Demographic and Public Health Characteristics of COVID-19 Mortality Cases in Rivers State, Nigeria – A Retrospective Cohort Study

ABSTRACT

Introduction:COVID-19 has accounted for approximately six million deaths globally. Several risk factors have been identified. However, the population profile varies in different population groups.The study'saim is to describe the population profile of COVID-19 mortality in Rivers State, Nigeria using captured population-based health records.

Methods: Using electronic State Health Records, secondary data analysis was conducted on recorded COVID-19 mortality. Data were obtained from the Public Health Emergency Operations Centre (PHEOC) at the State Ministry of Health. Data wereaccessed from the PHEOCdatabase, and it included COVID-19 related mortality. Data were collected on demographics, pre-existing comorbidity, symptoms, facility managed, patient status, treatment outcome, and dates of related events. Cohort characteristics were described using means and proportions.

Results: There were191 COVID-19 deaths identified. The mean age was 57.08, of which 144 were male (75.4%). The 51–65-year age group had the highest mortality count (38.9%). Over 50% of the patients were hypertensive, and diabetes was the second most common comrbidity (28.8%). Running nose, cough, fever and breathing difficulties were the most reported COVID-19 symptoms.

Conclusion: Findings from this study show higher mortality in men from COVID-19; and, among cases with hypertension and diabetes. Additionally, age and the presence of comorbidities may be associated with COVID-19 mortality. Future research in this area could further explain these findings.

Keywords: Health Records, COVID-19, coronavirus, Mortality, Population health

INTRODUCTION

The World Health Organization declared the Coronavirus disease 2019 (COVID-19) a pandemic in March 2020 [1]. As ofFebruary 2022, over 400 million confirmed cases and approximately six million deaths have been attributed to the COVID-19 virus[2]. Nigeria has recorded more than 250,000 confirmed cases and above 3,000 deaths[3]; with the initial case confirmed in February 2020[4]. Rivers State is one of the major commercial hubs in Nigeria. The index case in Rivers State was identified in March 2020; subsequently, thereare 16,509 confirmed cases and 154 deaths reported in Rivers State. The state ranks third in the number of cases by states in Nigeria[3].

COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and can infect a wide range of cells and systems in the body. It is most known for affecting the upper respiratory tract (sinuses, nose, and throat) and the lower respiratory tract (windpipe and lungs) [5]. Symptoms of the disease vary amongst individuals[6], but fever[7], headache[8], fatigue[9], cough, breathing difficulties, loss of smell and taste[10-12] are the most commonly reported. Age, gender, and co-morbidities like diabetes, hypertension, cardiovascular and respiratory diseases amongst others are factors that can increase the risk of COVID-19 infection in a host [13] and affect the prognosis [14].Risk factors attributed to disease severity were age above 65 years[15], male gender[16, 17], obesity[18], pre-existing comorbidities[18, 19] and longer waiting time to hospital admission[16, 20]. The symptoms: fever above 38.5°C, and dyspnoea were also associated with severe disease progression[15, 21].

Identifyingfactors that increase the risk of COVID-19 death is vital to ensuring that patients with a positive Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)test can be provided with augmented preventive and therapeutic interventions. Our objective therefore, was to describe the population profile of COVID-19mortalityin Rivers State, Nigeria using captured population-basedhealth records.

METHODS

Study area

The study was conducted in Rivers State; one of the 36 states in Nigeria. It isin the South-South geopolitical zone of Nigeria.Rivers Statehas a projected population of 7,303,924 for 2016, making it the sixth-most populous state in the country[22].At the inception of the COVID-19 pandemic, Rivers State had 12 isolation centres; 50% of which were publicly owned and managed.

Study design and population

A retrospective cohort study was conducted using deidentified COVID-19 patients record data. The data extraction began on the 24th of March 2020 being the first reported and recorded COVID-19 death and ended on the 15th of February, 2022.The cohort included all patients who died ofCOVID-19 related causes and explored the epidemiological characteristics of mortality casesin this population.The Rivers State Ministry of Health Research Ethics Committee and the Public Health Emergency Operations Centre approved the study. The individual informed consent requirement was waived for the secondary analysis of deidentified data.

