



Demographic Factors, Comorbidities and Symptoms Prevalent among Patients with COVID-19 in a Tertiary Health Institution in Nigeria

**Oluwakemi Ladipo ^a, Temitope Olusanya ^{b*}, Oluwasegun Adeniyi ^c,
Olalekan Kemiki ^c, John Sotunsa ^d, Tobiloba Aweda ^c, Adewale Adetosoye ^c,
Olusola Boyede ^e, Ismail Alimi ^c and Mary Adelabu ^c**

^a Department of Chemical Pathology, Babcock University Teaching Hospital Ilisan-Remo, Ogun State, Nigeria.

^b Department of Medical Laboratory Science, Babcock University Ilisan-Remo, Faculty of Public and "Allied" Health, Ogun State, Nigeria.

^c Molecular and Tissue Culture Laboratory, Babcock University Teaching Hospital Ilisan-Remo, Ogun State, Nigeria.

^d Department of Obstetrics and Gynecology, Babcock University Teaching Hospital Ilisan-Remo, Ogun State, Nigeria.

^e Department of Haematology, Babcock University Teaching Hospital Ilisan-Remo, Ogun State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. The conception and design of the study were carried out by authors OT, OL, OA, OK and TA. Acquisition of data was made by authors OA, OK, TA, AA, OT, OL, IA, MA, JS and OB. Analysis and interpretation of data were made by authors OT, OA, OK and TA. Drafting the article and the critically revising for important intellectual content were made by authors OT, OL, OA, OK and TA. Final approval of the version to be submitted were done by authors OA, OK, TA, AA, OT, OL, IA, MA, JS and OB. All authors read and approved the final manuscript.

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ABSTRACT

Background: Studies have suggested that patients' medical data could be correlated with the disease outcome in individuals with COVID-19. There is however, paucity of data on the impact of many of these factors especially in rural and semi-urban environment in Nigeria.

*Corresponding author: E-mail: typet12@hotmail.com;

Objective: This study seeks to establish the dynamics of patients tested for COVID-19 in a private tertiary facility located in a semi-urban area in Nigeria, with special focus on their symptoms, comorbidities, and demography.

Methods: The study was a retrospective study carried out using data generated by the Babcock Molecular and Tissue Culture Laboratory of Babcock University Teaching Hospital Ilisan-Remo, Ogun state between October 17, 2020 and July 20, 2021. Statistical analysis was carried out using Statistical Package for the Social Sciences version 21.0.

Result: Two thousand five hundred anonymized data were captured in the study. Under the period of review, only 9.5% of the entire tested population were positive to the SARS-CoV-2 virus. There was a significant relationship between age distribution, level of education and COVID-19 infection outcome ($P < 0.05$). Fever (42.6%) was the commonest symptom among the patient population while hypertension (34.6%) and diabetes (31.3%) were the leading comorbidities reported in this study.

Conclusion: Targeted approaches in the areas of tests and enlightenment for certain demographic groups such as those that are elderly and with low level of education is highly recommended.

Keywords: COVID-19; demographic factors; comorbidities; symptoms.

1. INTRODUCTION

The SARS-CoV-2 that causes the coronavirus disease 2019 (COVID-19) arises from the RNA mutation of a virus isolated for the first time in 1937 and which initially expanded asymptotically and with mild symptoms. However, SARS-CoV-2 is currently the pathogen that causes the most concern to the community around the world due to its high transmissibility, thus generating major impacts for health systems [1].

As at 8th of October, 2021, the world has confirmed 236,511,950 cases, with 4,828,340 deaths according to the WHO, and the CDC. Nigeria has so far confirmed 207,167 cases; with 9,629 active cases, 194,796 discharged and 2,742 deaths, of the total sum of 3,090,114 samples tested. In Ogun state, 5,367 cases have so far been confirmed, with 14 cases on admission, 5,273 discharged and 80 deaths recorded according to the Nigeria Center for Disease Control.

