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Epidemiology, Sociodemographic Characteristics, Symptoms Assessment and Outcome of COVID-19 Epidemic among Residents of Niger State, Nigeria (March 2020 – March 2021)

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ABSTRACT

Nigeria recorded the first case of COVID-19 infection on Feb 27, 2020. Thereafter, National response was imposed with different curtailing measures including travel bans, closure of schools, markets and limiting the number of persons that could congregate in a place. The objective of this study was to evaluate the epidemiological situation of COVID-19 in Niger state, Nigeria using the data collected during the outbreak, describing the sociodemographic characteristics and epidemiological behavior and clinical symptoms of those tested and confirmed COVID-19 cases. We conducted a state wide population based analysis of the epidemiology of COVID-19 using data reported from all the 25 Local Government Areas of the state from March 2020 to March 2021 for the first, second and third waves of the epidemic. We calculated the overall incidence, case fatality rate, association of sociodemographic variables and the outcome of COVID-19 cases, frequency of different symptoms and drew an epidemic curve. A total of 1128 cases and 20 deaths were included in the analysis with sex distribution of 63.9% males and 36.1% females. The overall incidence rate was 20 cases per 100,000 populations. Commonest symptoms were cough (62.5%), Fever (54.2%) and difficulty in breathing (42%). We found that age was an important determinant of death in COVID-19 cases and health care workers were significant contributors of morbidity and mortality. We recommend strengthening of the health care system especially emergency response, availability of intensive care services, improvement of laboratory services, community surveillance and contact tracing capacities to prevent and control future epidemics.

ARTICLE DETAILS

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INTRODUCTION

The world has experienced a number of threats particularly from viral outbreaks especially from emerging zoonotic diseases and specifically by coronaviruses [1]. There are at least three types of coronaviruses capable of causing epidemic outbreaks, including SARS-CoV, MERS-CoV and the newly discovered SARS-CoV-2 virus as identified by the WHO [2]. These viruses are respectively responsible for causing severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) and the Novel coronavirus disease (COVID-19).

Since the reports of the first cases of COVID-19 in Wuhan, China on December 2019, the SARS-CoV-2 virus has spread globally [3], infecting more than 235million people and

causing more than 4.8 million deaths as at October 2nd, 2021 [4]. The main reason the virus has spread so quickly was due to droplet transmission from both symptomatic and asymptomatic individuals, making it difficult to trace, quarantine, test and isolate new cases efficiently and effectively [5].

Nigeria recorded the first case of COVID-19 infection on Feb 27, 2020, when an Italian National in Lagos tested positive for the virus [6]. The second case of COVID-19 was confirmed on the 9th March 2020 who is a citizen of Nigeria from Ogun state, who came in contact with the index case [6]. The National response was the imposition of different curtailing measures including travel bans, closure of schools and universities as well as limiting the number of persons that could congregate in a place [7]. Despite the documented evidence of growing incidence of COVID-19 and change in transmission pattern from imported elitist cases to community transmission in Nigeria [8], only a few sero-prevalence surveys on SARS-CoV-2 have been conducted. One of such survey was a pilot study in Niger State that had only 85 participants [9]. Sero-prevalence survey would have provided a more reliable estimate of the prevalence of SARS-CoV-2 infection in a population and may indicate the immune status of individuals or the populations [10].

At the beginning of the pandemic, the diagnosis of COVID-19 was confirmed by the detection of SARS-CoV-2 via real-time reverse transcription polymerase chain reaction (qRT-PCR) assays, among suspected cases of SARS-CoV-2 infection and their contacts [11].

An insight into the dynamics of the transmission of SARS-CoV-2 infection in different settings especially in Africa with a high-density population that has unequal access to health care services, highly mobile and high burden of communicable and non-communicable diseases can provide an understanding of the extent of this disease. Many countries including Nigeria have experienced the first, second and third waves of the pandemic with rising cases of death. As at 20th November, 2021, 213,532 cases have been confirmed in Nigeria with 2,973 deaths [12]. A multi-sectoral National emergency operations center coordinates the COVID-19 response in Nigeria [13]. The Niger State emergency operation center (EOC) coordinates the COVID-19 epidemic response at the State level with support from the Federal ministry of health, WHO, Nigeria Center for Disease Control (NCDC) and other implementing partners.