DataSource

Data for the current study were obtained from the Rivers State Public Health Emergency Operations Centre (PHEOC) data center at the Rivers State Ministry of Health. The data were reported fromhealth facilities, public and private-owned isolation centres, offshore platforms,home management,and results of post-mortem examination. The dataset extends to 112columns of structured data characterisingdemographics, pre-existing comorbidities, symptoms, facility managed, patient status, treatment outcome, and dates of related events.The COVID-19 outcome – mortality defined as ‘deceased’ or ‘dead’was the basis of retrieval of patients’ information from the

dataset; alongsideinformation on age, sex, pre-existing comorbidities, symptoms present at diagnosis, date of health events –the first symptoms, diagnosis, facility managed,case classification defined as 'symptomatic or asymptomatic', late presentation amongst symptomatic individuals equally categorised as 'diagnosis greater than 2 days after symptom onset',and death.

COVID-19 Diagnosis

All COVID-19 diagnoses were based on a positive SARS-CoV-2 polymerase chain reaction test (PCR). Testing was available for all populace with or without COVID-19 symptoms. Hospital admissions and all deaths in SARS-CoV-2–positive cases are recorded and reviewed daily.

Outcome

The outcome of interest was mortality amongst people with confirmed COVID-19, ascertained from the COVID-19 patient database.

Statistical Analysis

To summarise the variables in the datasets, means and standard deviations were used for continuous variables; and categorised variables were analysed using counts and proportions.Descriptive statistics were conducted using IBM SPPS Statistics version 25.0 [23]. Microsoft Excel 365 [24]was used to develop charts.

RESULTS

Patient Characteristics

There were191 COVID-19 deaths identified.The mean age was 57.08; of which 144 were males. 139 patients were treated in a COVID-19 isolation facility; with 126 patients admitted in a publicly owned facility. A total of 128 were symptomatic, with 55 (28.8%) reporting no comorbidity. Over 50% of the patients were hypertensive. Running nose, cough, fever and breathing difficulties were the most reported symptoms. Other symptoms reported at time of diagnosis included acute respiratory distress, SpO_2< 50%, anorexia, headache, muscle pain and poor appetite. From the available data, the average interval between symptom onset and diagnosis was 3.77 ± 5.10 and average interval between symptom onset and death was 9.17 ± 7.41. 60.2% of patients were diagnosed late. Demographics and characteristics of the patients can be found in Table 1. The age group (51–65) had the highest mortality count, (39.8%). Figures 1 is a histogram depicting the mortality distribution by age; figure 2 shows the total mortality proportionandcategorises it by age group andsex, respectively.Figures 3 and 4 summarisespre-existing co-morbidities and reported symptoms correspondingly.Figure 5 describes the total number of persons tested for COVID-19; confirmed cases and deathsas reported by the[3].Unfinished sentence

DISCUSSION

This study characterisedthe population profile for COVID-19 mortality in Rivers State, Nigeria. Results showed that COVID-19 burden is more prevalent in the male gender, which made up 75% of the study population. Mortality in the male population was three times higher compared to the female population in the current study. Furthermore, age, in this case, 51–65 years, and the presence of comorbidities (hypertension and diabetes) were commonly reported in cases of COVID-19 mortality. Sixty-two per cent of the study population had at least one pre-existing comorbidity

with 53.9% of participants hypertensive and 28.8% diabetic. Prior research puts the prevalence of hypertension and diabetes in Nigeria at 45%[25] and 4.3% [26], respectively. The gender and comorbidity results from this study are consistent with currentevidence, which shows that males have a higher risk of death from COVID-19 [27]. One review described how COVID-19 may be gender sensitive with clinical outcomes demonstrating that males suffer both higher severity and mortality for COVID-19 infection than females[28]. Furthermore, hypertension, diabetes and coronary heart disease are the most commonly reported comorbidities associated with COVID-19[29].Even though our study showed that the 51–65 age group was the most affected, the result is contrary to prevailing evidence of higher ages being more at risk of mortality [30, 31]. A possible explanation to this observation could be that 51–65 age group possiblyrepresentsthe extreme range of aged persons in the region; considering the life expectancy in Nigeria is 55 years [32].Further research is essential to determine risk or prove association in this age group.