Since the outbreak of COVID-19 was confirmed in Wuhan, the Hubei province of China, on the 31st of December 2019, the world had experienced lots of dynamics relating to its origin, case definitions, preventive measures, signs and symptoms, demography, comorbidities, and vaccine development.

It is established that patients demography, symptoms, and comorbidities play a critical role in the management of COVID-19, as well as each patient's response [2,3].

Several studies have already correlated patients' medical data and the COVID-19 pandemic, in order to detect the variables that could be useful to predict mortality risk [3-14] or to predict length of hospital stay [15,16]. As stated by the systematic review of Wynants et al., age, sex, the presence of comorbidities, and a few biomarkers, such as C reactive protein, creatinine, lymphocyte count, red cell distribution width, and lactate dehydrogenase, are commonly reported as variables correlated with an increased mortality risk, while age and variables derived from computed tomography scans are reported to be more correlated with the length of hospital stay [17].

Liu et al., (2020) [16] in a research to determine the risk factors for severe COVID-19, report that fever, cough and fatigue appear as the main symptoms among the participants, with fever being the most common initial symptom (92.3%). Rivera-Izquierdo et al., (2020) [18] complement that in patients admitted for COVID-19 at Hospital Universitario Clínico San Cecilio, Spain, the most frequent clinical picture was also due to low fever (89.5%) and dry cough (80.7%), followed by general malaise (63.5%), dyspnea (61.3%) and tiredness (59.2%).

There is paucity of data on the impact of many of these factors especially in rural and semi-urban environments in Nigeria. This study seeks to establish the dynamics of patients tested for COVID-19 in a private tertiary facility located in a semi-urban area in Nigeria, with special focus on their symptoms, comorbidities, and demography.

3. MATERIALS AND METHODS

3.1 Study Design

This was a retrospective study.

3.2 Study Site

This study was carried out using data generated by the Babcock Molecular and Tissue Culture Laboratory of Babcock University Teaching Hospital Ilisan-Remo, Ogun state. Babcock University Teaching Hospital is a 204 bedded hospital located in Ogun state; one of the southwestern states of Nigeria. Although a non-government owned tertiary health institution, the hospital has over the years become a referral center to numerous health institutions in it's' environ. This is owing to its wide range of approach to health care services including specialized services related to orthopedic, pediatric, obstetric/gynecologic, gastroenterologic, as well as hearts and vascular medical care (it is one of the few institutions providing cardiovascular related surgeries in the country).

3.3 Data Source and Collection

All the data were sourced from the central database of all patients who were tested for COVID-19, as submitted to both the state ministry of health and the Nigeria Center for Disease Control. All data whose samples were collected through both the nasopharyngeal and oropharyngeal sites, tripled packaged in cold chain, and transported to the laboratory as confirmed from the field Medical Laboratory Scientists were included in this study. Anonymized data based on these criteria were collected from the forms attached to each sample sent to the laboratory between October 17, 2020 and July 20, 2021.

3.4 SARS CoV-2 Test Protocol

Inactivation and extraction was done using the protocol of Daan gene biotechnology (DaAn Gene Co, Ltd., of Sun Yat-sen University, China) and were analyzed using the Daan gene amplification kit on Rotor Gene 3000, Ecosystem Illumina, Bioer line gene 9600 RT qPCR.

3.5 Bias

Validation of all data collected was done through the central database of all patients who were

tested for COVID-19, as submitted to both the state ministry of health and the Nigeria Center for Disease Control.

3.6 Study Size

Two thousand five hundred anonymized data were captured in the study.

3.7 Statistical Analysis

Statistical analysis Was carried out using Statistical Package for the Social Sciences version 21.0. Results were presented in tables and figures. Relationship between variables were determined using Chi-square test, with level of statistical significance set at $P < 0.05$.

4. RESULTS

In Fig. 1 it is observed that among those tested for COVID-19 under the period of review, 261 were positive to the infection, representing 9.5% of the entire tested population.