In this study, using the data collected during the outbreak, we present the findings of an analysis of the epidemiological situation in Niger state, Nigeria, describing the sociodemographic characteristics and epidemiological behavior of those tested and confirmed COVID-19 cases using the reverse transcription polymerase chain reaction (RT-PCR) method.

METHODOLOGY

Study design

A state wide population based analysis of the epidemiology of COVID-19 using data reported from all the 25 LGAs of the state by the disease surveillance notification officers (DSNOs) from March 2020 to march 2021 for the first, second and third waves of the epidemic. The data includes results of those tested and those confirmed positive, using Reverse transcription polymerase chain reaction (RT-PCR) method.

Study setting and population

Nigeria is located in sub-Sahara Africa with a population of over 140 million people and occupying a landmass of 923,768 square kilometers [14]. Niger state is located in the North central geopolitical zone of Nigeria with a population of 3,950,249 people according to the 2006 national population commission census [14]. The projected population of Niger state for 2016 was 5,556,247 [15]. The three most popular ethnic groups are Nupe, Gbagyi and Hausa. It is considered as the state with the largest land area in Nigeria, lying on latitude 3.20° East and longitude 11.30° North, the State shares a country border with the Republic of Benin (West) and State borders within Nigeria. These state boarders include the Federal Capital Territory (FCT) on the South-East, Zamfara (North), Kebbi (North-West), Kwara (South-West) and Kaduna (North-East) [16].

Data

Data on socio-demographic variables, such as age, sex, marital status and place of residence was obtained from the Ministry of Health (MOH) registries. Clinical data including date of onset of symptoms, date of diagnosis and date of death was obtained from the MOH registries. Data on presence of comorbidities such as Hypertension and Diabetes mellitus and pregnancy was not available. Epidemiological information including location, occupation, educational level and travel history was obtained. The information was transferred to our research team after signing a confidentiality agreement with the MOH to protect patient's rights. From the online self-reporting tool delivered through the MOH surveillance department, clinical information about signs and symptoms, as well as civil status and educational attainment was obtained from all cases that completed the voluntary self-reporting tool

Ethical clearance

Ethical clearance to conduct the study was obtained from Ministry of health, Ethics Committee for Research Involving Human Subjects.

Study size.
All individuals that were tested during the study period were included to participate in the study from March 2020 to March 2021.

Data Analysis
Statistical package for social sciences (SPSS) version 23 and Surveillance Outbreak Response Management and Analysis system (SORMAS) were used to analyze the data. Descriptive and analytical statistics of the data was conducted. The overall incidence (attack rate, mortality rate, and case fatality rate were computed according to the entire population at risk living in the state). Measurements of frequency (counts, absolute and relative percentages), central tendency (median), dispersion (interquartile range) and absolute differences was calculated for all categorical and continuous variables. Case fatality rates (CFR%) was computed using the number of cases reported while the dichotomized variable (alive or died) was used as an outcome of the confirmed cases. To determine association between different variables Chi square were conducted.

RESULTS
There were 1128 confirmed case of COVID-19 from March 2020 to March 2021 for the first, second and third waves of the epidemic in Niger state.

Table 1: Relationship between sociodemographic characteristics and outcome of COVID-19 cases among residents of Niger state, Nigeria

Variables	frequency	Percentage	Outcome		Test statistic
			Alive	dead	
Age (years)					
0-9	32	2.8	32	0	Fisher exact test = 31.09
10-19	139	12.3	139	0	P value = 0.001
20-29	341	30.2	340	1	Median age = 30 years
30-39	243	21.5	242	1	
40-49	155	13.7	150	5	
50-59	105	9.3	102	3	
60 and above	113	10.0	103	10	
Gender					
Male	721	63.9	705	16	Chi square 3.09
Female	407	36.1	403	4	P value = 0.162
Educational level					
No formal education	141	12.5	141	0	
Primary	90	8.0	89	1	Fisher exact test = 7.071
Secondary	382	33.9	374	8	P value = 0.094
Tertiary	390	34.6	379	11	
Others	125	11.1	125	0	
Occupation					
Farmer	39	3.5	38	1	Fisher exact test = 6.21
Businessmen/traders	213	18.9	207	6	P value = 0.131
Housewives	113	10.0	113	0	
Health workers	79	7.0	76	3	
Others (pupils/students, religious leaders)	684	60.6	674	10	
Location					
Urban	641	56.8	626	15	p value = 0.091
Rural	487	43.2	482	5	