Symptoms associated with COVID-19 have been shown to vary. Our study showed that the three most prevalently reported symptoms are runny nose, cough, and sore throat. These results align with evidence from the [33] as commonly reported symptoms.?Genomic studies of variants wereunfeasible at the time of the study; hence, the inability to determine if the symptoms were characteristic of a particular COVID-19 variant.

A case fatality rate, CFR, of 1.47% from the current study is similar to country –Sierra Leone, CFR =1.63%[34], city –Hong Kong, CFR =1.18% [35],and states–Washington CFR = 0.8% [36] and Arizona, CFR =1.3% [37] of similar population size[38, 39]. These rates rank lower in terms of mortality compared to other common diseases in the study area (World Health Rankings, 2022). However, the COVID-19 testing capacity is an important factor to consider; the total cases tested (370,358) represents a meagre 5% of the total population using the [22] projected population figures. In this study it is undecipherable if the rates are attributable to the non-severity of COVID-19 in the region or low detection of cases. Also, it is notable that the total COVID-related deaths in this study exceeds

the national data, the additional casesarebecause of a more detailed retrospective case search.Thisstudy,therefore, adds to the evidence base on the clinical profile of COVID-19 mortality across the globe from a Nigerian population perspective. A study comparing expected deaths before and during the region's pandemic would indicate the excess deaths attributable to COVID-19 in the region.

CONCLUSIONS

In conclusion, data from this study showa higher mortality burden in men from COVID-19;and, among cases with hypertension and diabetes. The presence of the preceding listed comorbiditiesand age group (50–65) might be associated with COVID-19 mortality in the region. Future researchin this areacould further explain these findings. As a result, COVID-19 surveillance needs to be ramped up in the region to ensure that these people at risk receive required healthcare services promptly.

Limitations

The study relied on secondary data, therefore is susceptible to data bias. A comparative study utilising data on all positive cases of COVID-19 would give more information on correlation with risk factors.

What is already know on this topic

- Men and persons with comorbidities have a higher burden of mortality from COVID-19
- Older aged individuals, 65 years and above are more at risk of disease severity and mortalityfrom COVID-19

What this study adds

- The total COVID-related deaths in this study exceeds the national data for the region, the additional cases are because of a more detailed retrospective case search.
- The three most prevalently reported symptoms in the study region are runny nose, cough, and sore throat.
- The mean age of mortality cases was 57 years, and the 51–65 age group was the most affected.

DECLARATIONS

Ethics Approval and *Consent To Participate*

Ethical approval to conduct the study was obtained from the Ethics Committee of the Rivers State Ministry of Health –Ethics ID: MH/PRS/391/VOL.2/817. The study was conducted according to the guidelines of the Declaration of Helsinki. Paricipants' consent was not required as the study utilised secondary data without personal identifiers.

TABLES AND FIGURES

Table 1. Demographic and clinical characteristics of COVID-19 mortality cases (n = 191)

Figure 1. Mortality distribution by age

Figure 2. The proportion of deaths by age groups and sex

Figure 3. The distribution of pre-existing comorbidities

Figure 4. The distribution of reported symptoms

Figure 5. Summary of cases in Rivers State as of 15th February 2022 [3]

REFERENCES

1. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19-11 March 2020 Geneva, Switzerland2020.
2. Worldometer. COVID Live - Coronavirus Statistics - Worldometer

2022 [updated 2022/02/25/]. Available from: https://www.worldometers.info/coronavirus.
3. Nigeria Centre for Disease Control. NCDC Coronavirus COVID-19 Microsite 2022 [updated 2022/02/16/]. Available from: http://covid19.ncdc.gov.ng.
4. Nigeria Centre for Disease Control. Nigeria Centre for Disease Control 2021 [updated 2021/12/16/]. Available from: https://ncdc.gov.ng/news/227/first-case-of-corona-virus-disease-confirmed-in-nigeria.
5. Harrison AG, Lin T, Wang P. Mechanisms of SARS-CoV-2 Transmission and Pathogenesis. Trends Immunol. 2020;41(12):1100-15. PubMed PMID: 33132005. Epub 2020/10/14. eng.https://pubmed.ncbi.nlm.nih.gov/33132005