In Table 1 it is observed that there was an even distribution between the genders among those that were tested. Similar percentages among the genders were also positive (Male = 9.7%, Female = 9.3%).

There was significant relationship between age distribution and COVID-19 infection outcome as seen in Table 2 ($P < 0.05$). Patients who were greater than 50 years had the highest percentage among their population who were positive to the infection (41.8%) after being tested. After the age of 10, the percentage of positive outcome for each group seemed to be increasing as the ages increased (11-30 = 8.0%, 31-50 = 26.6, >50 = 41.8%).

In Table 3 it is observed that positive outcome for the infection is commoner in patients with the least level of education (primary) and those with no education; as both groups had a 100% outcome of positivity. This outcome was also statistically significant ($P < 0.05$).

In Table 4 it is seen that although a large percentage (77.0%) of the patient population were from the south western region of the country, there was no significant relationship between the geographical location the patients came from and the eventual outcome of the COVID-19 test ($P < 0.05$).

In Table 5 it is revealed that patients who were health workers had a higher percentage (42.9%) of positive outcome to COVID-19 test compared to those that were not health workers who had just 9.3% of their population with positive outcome. This was statistically significant ($P < 0.05$).

In Fig. 2 it is revealed that fever was the commonest symptom among the patient population, occurring in 42.6% of those who

tested positive. This was closely followed by breathing difficulty (38.6%), body pain (31%), and taste loss (30.8%). Diarrhea was the least reported symptom among this patient population, occurring in only 10.0% of the patients.

In Fig. 3, it is observed that 34.6% of patients in this study with COVID-19 also had hypertension at the same time. This was the most frequently reported comorbidity, next to which were cases of Diabetes mellitus (31.3%).

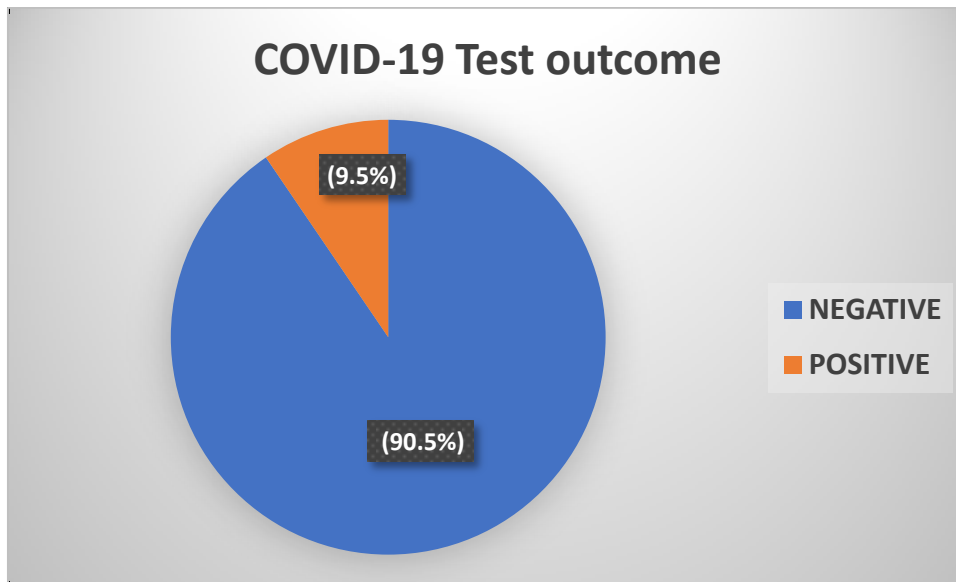


Fig. 1. Incidence of COVID-19 infection among study population

Table 1. Relationship between gender distribution and COVID-19 infection

Gender	Total N (%)	Positive N (%)	Negative N (%)	Chi-square	P-value
Male	1389 (50.6)	135 (9.7)	1254 (90.3)	0.548	0.760
Female	1352 (49.3)	126 (9.3)	1226 (90.7)		