Table 1 shows the relationship between five sociodemographic variables and the outcome of confirmed cases of COVID-19. There was a statistically significant relationship between age and the outcome of COVID-19 cases (p value = 0.001). Other variables (sex, educational level, occupation and place of residents) showed no statistically significant relationship with the outcome of COVID-19 cases.

Table 2. Symptoms of COVID 19 as reported in Niger state, Nigeria

S/no.	Symptoms	Frequency	Percentage
1	Fever	611	54.2
2	Headache	304	27.0
3	Cough	705	62.5
4	Difficulty In Breathing	474	42.0
5	Loss Of Taste (Ageusia)	241	12.5
6	Loss Of Smell (Anosmia)	258	22.9
7	Fatigue /Tiredness	282	25.0
8	Catarrh	187	16.6
	Total	3062	

Table 2 above shows the commonest symptoms of COVID-19 reported in Niger state, Nigeria. 62.5% of patients complained of cough, majority had dry cough. 54.2% had fever while 42% presented with difficulty in breathing. The less frequent symptoms were loss of smell (22.9%), catarrh (16.6%) and loss of taste (12.5%).

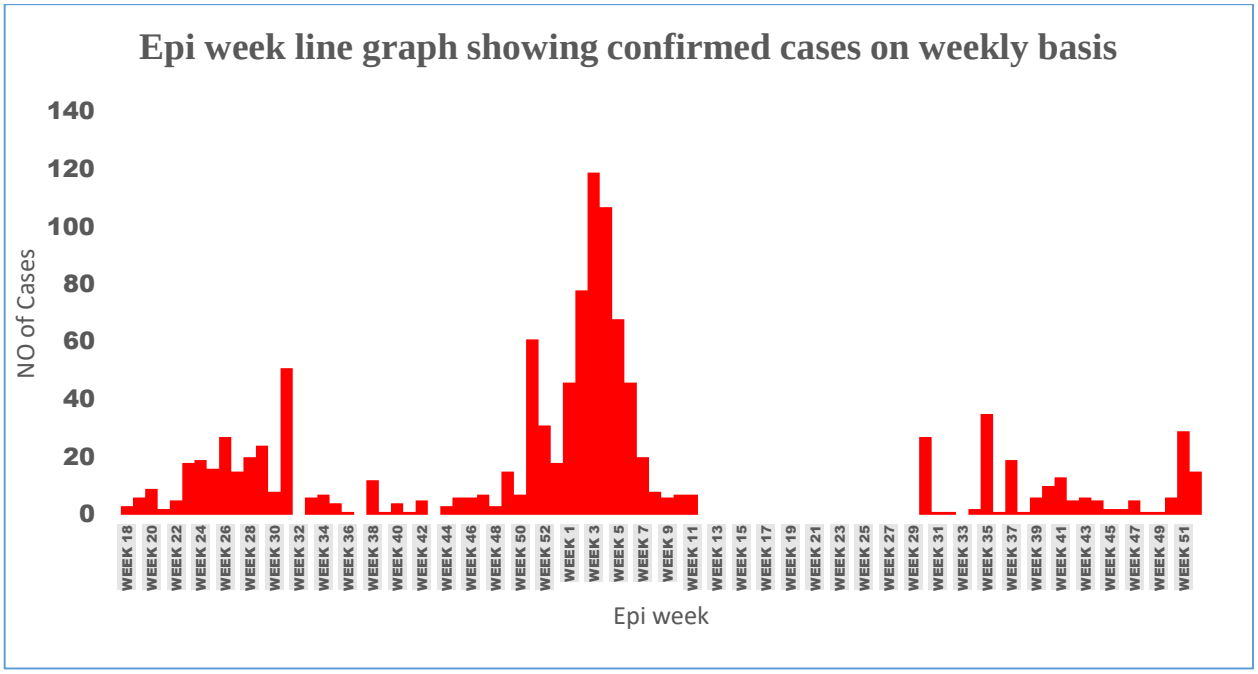

Fig. 1 shows the Epidemic Curve

Fig. 1 shows the epidemic curve of the three waves of COVID-19 experienced in Niger state from week 18 of 2020 through to week 51 of 2021. The highest number of cases during wave 1 was recorded in week 31 of 2021 with 51 positive cases. The second wave had the highest number of cases compared to other waves with week 3 recording 119 positive cases. The third wave had fewer cases with the highest number of cases been experienced in week 35 with a record of 35 cases. The third wave spanned from week 30 to week 51.