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7556779/
6. World Health Organisation. Coronavirus. World Health Organization: WHO. 2020 2020/01/10/. English.https://www.who.int/health-topics/coronavirus#tab=tab_3
7. Islam MA, Kundu S, Alam SS, Hossan T, Kamal MA, Hassan R. Prevalence and characteristics of fever in adult and paediatric patients with coronavirus disease 2019 (COVID-19): A systematic review and meta-analysis of 17515 patients. PLOS ONE. 2021;16(4):e0249788.https://doi.org/10.1371/journal.pone.0249788
8. Islam MA, Alam SS, Kundu S, Hossan T, Kamal MA, Cavestro C. Prevalence of Headache in Patients With Coronavirus Disease 2019 (COVID-19): A Systematic Review and Meta-Analysis of 14,275 Patients. Frontiers in neurology. 2020;11:562634-. PubMed PMID: 33329305. eng.https://pubmed.ncbi.nlm.nih.gov/33329305

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7728918/
9. Mahase E. Covid-19: Sore throat, fatigue, and myalgia are more common with new UK variant. BMJ. 2021;372:n288.https://www.bmj.com/content/bmj/372/bmj.n288.full.pdf
10. Saniasiaya J, Islam MA, Abdullah B. Prevalence of Olfactory Dysfunction in Coronavirus Disease 2019 (COVID-19): A Meta-analysis of 27,492 Patients. The Laryngoscope. 2021;131(4):865-78. PubMed PMID: 33219539. Epub 2020/12/05. eng.https://pubmed.ncbi.nlm.nih.gov/33219539

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7753439/
11. Agyeman AA, Chin KL, Landersdorfer CB, Liew D, Ofori-Asenso R. Smell and Taste Dysfunction in Patients With COVID-19: A Systematic Review and Meta-analysis. Mayo Clinic proceedings. 2020;95(8):1621-31. PubMed PMID: 32753137. Epub 2020/06/06. eng.https://pubmed.ncbi.nlm.nih.gov/32753137

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7275152/
12. Whitcroft KL, Hummel T. Olfactory dysfunction in COVID-19: diagnosis and management. Jama. 2020;323(24):2512-4.
13. Rashedi J, Mahdavi Poor B, Asgharzadeh V, Pourostadi M, Samadi Kafil H, Vegari A, et al. Risk factors for COVID-19. Infez Med. 2020;28(4):469-74.
14. 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. Journal of Infection. 2020 2020/08/01/;81(2):e16-e25.https://www.sciencedirect.com/science/article/pii/S0163445320302346
15. Chen R, Liang W, Jiang M, Guan W, Zhan C, Wang T, et al. Risk Factors of Fatal Outcome in Hospitalized Subjects With Coronavirus Disease 2019 From a Nationwide Analysis in China. Chest. 2020 2020/07/01/;158(1):97–105. English.https://journal.chestnet.org/article/S0012-3692(20)30710-8/fulltext
16. Cao M, Zhang D, Wang Y, Lu Y, Zhu X, Li Y, et al. Clinical features of patients infected with the 2019 novel coronavirus (COVID-19) in Shanghai, China. MedRxiv. 2020.
17. Jin J-M, Bai P, He W, Liu S, Wu F, Liu X-F, et al. Higher severity and mortality in male patients with COVID-19 independent of age and susceptibility. MedRxiv. 2020. pages
18. Simonnet A, Chetboun M, Poissy J, Raverdy V, Noulette J, Duhamel A, et al. High Prevalence of Obesity in Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) Requiring Invasive Mechanical Ventilation. Obesity. 2020;28(7):1195-9.https://onlinelibrary.wiley.com/doi/abs/10.1002/oby.22831
19. Ma K-L, Liu Z-H, Cao C-f, Liu M-K, Liao J, Zou J-B, et al. COVID-19 Myocarditis and Severity Factorsï¼ An Adult Cohort Study. 2020.
20. Feng Z, Yu Q, Yao S, Luo L, Zhou W, Mao X, et al. Early prediction of disease progression in COVID-19 pneumonia patients with chest CT and clinical characteristics. Nature communications. 2020;11(1):1-9.
21. Gao Y-d, Ding M, Dong X, Zhang J-j, Kursat Azkur A, Azkur D, et al. Risk factors for severe and critically ill COVID-19 patients: A review. Allergy. 2021;76(2):428-55.https://onlinelibrary.wiley.com/doi/abs/10.1111/all.14657
22. National Bureau of Statistics. Nigeria Projected Population 2006-2016. 2016.
23. IBM Corporation. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.; 2017