Table 2. Relationship between age distribution and COVID-19 infection

Age category	Total N (%)	Positive N (%)	Negative N (%)	Chi-square	P-value
0-10	15 (0.5)	4 (26.7)	11 (73.3)	119.443	0.000
11-30	2584 (94.1)	208 (8.0)	2376 (92.0)		
31-50	79 (2.9)	21 (26.6)	58 (73.2)		
>50	67 (2.4)	28 (41.8)	39 (58.2)		

Table 3. Relationship between level of education and COVID-19 infection

Level education	Total N (%)	Positive N (%)	Negative N (%)	Chi-Square	P-Value
Tertiary	68 (2.5)	13 (19.1)	55 (80.9)	502.258	0.000
Secondary	2668 (97.2)	197 (7.4)	2471 (92.6)		
Primary	7 (0.3)	7 (100)	0 (0)		
Uneducated	2 (0.1)	2 (100)	0 (0)		

Table 4. Relationship between geographical location and COVID-19 infection

Geographic location	Total N (%)	Positive N (%)	Negative N (%)	Chi-square	P-value
South West	2113 (77.0)	208 (9.8)	1905 (90.2)	9.202	P < 0.05
South-South	264 (9.6)	32 (12.1)	232 (87.9)		
South East	114 (4.2)	8 (7.0)	106 (93.0)		
North West	31 (1.1)	1 (3.2)	30 (96.8)		
North Central	218 (7.9)	12 (5.5)	206 (94.5)		
North West	5 (0.2)	0 (0)	5 (100)		

Table 5. COVID-19 Exposure Among Health Workers And No-Health Workers

Occupation	Total N (%)	Positive N (%)	Negative N (%)	Chi-Square	P-value
Non-health Workers	2724 (99.2)	252 (9.3)	2472 (90.7)	27.353	0.000
Health Workers	21 (0.8)	9 (42.9)	12 (57.1)		