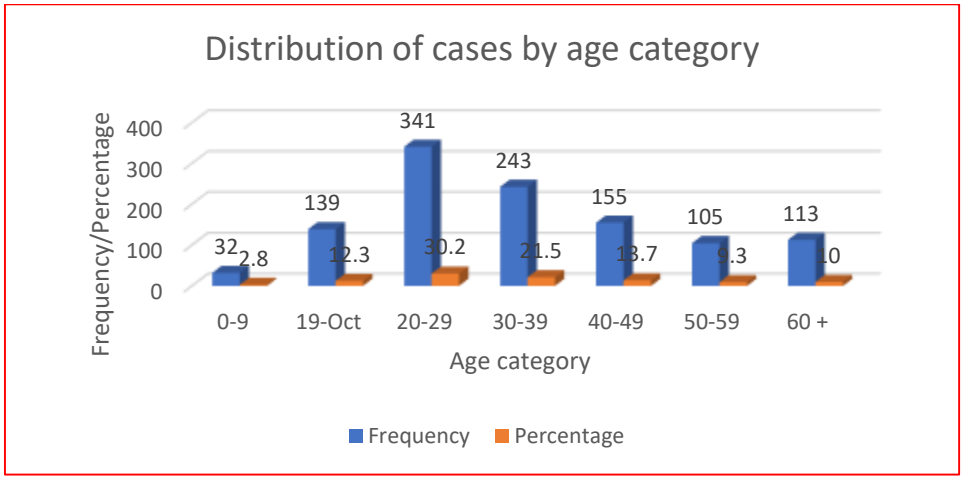

Figure 2. shows the distribution of cases by age category

Fig. 2 shows the cases by age category. The median age of COVID-19 patients was 30 years Majority of the cases were within the age bracket of 20-29 years accounting for 30.2% of all the cases. This was closely followed with those in the age category of 30-39 years with 21.5%. The lowest incidence occurred in those below the age of 9 years with a prevalence of 2.8%. Those 60 years and above accounted for 10% of all the confirmed COVID-19 cases. 50% of the case fatality occurred in those 60 years and above.

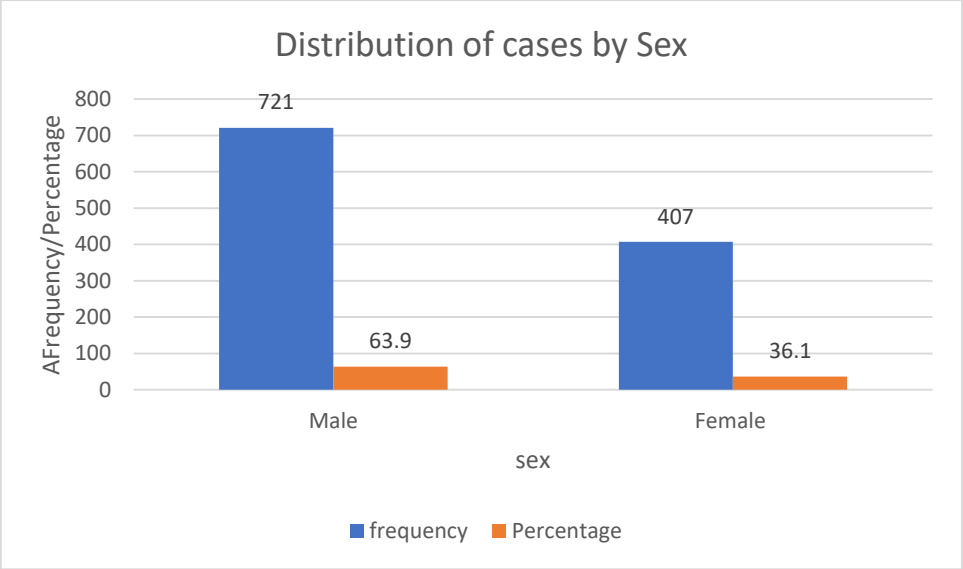

Fig. 3 Sex Distribution of cases

Fig. 3 above shows the distribution of cases by sex. 63.9% of the cases were males, while female constituted 36.1% of all confirmed cases.