24. Microsoft Corporation. Microsoft Excel 365. 2022.https://www.office.com/launch/excel?auth=1
25. Akinlua JT, Meakin R, Umar AM, Freemantle N. Current Prevalence Pattern of Hypertension in Nigeria: A Systematic Review. PLoS One. 2015;10(10):e0140021. PubMed PMID: 26461923. Pubmed Central PMCID: PMC4603956. Epub 2015/10/16. eng
26. World Health Organisation. Diabetes: Country Profile -Nigeria. 2016 2022/01/28/. Report No.
27. Kelada M, Anto A, Dave K, Saleh SN. The Role of Sex in the Risk of Mortality From COVID-19 Amongst Adult Patients: A Systematic Review. Cureus. 2020 Aug 29;12(8):e10114. PubMed PMID: 33005531. Pubmed Central PMCID: PMC7523740. Epub 2020/10/03. eng
28. Mukherjee S, Pahan K. Is COVID-19 Gender-sensitive? J Neuroimmune Pharmacol. 2021 Mar;16(1):38-47. PubMed PMID: 33405098. Pubmed Central PMCID: PMC7786186. Epub 2021/01/07. eng
29. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020 Mar 28;395(10229):1054-62. PubMed PMID: 32171076. Pubmed Central PMCID: PMC7270627. Epub 2020/03/15. eng
30. Center for Disease Control. Cases, Data, and Surveillance 2022 [updated 2022/01/31/]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html.
31. Yanez ND, Weiss NS, Romand J-A, Treggiari MM. COVID-19 mortality risk for older men and women. BMC Public Health. 2020 2020/11/19;20(1):1742.https://doi.org/10.1186/s12889-020-09826-8
32. World Bank Data Bank. Life expectancy at birth, total (years) - Nigeria | Data 2022 [updated 2022/02/15/]. Available from: https://data.worldbank.org/indicator/SP.DYN.LE00.IN?locations=NG.
33. Center for Disease Control. Coronavirus Disease 2019 (COVID-19) – Symptoms 2022 [updated 2022/01/04/]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html.
34. Worldometer. Sierra Leone COVID - Coronavirus Statistics - 2022 [updated 2022/02/16/]. Available from: https://www.worldometers.info/coronavirus/country/sierra-leone.
35. Government of Hong Kong. Latest Situation of Novel Coronavirus Infection in Hong Kong 2020 [updated 2020/09/02/]. Available from: https://chp-dashboard.geodata.gov.hk/covid-19/en.html.
36. USA Facts. Washington coronavirus cases and deaths 2022 [updated 2022/02/16/]. Available from: https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/washington.
37. USA Facts. Arizona coronavirus cases and deaths 2022 [updated 2022/02/16/]. Available from: https://usafacts.org/visualizations/coronavirus-covid-19-spread-map/state/arizona.
38. Worldometer. Population by Country (2022) 2022 [updated 2022/02/16/]. Available from: https://www.worldometers.info/world-population/population-by-country.
39. Kershner E. The 50 US States Ranked By Population. WorldAtlas. 2020 2020/06/12/. English.https://www.worldatlas.com/articles/us-states-by-population.html

TABLE 1.

