Asian Journal of Research in Infectious Diseases

Volume 12, Issue 3, Page 52-61, 2023; Article no.AJRID.96894
ISSN: 2582-3221

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

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Authors' contributions

This work was carried out in collaboration among all authors. Authors FP, GO and GA did the conceptualization. Authors CEE and GO performed the methodology. Authors FP, GA, CEE and NI did data collection. Authors CEE and EI did the formal analysis and wrote the original draft of the manuscript. Authors FP, CEE, EI, IDW and GO wrote, reviewed and edited the manuscript. Authors CEE, EI and GO did the data visualization. Authors GO and IN supervised the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJRID/2023/v12i3248

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/96894

Original Research Article

Received: 28/12/2022
Accepted: 01/03/2023
Published: 02/03/2023

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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's aim 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, Rivers State. Data were accessed from the PHEOC database, 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 were 191 COVID-19 deaths identified. The mean age was 57.08 years, 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: This study found that COVID-19 was responsible for a greater mortality increase in men and that the prevalence of hypertension and diabetes was higher in these individuals. 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.

1. INTRODUCTION

The World Health Organization declared the Coronavirus disease 2019 (COVID-19) a pandemic in March 2020 [1]. As of February 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, there are 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].

Identifying factors 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-19 mortality in Rivers State, Nigeria using captured population-based health records.

2. METHODS

2.1 Study Area

The study was conducted in Rivers State; one of the 36 states in Nigeria. It is in the South-South geopolitical zone of Nigeria. Rivers State has 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.

2.2 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 of COVID-19 related causes and explored the epidemiological characteristics of mortality cases in this population. The Rivers State Ministry of Health Research Ethics Committee and the Public Health Emergency Operations Centre approved the study. For the secondary examination of anonymous data, we did not need individual consent.

2.3 Data Source

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 from health facilities, public and private-owned isolation centres, offshore platforms, home management, and results of post-mortem examination. The dataset extends to 112 columns of structured data characterising demographics, 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; alongside information 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.

2.4 COVID-19 Diagnosis

All COVID-19 diagnoses were based on a positive SARS-CoV-2 polymerase chain reaction test (PCR) [12]. 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.

2.5 Outcome

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

2.6 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.

3. RESULTS

3.1 Patient Characteristics

There were 191 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 days and average interval between symptom onset and death was 9.17 ± 7.41 days. More than half (60.2%) of patients were diagnosed late. Demographics and characteristics of the patients can be found in Table 1. The age group (51–65) years had the highest mortality count, (39.8%). Fig. 1 is a histogram depicting the mortality distribution by age, with the most mortality observed among those between 55 to 80 years; Fig. 2 shows the total mortality proportion and categorises it by age group and sex, respectively. Figs. 3 showed that Hypertension was reported as the most pre-existing comormidity (53.9%), followed by Diabetes (28.8%). Fig. 4 summarises reported symptoms correspondingly, were runny nose (36.6%), cough (34), sore throat (31%), and fever (26.2%) were the most recorded. Fig. 5 describes the total number of persons tested for COVID-19, with the total tested to be 370,358 and the confirmed 16,509 as at 15th February 2022 [3].

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%*

4. DISCUSSION

This study characterised the 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 current evidence, which shows that males have a higher risk of death from COVID-19 [27,28]. 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 [29]. Furthermore, hypertension, diabetes and coronary heart disease are the most commonly reported comorbidities associated with COVID-19 [30]. 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 [31,32]. A possible explanation to this observation could be that 51–65 age group possibly represents the extreme range of aged persons in the region; considering the life expectancy in Nigeria is 55 years [33]. 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 Centre for Health and Developmene (CDC) [34]. Genomic studies of variants were unfeasible 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% [**35**], city –Hong Kong, CFR =1.18% [**36**], and states –Washington CFR = 0.8% [**37**] and Arizona, CFR =1.3% [**38**] of similar population size [**39,40**]. 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 cases are because of a more detailed retrospective case search. This study, therefore, adds to the evidence base on the clinical profile of COVID-19 mortality across the globe from a Nigerian population perspective [41]. A study comparing expected deaths before and during the region's pandemic would indicate the excess deaths attributable to COVID-19 in the region.