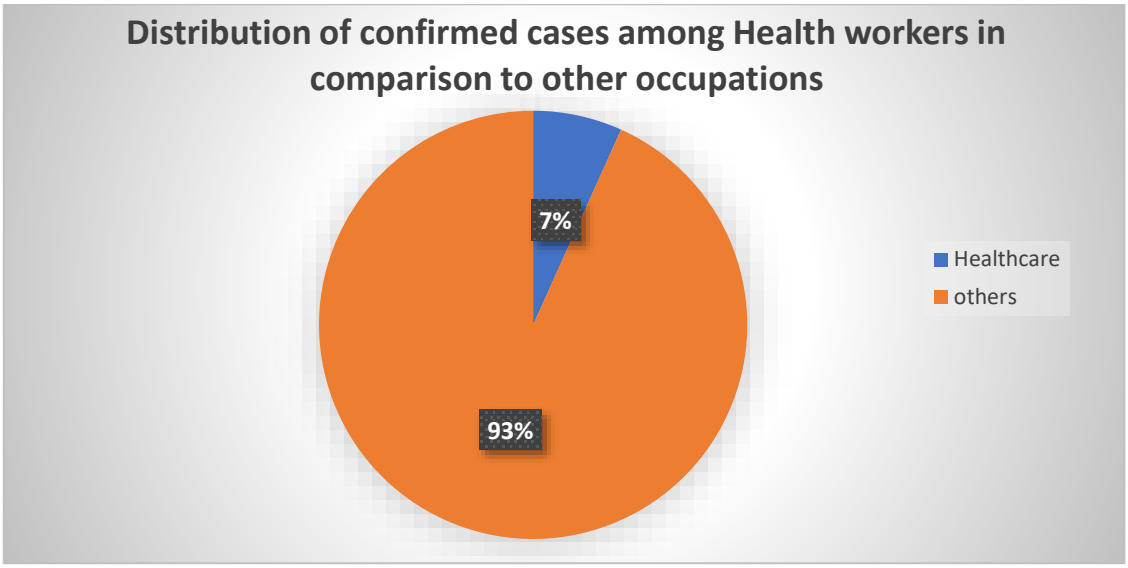

Fig 4: Distribution of confirmed cases among Health workers in comparison to other occupations

Fig. 4 shows the distribution of cases according to their occupations. 7% of cases are health workers.