Table 1. Demographic and clinical characteristics of COVID-19 mortality cases (n = 191)

Variable	n (%)		
	Total	**Male**	**Female**
Mortality	191 (100)	144 (75.4)	47 (24.6)
Age	57.08 ± 15.33*	56.29 ± 15.95*	59.49 ± 13.10*
Facility			
Isolation centre	139 (72.8)	102 (53.4)	37 (19.4)
Public	*126 (90.65)*	*92 (48.2)*	*34 (17.8)*
Private	*13 (9.35)*	*10 (5.2)*	*3 (1.6)*
Non-Isolation centre	52 (27.2)	42 (22)	10 (5.2)
Number of Co-morbidities			
None	55 (28.8)	42 (24.3)	13 (7.5)
At least one	118 (61.8)	86 (49.7)	32 (18.5)
Nonresponse/Incomplete data	18 (9.4)		
Pre-Existing Comorbidity			
Hypertension	103 (53.9)	75 (39.3)	28 (14.7)
Diabetes	55 (28.8)	40 (20.9)	15 (7.9)
Asthma	5 (2.6)	3 (1.6)	2 (1)
Malignancies	1 (0.5)	0 (0)	1 (0.5)
Obesity	8 (4.2)	5 (2.6)	3 (1.6)
Case class			
Asymptomatic	63 (33)	47 (24.6)	16 (8.4)
Symptomatic	128 (67)	97 (50.8)	31 (16.2)
Symptoms			
Runny Nose	66 (34.6)	50 (26.2)	16 (8.4)
Cough	65 (34)	48 (25.1)	17 (8.9)

Breathing Difficulties	49 (25.7)	37 (19.4)	12 (6.3)
Fever	50 (26.2)	39 (20.4)	11 (5.8)
Sore Throat	31 (16.2)	23 (12)	8 (4.2)
Ageusia	18 (9.4)	14 (7.3)	4 (2.1)
Anosmia	16 (8.4)	12 (6.3)	4 (2.1)
Vomiting	13 (6.8)	10 (5.2)	3 (1.6)
Nausea	12 (6.3)	9 (4.7)	3 (1.6)
Fatigue	9 (4.7)	7 (3.7)	2 (1)
Diarrhoea	8 (4.2)	3 (1.6)	5 (2.6)
Chest Pain	5 (2.6)	4 (2.1)	1 (0.5)
Chills	2 (1)	1 (0.5)	1 (0.5)
Headache	2 (1)	2 (1)	0 (0)
Acute respiratory distress, SpO2 < 50%	2 (1)	2 (1)	0 (0)
Anorexia	1 (0.5)	1 (0.5)	0 (0)
Muscle pain	1 (0.5)	1 (0.5)	0 (0)
Poor appetite	1 (0.5)	1 (0.5)	0 (0)
Late presentation	113 (59.8)	86 (45.5)	27 (14.3)
Intervals (days)			
Symptom onset and diagnosis	3.77 ± 5.10*	3.42 ± 5.19*	2.26 ± 3.67*
Symptom onset and death	9.17 ± 7.41*	9.68 ± 7.72*	7.55 ± 6.28*