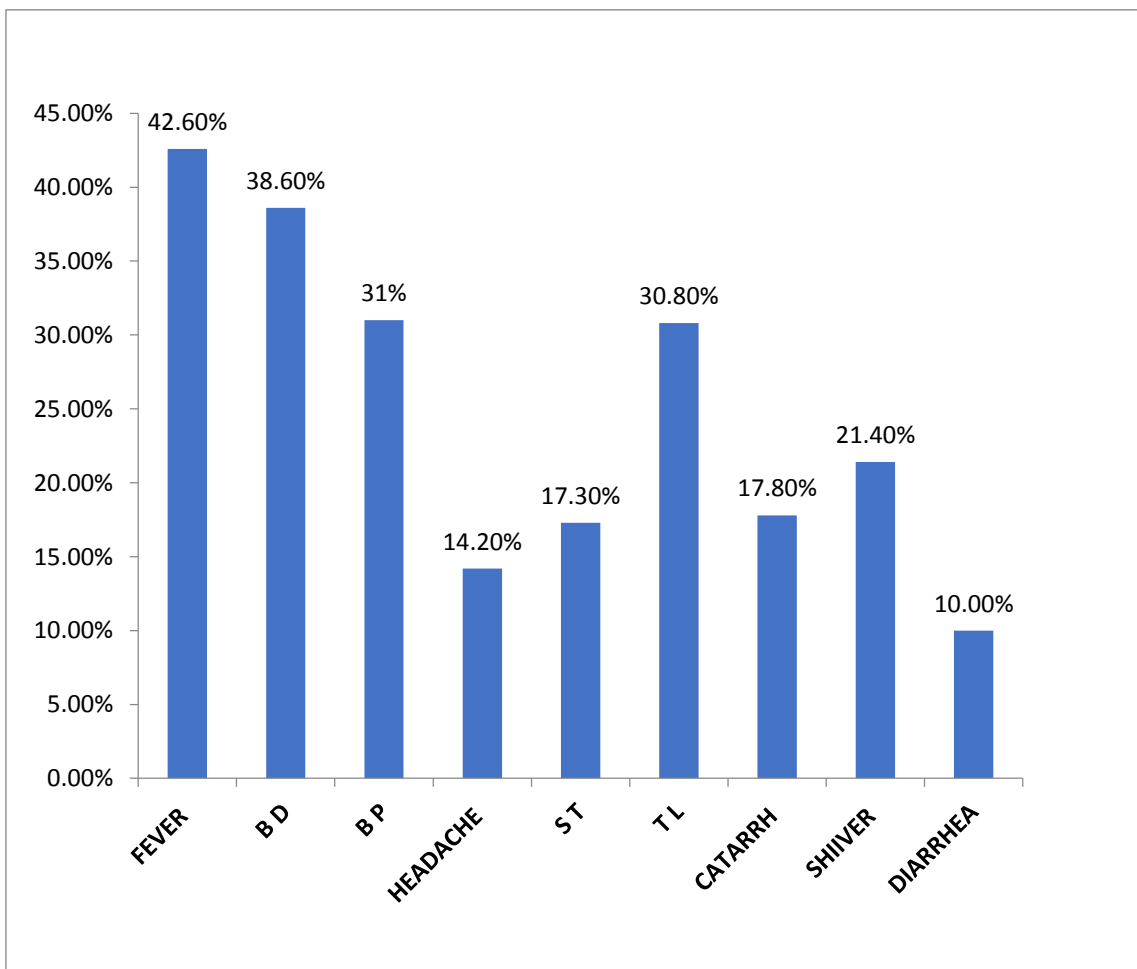


Fig. 2. Reported symptoms associated with COVID-19 among positive subjects

KEYS
 BD – Breathing difficulty
 BP – Body pain
 ST – Sore throat
 TL – Taste loss