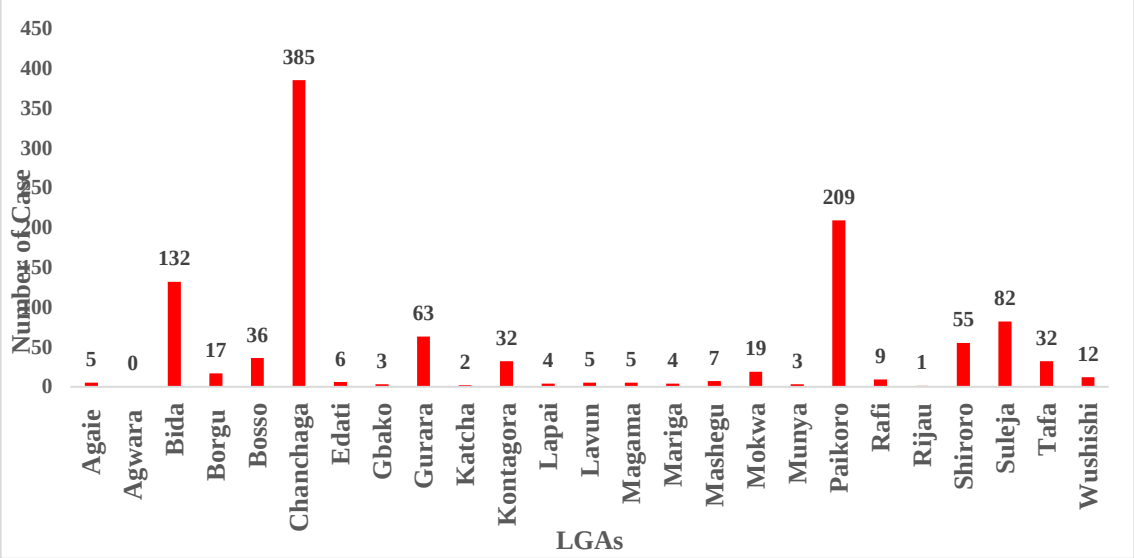

Fig 5. Shows the distribution of cases by LGA

Fig 5. Shows the distribution of cases by LGA. Chanchaga LGA had the highest number of confirmed cases of COVID-19 accounting for 34.1% of all cases. Paikoro LGA had the second highest number of reported cases with 18.5% of all cases. Agwara LGA reported zero case of COVID-19 throughout the epidemic for the 3 waves.

DISCUSSION

At the end of the three waves of the epidemic, Niger state reported a total of 1128 cases and 20 deaths between March 2020 – March 2021. The sex distribution was 63.9% for males and 36.1% for females in contrast to the sex distribution reported from South Africa (55·7% females) [19], and similar to the report from China (58% males) [20] and Italy (59.8% males) [21]. The gender discrepancy in COVID-19 distribution may be explained by the regional difference in Health seeking behavior. The median age of COVID 19 cases in this study was 30 years. The age group mostly affected was 20-49 years accounting for 65.4% of all cases, more than double the same age group reported from Italy of 24% [21]. The overall incidence rate was 20 cases per 100,000 populations with the incidence in male of 13/100,000 population and female of 7/100,0000 population based on a projected population of 5,556,247 people [22]. The difference in the age group of those mostly affected in both countries may be due to the fact that Italy has one of the oldest population in the world compared to Nigeria. The latter has a youthful population, 50% below 19 years and those above 60 years represents a small fraction of the population [23]. This age group also constitute a greater number of the work force of the populace, tends to travel a lot and are prone to engage in social activities that may expose them to COVID-19.

The overall Case Fatality Rate (CFR) was 1.7%. The mortality in men was 2.2% and 0.9% in women. In relation to age those between the age of 0-59 years had a CFR of 0.98%, this is similar to the CFR reported in China 0.4% [24] and Spain of 0.6% [25] for the same age group. In this study we found that those 60 years and above had a CFR of 8.8%. Age was found to be significantly related with the outcome of COVID-19 disease. The chances of death from COVID-19 infection increased in older patients. This was consistent with findings of an exploratory ecological study of data from 177 countries which identified age as an independent risk factor to both incidence and case fatality rate of COVID-19 disease [26]. Interestingly, in this study, children and adolescents from the age of 0-19 years with an incidence of 15.1 % recorded no fatality. Similar finding was reported from a study of COVID-19 trend among children and adolescents age 0-24 years after analysis of COVID-19 cases and electronic laboratory data of over 30,000 cases in 2020 which revealed a case fatality rate of less than 0.1% [27]. The possible explanation to why children and adolescents have low mortality compared to adults especially those 60 years and above could be due to low prevalence of Co-morbidities. A study compared death rate among COVID 19 cases using ages 18 to 29 years as reference showed that the rate of death is four times higher in ages 30 to 39 years, and 330 times higher in those who are ages 85 years and older and far less in those 17 years and below [28]. Another possible reason why the death rate in children and adolescents is low could be due to frequent exposure to other viral respiratory tract infections that might have provided some level of cross immunity to COVID-19.