***Mean ± SD; Case fatality rate = 1.16%**

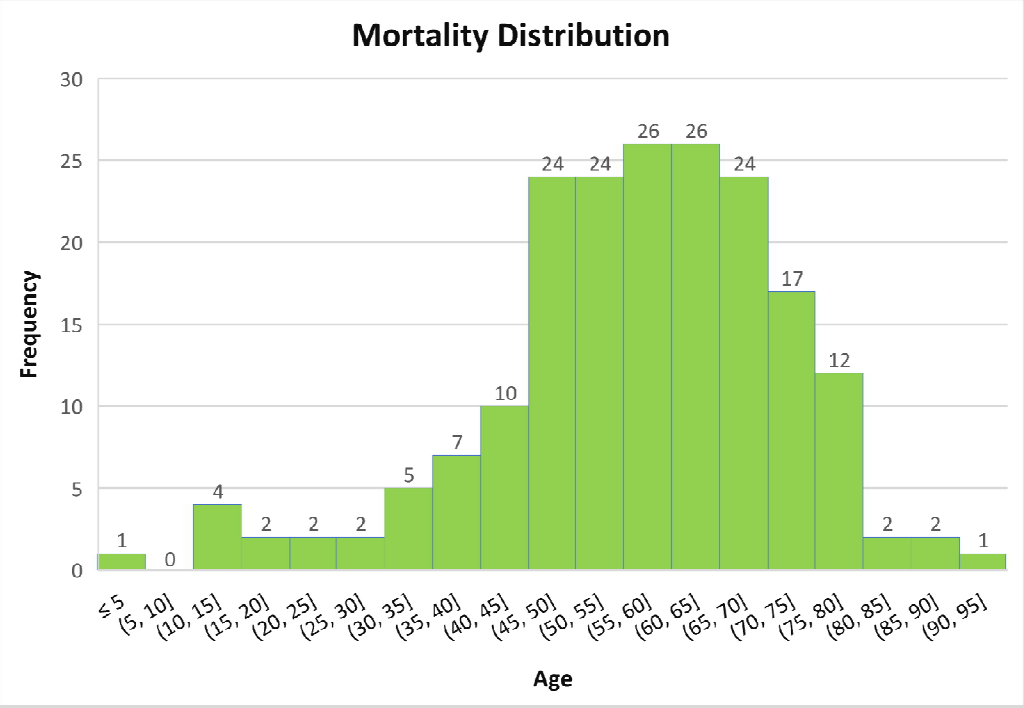


Figure 1. Mortality distribution by age

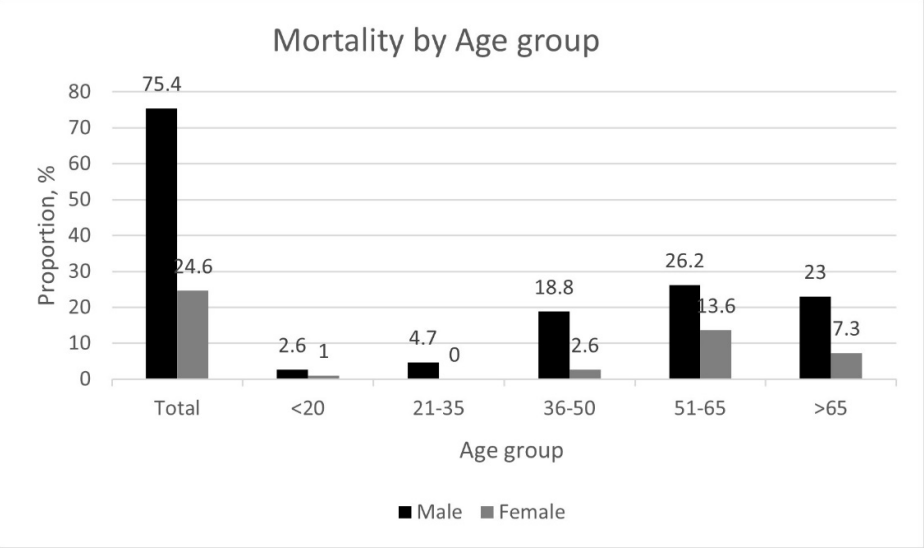


Figure 2. The proportion of deaths by age groups and sex

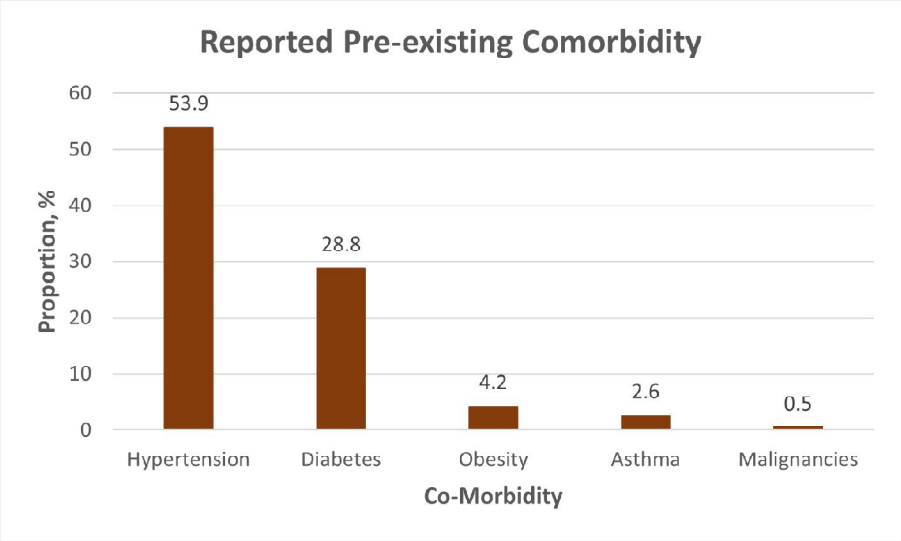


Figure 3. The distribution of pre-existing comorbidities