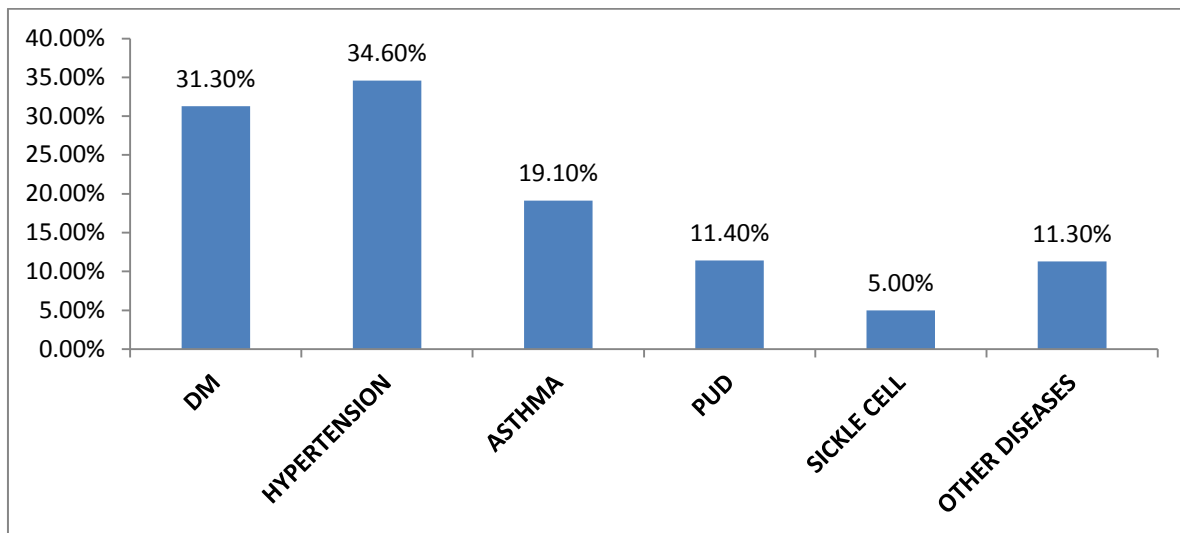


Fig. 3. Comorbidities in individuals with COVID-19 infection

5. DISCUSSION

This study is one of the few to determine the demographic influences as well as comorbidities in COVID-19 infected individuals in a suburban environment in Nigeria. The study established an incidence of 9.5% among the tested population. Although close to a similar study conducted in Lagos in 2021 [19], this incidence seems to be higher than what was reported in the COVID-19 WHO dashboard as at January 2022 [20]. This therefore points to the fact that reported cases may not be truly reflective of the actual situation of the country, hence, a need for more efforts in public enlightenment especially on the need to regularly observe laid down preventive measures as well as getting vaccinated.

Further evaluations of data revealed that there was a significant predominance of positive outcomes as the age category increased, especially among the adults. This pattern of susceptibility among the elderly has also been reported in a study in Europe where it was discovered that of the 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy region, Italy, a great percentage were elderly. Many factors could account for this observation chief of which is the common practice of only getting tested after coming down with severe symptoms which are more likely to occur in the elderly because of their depreciating immune status [21]. There is therefore a need to prioritize screening and vaccination in this group, especially if the country is to curtail the spread of COVID-19.

In this study, level of education has been shown to play a significant role in the outcome of covid-19 test. This shows that patients with no or low level of formal education are more likely to have their tests turned out to be positive. Many individuals in this category especially in developing countries tend to have poor attitude towards the viral infection especially in adopting the necessary preventive measures. This pattern of poor attitude in those with low level of education has also been reported in other studies [22]. This poor attitude or in some cases complete disbelief in the authenticity of the virus leads to many avoid getting tested and will only have to be placed on such when hospitalized with severe symptoms.

Healthcare worker infection with SARS-CoV-2 has been a global source of concern since the onset of the pandemic with alarming prevalence rates of HCW infection. The prevalence of health workers infection in this group of patients tested was 42.9%. This value is higher than both the range of 3% - 19% reported globally [23] and the 9.3% prevalence reported by Elimian et al. (2020) [24], in a descriptive study of COVID-19 from all states in Nigeria. The understanding that Ogun state is one of the high burden states for COVID-19 infection may explain the higher prevalence of healthcare workers' infection above a National average value in this study. As it has been continuously shown that healthcare workers contribute a significant burden of COVID-19 infections there is a drastic need for action to improve and prevent healthcare workers' infections in hospital settings in addition

to improving their infection prevention behavior in the community.

Hypertension and diabetes were observed to be the most common comorbidities among patients that tested to COVID-19 in this study. Similar to our findings, hypertension and diabetes were among the most common comorbidities in China and the US [25,26]. In the same vein, it has been reported in other studies that patients with these comorbidities are more likely to die from COVID-19 [25]. The epidemiological transition in sub-Saharan Africa has resulted in a rise of non-communicable diseases in the presence of longstanding burden of infectious diseases [28]. The burden of hypertension and diabetes in Nigeria is high with national prevalence of 28.9% and 5.77% respectively [29,30]. There are still a lot of undiagnosed cases as a result of lack of awareness and poor health seeking behavior of the population, as a result, many patients present with uncontrolled diseases with attending complications [31]. It is therefore emphatic about these high-risk comorbidities important that public enlightenment should be Persons with hypertension and diabetes should be encouraged to use all recommended protective measures.