Health workers constituted 7.0% of the total diagnosed COVID-19 patients during the period of the epidemic and CFR recorded for this group was 3.0%. This is contrary to a study conducted in Rivers state, Nigeria on the prevalence of COVID-19 among health care workers of 15.2% of the patients' population with a case fatality of 1% [29]. Even though our sample was twice the sample size of the study being referred to, the prevalence among health care workers in our study was low, but with a higher case fatality. The low prevalence observed in this study might be due to early introduction of containment measures such as the use of face mask, hand washing with soap, use of hand sanitizers and social distancing. It is important to note that the level of awareness among health workers was high and immediate isolation of suspected cases could have also contributed to the low prevalence. Even though majority of the health workers screened were those that manifested with symptoms which could have influenced the low positivity yield. Studies from other countries such as Iran and Spain revealed prevalence's of 2.8% and 2.5% respectively [30, 31] which is much lower than the prevalence among health care workers in this study. Furthermore, it shows that health care workers contributed significantly to the burden of COVID-19 across the globe.

Majority of patients studied presented with cough (62.5%). Other common symptoms reported in these patients include fever (54.2%), headache (27%) and difficulty in breathing (42%) which is consistent with symptoms reported by other studies [32, 33]. Similarly, less common symptoms in this study are loss of smell (22.9%) and loss of taste (12.5%) which is in conformity with the findings of a study from Ecuador [33]. However, this is in contrast to the study from China that reported 5.1% loss of smell and 5.6% loss of taste respectively [34].

The epidemic curve in this study showed periodic peaks and troughs in the infection rates which may not be unconnected with the, demographic characteristics, climate conditions, government actions especially lockdowns that affected major activities like markets, schools, and movement restrictions. These factors may have had a strong impact on COVID-19 epidemic evolution in Niger state, Nigeria. The observed epidemic curve trend is similar to that of the National level based data reported from various states as documented by Nigeria Centre for Disease control (NCDC) which showed an upward trend [35] and recording the highest number of cases in week 31 of 2020 for the first wave. Furthermore, we observed a decline in the number of cases after the implementation of control measures (lockdowns and suspension of all public activities) across the state in line with the National government directive. However, the second wave had more cases probably due to relaxation of the containment measures as well as the increase in the testing capacity across the state. The influence of containment measures on the COVID-19 epidemic curve in this study was consistent with the report of studies from other regions of the world including Germany, Sweden, Italy, Mexico, Colombia, India, and Nepal [36]. The various control measures though thought to be harsh were effective as reflected on the positive impact in curbing the spread of the virus on the rate of spread of COVID-19 in Niger state.

There was no significant difference in terms of urban – rural distribution of infected individuals. However most of the deaths were recorded among urban dwellers. This was contrary to the report from Ecuador which recorded more fatalities in the rural areas attributed to social inequalities and reduced access to health care [33]. The probable reason for increase fatality observed in the urban areas in this study may be associated with other social determinants of health such as delay in decision to go to the hospital, late presentation, stigma, fear of been diagnosed of COVID-19 and quarantine/ isolation among others.

The limitations of this study are the lack of data on comorbidities and that the database did not have record of the total number of persons tested nor indicate the severity of the disease and whether the cases hospitalized were not identifiable. Another limitation was that testing was done mainly in symptomatic people, probably because of limited test availability. Moreover, testing was concentrated more in

the LGAs situated close to the State capital probably due to difficult terrains and insecurities experienced in some distant LGAs.

CONCLUSION

This study is on COVID-19 epidemic trend in Niger state Nigeria. It gives a brief on the response of the health care system in the control and management of the epidemic, its impact, lessons and experiences. It also revealed the readiness of Government both at the National and subnational levels to respond to disease outbreaks and the outcome of such responses and interventions. The epidemic curve flattened out within the period under review either as a result of containment measures that were implemented or because of some climate or weather conditions that affects the infectivity of the virus. We found out that age is an important variable that determines the outcome of COVID-19 cases in Niger state, Nigeria. Majority of patients that died of COVID-19 were sixty years and above which may not be unrelated to presences of co-morbidities, late presentation at the hospital and inadequate or lack of intensive care services in the health care facilities they were managed. We also found out that health care workers contributed to both the incidence and mortality of COVID-19 cases possibly as an occupational hazard which is consistent with reports around the globe. We recommend strengthening of the health care system especially availability of emergency response systems, intensive care services, capacity building on epidemic case management, well equipped isolation centers, improvement of laboratory services, community surveillance and contact tracing capacities to prevent and control future epidemics. In addition, standard universal precaution protocols should be adhered to at all times especially among health care workers.

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CONFLICT OF INTEREST

All authors declare that there is no conflicts of interest.

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