of mortality among Covid-19 patients.<sup>[9]</sup> Other predictors of mortality were comorbidity and having other severe life-threatening illnesses. This was similar to the finding of other studies within and outside Nigeria.<sup>[9,10,28,29,30]</sup>

A limitation of the study is the absolute dependence on data retrieved from the SORMAS, which the authors did not independently verify. However, the authors improved the data quality by ensuring only patients with complete data were included in the study.

## CONCLUSION

The prevalence of Covid-19 was low, and the associated clinical characteristics presented were running nose, cough, shortness of breath, vomiting,

nausea, diarrhea, comorbidity and other severe life threatening illness. The study findings have presented data that would help improve the care of Covid-19 patients in the study area and beyond.

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## REFERENCES

1. Hui DS, Azhar EI, Madani TA, Ntoumi F, Kock R, Dar O, *et al.* The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health the latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis.* 2020; 91:264266.
2. World Health Organisation. WHO Coronavirus (COVID-19) Dashboard. Available at: <https://covid19.who.int/>. Accessed 18<sup>th</sup> October 2021].
3. Nigerian Centre for Disease Control. NCDC Coronavirus (COVID-19) Dashboard. Available at: <https://covid19.ncdc.gov.ng/report/>. [Accessed 14<sup>th</sup> October 2021].
4. Yang X, Yu Y, Xu J, Shu H, Liu H, Wu Y, *et al.* Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *Lancet Respirat Med.* 2020; 8(5): 475-481.
5. Guan WJ, Ni ZY, Hu Y. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med.* 2020; 382:1708-1720.
6. Zhang JJ, Dong X. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. *Allergy* 2020; 75(7):1730-1741.

7. Bornstein SR, Rubino F, Khunti K, Mingrone G, Hopkins D, Birkenfeld AL. Practical recommendations for the management of diabetes in patients with COVID-19. *Lancet Diabet Endocrinol.* 2020; 8(6):546-550.
8. Agofure O, Eduviere AT, Okandeji-Barry OR. Coronavirus disease-19 and diabetes mellitus: implications for diabetes management in Nigeria. *Int J Community Med Public Health.* 2021; 8(2):969-974.
9. Elimian KO, Ochu CL, Ebhodaghe B, Myles P, Crawford EE, Igumbor E, et al. Patient characteristics associated with COVID-19 positivity and fatality in Nigeria: retrospective cohort study. *BMJ Open.* 2020; 10:e044079. doi:10.1136/bmjopen-2020-044079.
10. Osibogun A, Balogun M, Abayomi A, Idris J, Kuyinu Y, Odukoya O, et al. Outcomes of COVID-19 patients with comorbidities in Southwest Nigeria. *PLoS ONE.* 2021; 16(3): e0248281. <https://doi.org/10.1371/journal.pone.0248281>.
11. Salako AO, Amoo OS, Odubela OO, Osulale KA, James AB, Oladele DA, et al. Prevalence and Clinical Characteristics of Coronavirus Disease 2019 Seen at a Testing Centre in Lagos Nigeria. *West Afri J Med.* 2021; 38(1):54-58.
12. Olayinka RI, Bello MS, Suleiman BA, Taofeek O, Abdallah S, Maruf SG. Epidemiology of COVID-19 and Predictors of Outcome in Nigeria: A Single-Center Study. *Am. J. Trop. Med. Hyg.* 2020; 103(6): 23762381.
13. Helmholtz Centre for Infection Research. SORMAS: the real-time software for outbreak and epidemic surveillance, 2019. Available: [https://sormas.org.helmholtz-hzi.de/About\\_SORMAS.html](https://sormas.org.helmholtz-hzi.de/About_SORMAS.html) [Accessed 14 October 2021].
14. Nigeria Centre for Disease Control. Case definitions for coronavirus disease. Abuja, 2020. Available: [https://covid19.ncdc.gov.ng/media/files/Case\\_Definition.pdf](https://covid19.ncdc.gov.ng/media/files/Case_Definition.pdf) [Accessed Oct 9, 2020].
15. World Health Organization. Laboratory testing for coronavirus disease (COVID-19) in suspected human cases: interim guidance, 19 March 2020. WHO. Available: <https://www.who.int/publications-detail/laboratory-testing-for-2019-novel-coronavirus-in-suspected-human-cases-20200117> [Accessed 10<sup>th</sup> October 2021].
16. Nigeria Centre for Disease Control. National interim guidelines for clinical management of COVID-19, version 2, may 2020. Abuja. Available: [https://ncdc.gov.ng/themes/common/docs/protocols/177\\_1584210847.Pdf](https://ncdc.gov.ng/themes/common/docs/protocols/177_1584210847.Pdf) [Accessed 10<sup>th</sup> October, 2020].
17. Amzat J, Aminu K, Kolo VI, Akinyele AA, Ogundairo JA, Danjibo MC. Coronavirus outbreak in Nigeria: Burden and socio-medical response during the first 100 days. *Int J Infect Dis.* 2020; 98: 218224.
18. Wu Z, McGoogan JM. Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA.* 2020; 323(13): 1239-1242.
19. Morlock R, Morlock A, Downen M, Shah SN. COVID-19 prevalence and predictors in United States adults during peak stay-at-home orders. *PLoS ONE.* 2021; 16(1): e0245586. <https://doi.org/10.1371/journal.pone.0245586>.
20. World Health Organisation. Coronavirus disease (COVID-19) Situation Report 122. Available at: <https://reliefweb.int/report/world/coronavirus-disease-2019-covid-19-situation-report-122-21-may-2020>. [Accessed 20<sup>th</sup> October 2020].
21. Fu L, Wang B, Yuan T, Chen X, Ao Y, Fitzpatrick T, et al. Clinical characteristics of coronavirus disease 2019 (COVID-19) in