6. CONCLUSION

This study has shown age, level of education and occupation as some of the important demographic factors that significantly affects the outcome of SARS-CoV-2. Hypertension and diabetes were the commonest comorbidities among the patient population that tested positive to the virus. Targeted approaches in the areas of tests and enlightenment for certain demographic groups such as those that are elderly and with low level of education is highly recommended.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

There was no ethical considerations because it was a retrospective study using anonymised data.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. World Health Organization. COVID-19 Strategy Update, 14 April 2020. Available: <https://www.who.int/publications-detail/covid-19-strategy-update---14-april-2020>
2. Soares RdCM, Mattos LR, Raposo LM. Risk Factors for Hospitalization and Mortality due to COVID-19 in Espírito Santo State, Brazil. *The American Journal of Tropical Medicine and Hygiene*. 2020;103(3):1184–1190.
3. Bicheng Z, Zhou X, Qiu Y, Song Y, Feng F, Feng J, et al. Clinical characteristics of 82 cases of death from COVID-19. *PLOS ONE*. 2020;15(7):1–13.
4. Al-Najjar H, Al-Rousan N. A classifier prediction model to predict the status of Coronavirus COVID-19 patients in South Korea. *Eur Rev Med Pharmacol Sci*. 2020;24(6):3400–3403. PMID:32271458
5. Barda N, Riesel D, Akriv A, Levy J, Finkel U, Yona G, et al. Developing a COVID-19 mortality risk prediction model when individual-level data are not available. *Nature Communications*. 2020;11(1):4439. PMID:32895375
6. Bello-Chavolla OY, Bahena-López JP, Antonio-Villa NE, Vargas-Vázquez A, González-Díaz A, Márquez-Salinas A, et al. Predicting Mortality Due to SARS-CoV-2: A Mechanistic Score Relating Obesity and Diabetes to COVID-19 Outcomes in Mexico. *The Journal of Clinical Endocrinology & Metabolism*. 2020;105(8):2752–2761. PMID:32474598
7. Colombi D, Bodini FC, Petrini M, Maffi G, Morelli N, Milanese G, et al. Well-aerated