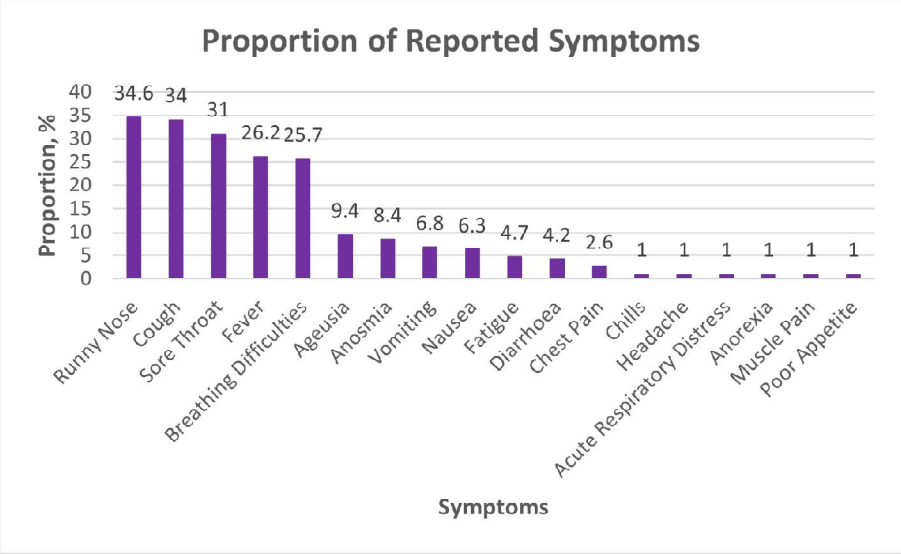
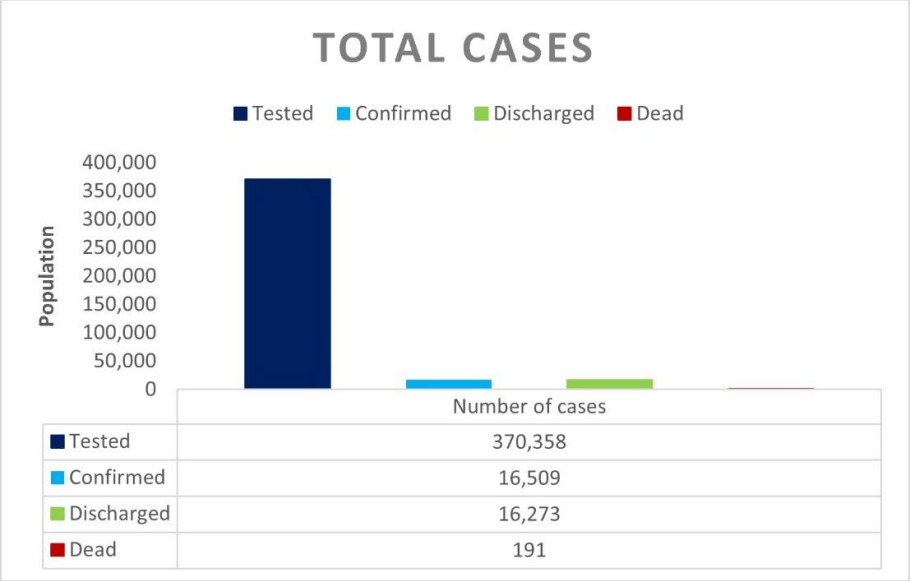


Figure 4. The distribution of reported symptoms



	Number of cases
Tested	370,358
Confirmed	16,509
Discharged	16,273
Dead	191

Figure 5. Summary of cases in Rivers State as of 15th February 2022 [3]