- China: a systematic review and meta-analysis. *J Infect.* 2020; 80: 656665.
22. Aggarwal S, Garcia-Telles N, Aggarwal G, Lavie C, Lippi G, Henry BM. Clinical features, laboratory characteristics, and outcomes of patients hospitalized with coronavirus disease 2019(COVID-19): early report from the United States. *Diagnosis.* 2020; 7: 9196.
23. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult in patients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet.* 2020; 395: 10541062.
24. Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, et al. comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. *Eur Respir J.* 2020; 55(5):2000547.  
<https://doi.org/10.1183/13993003.00547-2020> PMID: 32217650.
25. Wang B, Li RL, Zhong L, Huang Y. Does Comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. *Ageing.* 2020; 12(7): 604957.  
<https://doi.org/10.18632/aging.103000>. PMID: 32267833.
26. Sanyaolu A, Okorie C, Marinkovic A, Patidar R, Younis K, Desai P, et al. Comorbidity and its Impact on Patients with COVID-19 [published online ahead of print, 2020 Jun 25]. *SN Compr Clin Med.* 2020; 18. <https://doi.org/10.1007/s42399-020-00363-4> PMID: 32838147.
27. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW et al. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. *JAMA.* 2020; 323(20):20522059.  
<https://doi.org/10.1001/jama.2020.6775> PMID:32320003.
28. Zheng Z, Peng F, Xu B, Zhao J, Liu H, Peng J, et al. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta- analysis. *J Infect.* 2020; 81:e1625.
29. Shi L, Wang Y, Wang Y, Duan G, Yang H, et al. Dyspnea rather than fever is a risk factor for predicting mortality in patients with COVID-19. *J Infect.* 2020; 81:64779.
30. Pan L, Mu M, Yang P, Yu Sun, Wang R, Yan J. et al. Clinical characteristics of COVID-19 patients with digestive symptoms in Hubei, China. *Am J Gastroenterol.* 2020; 115:76673.