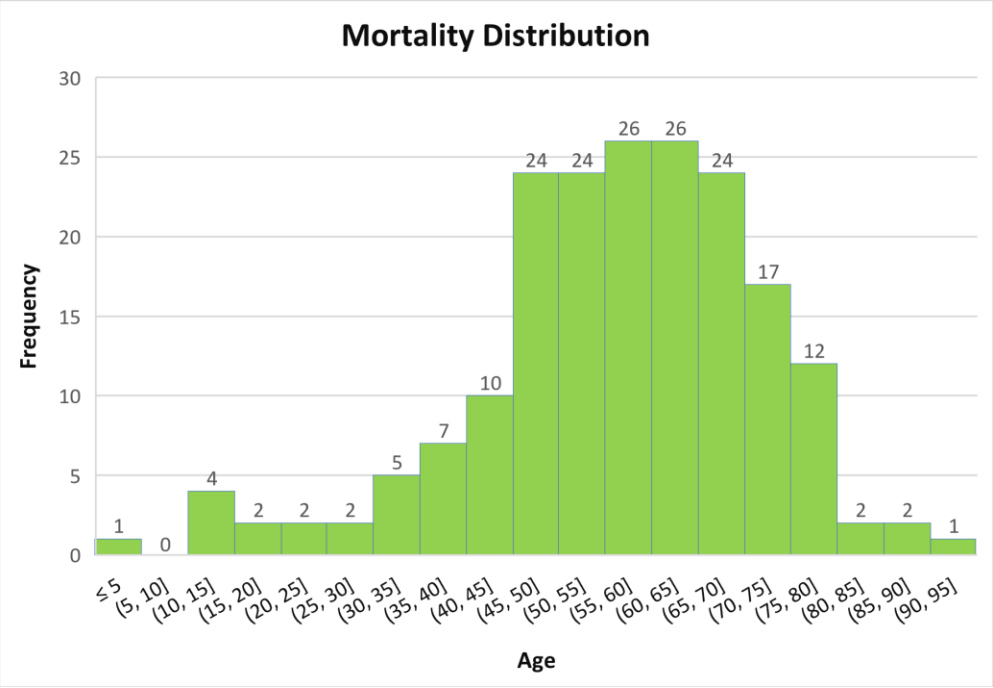

Fig. 1. Mortality distribution by age

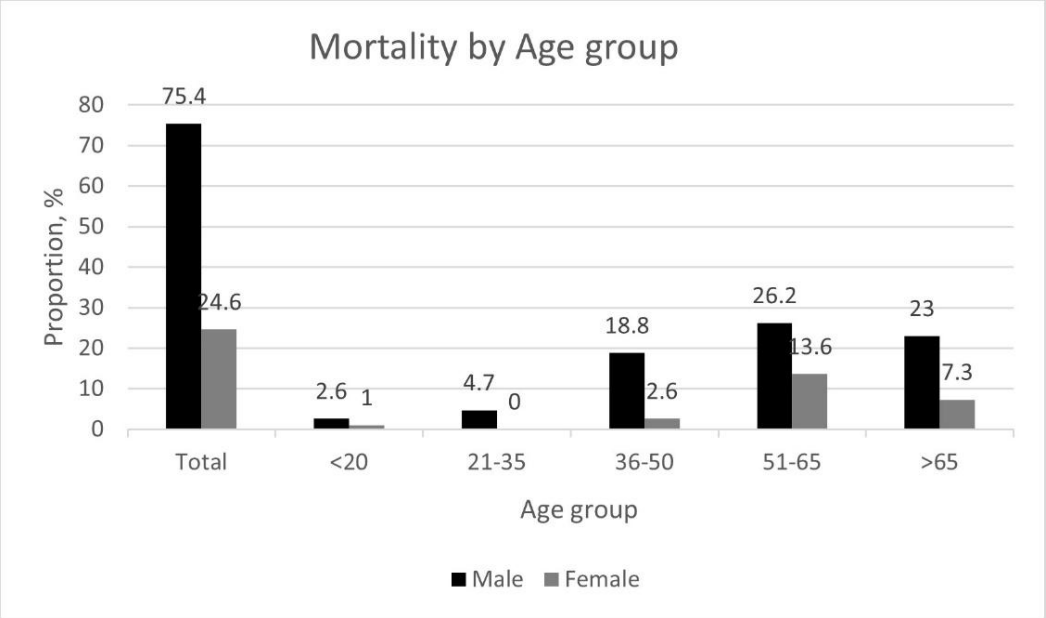

Fig. 2. The proportion of deaths by age groups and sex

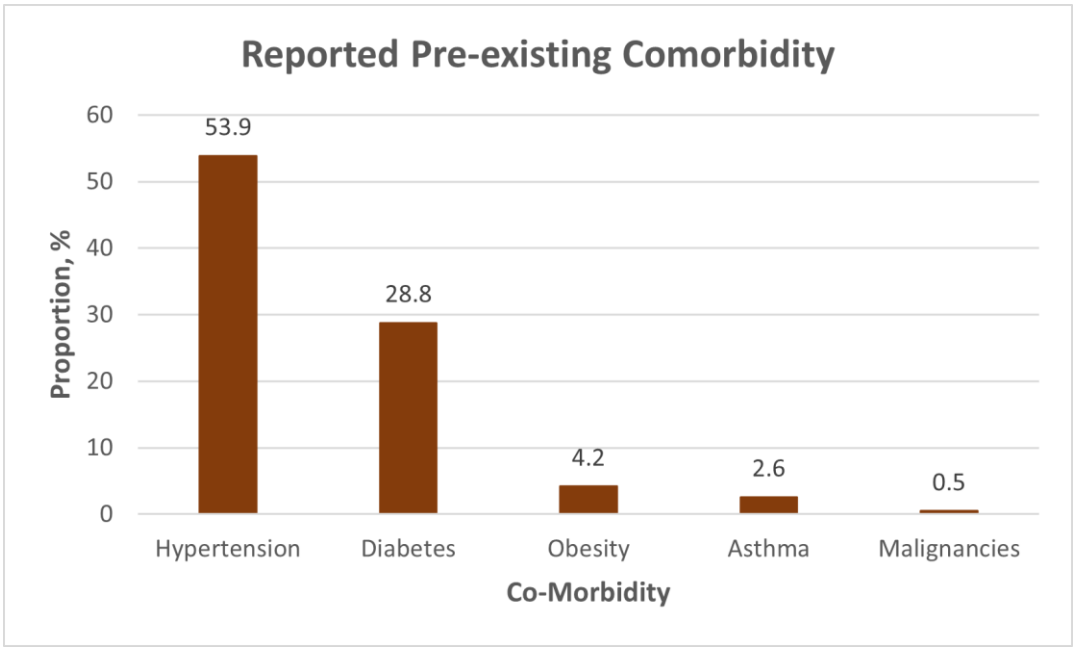

Fig. 3. The distribution of pre-existing comorbidities

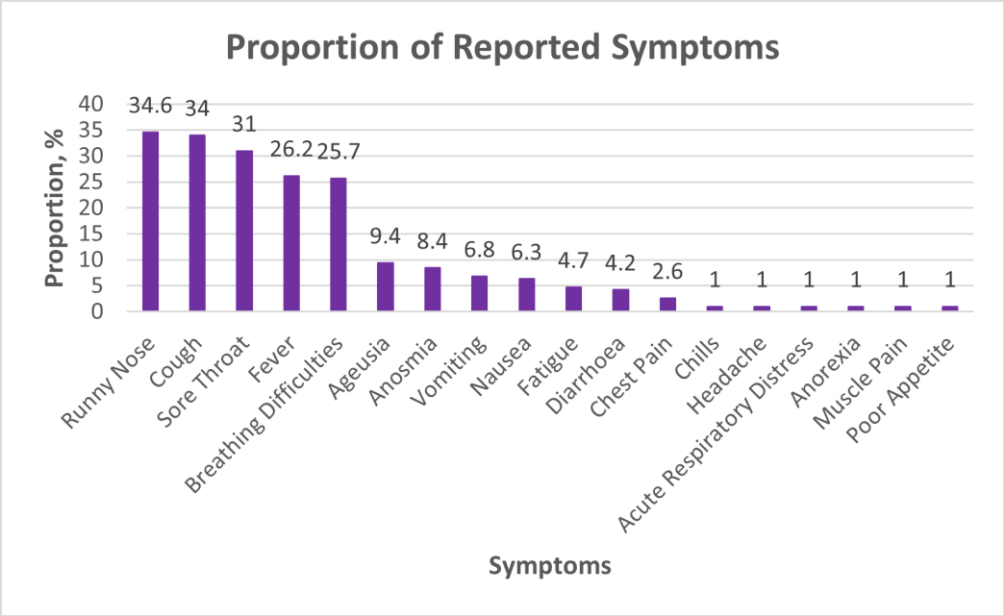

Fig. 4. The distribution of reported symptoms

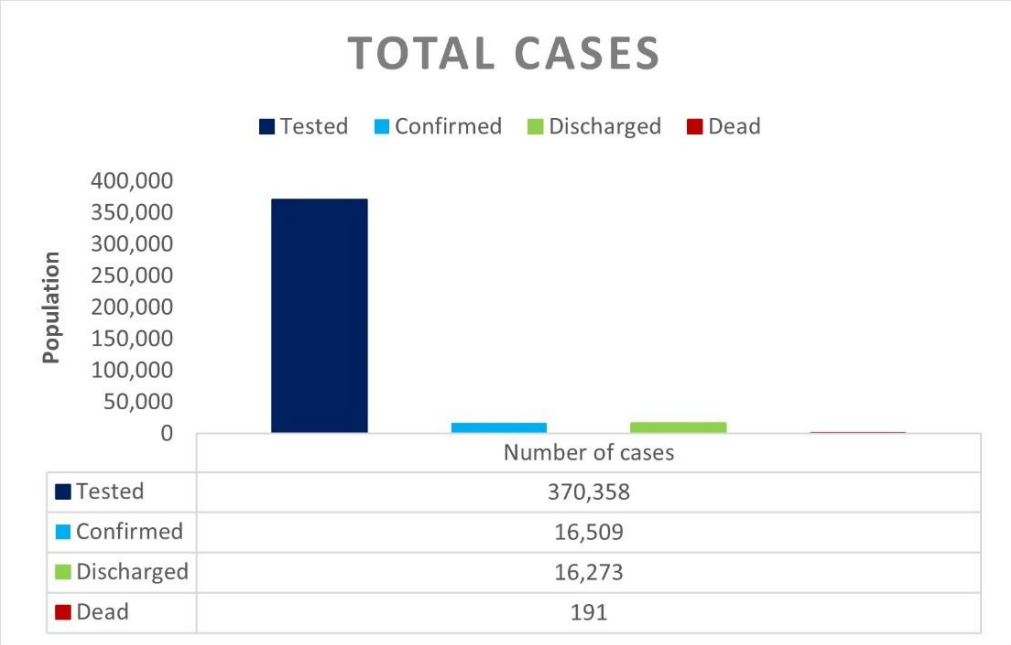

Fig. 5. Summary of cases in Rivers State as of 15th February 2022 [3]

5. CONCLUSIONS

In conclusion, data from this study show a higher mortality burden in men from COVID-19; and, among cases with hypertension and diabetes. The presence of the preceding listed comorbidities and age group (50–65) might be associated with COVID-19 mortality in the region. Future research in this area could 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.

6. 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 mortality from 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.

DISCLAIMER

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CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICS APPROVAL

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.

ACKNOWLEDGEMENTS

We highly appreciate the editor and anonymous reviewers whose comments and suggestions helped greatly improve and clarify the manuscript. The authors acknowledge the Rivers State Public Health Emergency Operations Centre and its staff who were frontliners in the COVID-19 response; and the Rivers State Ministry of Health.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
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