- Lung on Admitting Chest CT to Predict Adverse Outcome in COVID-19 Pneumonia. *Radiology*. 2020;296(2):E86–E96. PMID:32301647
8. Hu H, Yao N, Qiu Y. Comparing Rapid Scoring Systems in Mortality Prediction of Critically Ill Patients With Novel Coronavirus Disease. *Academic Emergency Medicine*. 2020;27(6):461–468. PMID:32311790
 9. Imam Z, Odish F, Gill I, O'Connor D, Armstrong J, Vanood A, et al. Older age and comorbidity are independent mortality predictors in a large cohort of 1305 COVID-19 patients in Michigan, United States. *Journal of Internal Medicine*. 2020. PMID:32498135
 10. Shi Y, Yu X, Zhao H, Wang H, Zhao R, Sheng J. Host susceptibility to severe COVID-19 and establishment of a host risk score: findings of 487 cases outside Wuhan. *Critical Care*. 2020;24(1):108. PMID:32188484
 11. Yan L, Zhang HT, Goncalves J, Xiao Y, Wang M, Guo Y, et al. An interpretable mortality prediction model for COVID-19 patients. *Nature Machine Intelligence*. 2020;2(5):283–288.
 12. Yuan M, Yin W, Tao Z, Tan W, Hu Y. Association of radiologic findings with mortality of patients infected with 2019 novel coronavirus in Wuhan, China. *PLOS ONE*. 2020;15(3):1–10. PMID:32191764
 13. Zhao Z, Chen A, Hou W, Graham JM, Li H, Richman PS, et al. Prediction model and risk scores of ICU admission and mortality in COVID-19. *PLOS ONE*. 2020;15(7):1–14. PMID:32730358
 14. Wang S, Zha Y, Li W, Wu Q, Li X, Niu M, et al. A Fully Automatic Deep Learning System for COVID-19 Diagnostic and Prognostic Analysis. *European Respiratory Journal*; 2020. PMID:32444412
 15. Yue H, Yu Q, Liu C, Huang Y, Jiang Z, Shao C, et al. Machine learning-based CT radiomics method for predicting hospital stay in patients with pneumonia associated with SARS-CoV-2 infection: a multicenter study. *Annals of translational medicine*. 2020;8(14):859–859. PMID:32793703
 16. Liu X, Yue X, Liu F, Wei L, Chu Y, Bao H, et al. Analysis of clinical features and early warning signs in patients with severe COVID-19: A retrospective cohort study. *PLOS ONE*. 2020;15(6):1–12. PMID:32589691
 17. Wynants L, Van Calster B, Collins GS, Riley RD, Heinze G, Schuit E, et al. Prediction models for diagnosis and prognosis of COVID-19 infection: systematic review and critical appraisal. *BMJ*. 2020;369:m1328. DOI: 10.1136/bmj.m1328.
 18. Rivera-Izquierdo M, del Carmen Valero-Ubierna M, R-delAmo JL, Fernandez-Garcia MA, Martinez-Diz S, Tahery-Mahmoud A, et al. Sociodemographic, clinical and laboratory factors on admission associated with COVID-19 mortality in hospitalized patients: A retrospective observational study. *PLOS ONE*. 2020;15(6):1–12. PMID:32584868
 19. Salako AO, Amoo OS, Odubela OO, Osuolale KA, James AB, Oladele DA, Musa AZ, Ige FA, Okwuraiwe AP, Onwuamah CK, Shaibu JO, David AN, Audu RA, Ezechi OC, Odunukwe NN, Salako BL. Prevalence and Clinical Characteristics of Coronavirus Disease 2019 Seen at a Testing Centre in Lagos Nigeria. *West Afr J Med*. 2021;38(1):54-58. PMID: 33463708.
 20. Covid19.who.int. 2022. Nigeria: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data. [online] Available: <<https://covid19.who.int/region/afro/country/ng>> [Accessed 5 January 2022].
 21. World Health Organization. Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19): Interim guidance; 2020 (accessed August 4, 2020). Available:<https://apps.who.int/iris/handle/10665/331299>.
 22. Erfani A, Shahriarirad R, Ranjbar K, Mirahmadizadeh A & Moghadami M. Knowledge, Attitude and Practice toward the Novel Coronavirus (COVID-19) Outbreak: A Population-Based Survey in Iran. [Preprint]. *Bull World Health Organ*. E-pub: 30 March 2020.
 23. Alajmi J, Jeremijenko AM, Abrahama JC, Alishaqa M, Concepciona EG, Butta AA, Abou-Samra, A-B. COVID-19 Infection among Healthcare Workers in a National Healthcare System: The Qatar Experience. *International Journal of Infectious Diseases*. 2020;100:386-389.

24. Elimian KO, Ochu CL, Ilori E, Oladejo J, Igumbor E, Steinhardt L, Wagai J, et al. Descriptive Epidemiology of Coronavirus Disease 2019 in Nigeria, 27 February-6 June 2020. *Epidemiology and Infection*. 2020;148:e208.
25. 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 May 14; 55(5):2000547
26. 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):2052–2059.
27. 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
28. National Research Council. The Continuing Epidemiological Transition in subSaharan Africa: A Workshop Summary. Thomas J. Plewes and Kevin Kinsella, Rapporteurs. Committee on National Population, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press; 2012.
29. Adeloye D, Basquill C, Aderemi AV, Thompson JY, Obi FA. An estimate of the prevalence of hypertension in Nigeria. *J Hypertens*. 2015;33(2):230–242.
30. Uloko AE, Musa BM, Ramalan MA, Gezawa ID, Puepet FH, Uloko AT, et al. Prevalence and Risk Factors for Diabetes Mellitus in Nigeria: A Systematic Review and Meta-Analysis. *Diabetes Ther*. 2018; 9(3):1307–1316.
31. Vincent-Onabajo G, Mohammad HS, Umeonwuka C. Prevalence of undiagnosed hypertension among a cohort of university workers in Nigeria. *Int J Community Med Public Health*. 2016;3(7): 1963–1967.

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