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Review

SARS-CoV-2 Pandemic in Nigeria: The Impact on Age and Sex Distributions

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Abstract: The paper was on the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic of Nigeria as well as the effect on age and sex distributions. The assessment of this particular effort was based on the data generated on confirmed deaths, and active cases by the Nigeria Center for Disease Control (NCDC) between February and June 2020. The information as of June 2020, revealed that the death cases was 506, even though the confirmed active cases figure was 19808. The confirmed cases for the states followed this particular order: Lagos, FCT, Kano, Rivers, and down to Kogi (probably the least figure recorded), while death rates followed this order: Lagos, FCT, Edo, Oyo, and down to Adamawa State (probably the least figure). The sex distributions of SARS-CoV-2 of the confirmed cases showed that male had a higher number in comparison to female, while in the age distributions, it was noticed that the age groups most affected were: 21 - 30, 31 - 40, 41 - 50, 51 - 60 for each male and female. Approximately 4% (male) as well as 5% (female) had been captured for ages under 10 years old. The sex and age distributions found in Covid-19 vulnerability depict the value of a more clear understanding of the effect of age and sex on incidence as well as case fatality of the virus and also in order to tailor therapy based on age and sex.

Keywords: *SARS-CoV-2; age; confirmed cases; NCDC; WHO; UNDP*

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1. Introduction

Coronavirus disease-19 (Covid-19) is caused by a coronavirus. It is an infectious disease which is tormenting the entire universe. Any infected person normally has respiratory problem, but this is usually overcome without special treatment. The most vulnerable are the old and people having respiratory problems, cancer, and diabetes (WHO, 2020a). As of 27th June 2020, 9,653,048 confirmed cases including 491,128 deaths worldwide was reported by World Health Organization (WHO) (WHO, 2020). COVID-19 (SARS-CoV-2) causes severe respiratory disease. From its inception till now, the pandemic has been experienced by over

196 countries (Coronavirus Resource Center, 2020; WHO 2020b). Two-thirds of the death happened in Europe (Gebhard et al., 2020). Presently, there are no known antiviral treatments to combat this menace, but there are many on-going trials using remdesivir, lopinavir-ritonavir, a combined protease inhibitor, chloroquine/hydroxychloroquine, colchicine, and tocilizumab, an IL-6 inhibitor (Gebhard et al., 2020; Roche Media, 2020).

According to UNDP (2020), Covid-19 is much more than a health crisis. It has devastating effects on the social, economic, and politics of each county of the world. In an urgent response to the pandemic, the United Nations (UN) has provided US$2 billion aids to assist the most vulnerable people and economies. Many fundamental lessons have been learning from this crisis which include restricted movements, wasted lives, lack of security, interdependent, health, environmental, economic, political, and social breakdowns. The pandemic is leaving an indelible mark worldwide which can never be forgotten.

Globally, the issue of gender has not been handle with levity. Much seriousness has been on this issue, for an example, the UN Women, the African Union, Economic Commission for Africa, and African Ministers for Gender and Women's Affairs met in May 2020 online to discuss on the pandemic (Covid-19) with a reference on the mitigation of the impacts of the crisis on women and girls (UN, 2020). The meeting aimed to address challenges women and girls in Africa is experiencing due to the pandemic while informing response and recovery planning and financing for better addressing the differentiated impact of the pandemic on women and girls in the continent. No doubt, Covid-19 outbreaks have different effects on women and men. On this premise, the globally reported cases are carried out to reflect age and sex disaggregation (UN Women). According to WHO (2020c) preliminary data, there was relatively even distribution of infections between women (47%) and men (51%), with some variations across age groups.

Generally, worldwide, women dominate the number of staff engaged in the health sector for this reason they are more likely to be diagnosed with Covid-19, but records show that higher death rate was in men compared to women (Global Health 5050, 2020). Although the interaction of sex and age by different countries were not provided publicly, the few records available depicted that cases of fatality vary significantly by region (Gebhard et al., 2020). In detailed reports of confirmed Covid-19 cases in Italy, China, Spain, France, Germany, and Switzerland, there are no major sex differences (men and women) in the cases from these countries but the reports show that there are higher incidences in men in the older age groups (Chene, 2020; Federal Office of Public Health FOPH, 2020; Robert Koch Institute, 2019). Reports from Switzerland and Germany have recently reported incidence rates (cases per 100,000 inhabitants by age and sex), which confirm an increased disease incidence in men above 60 years old (Federal Office of Public Health, FOPH, 2020; Robert Koch Institute, 2020). The death rate is highest in age 80 years and above (14.8% in China, 20.2% in Italy) (Onder et al., 2020; Wu, et al., 2019). Existing data shows that mortality rate caused by Covid-19 increases significantly with respect to age and over time. From the data, the rate is more prone in men than women in all age groups. The cases in Germany and other countries confirmed this (Ravi and Kapoor, 2020).

The fatality case of children is minimal, the Chinese Center for Disease Control and Prevention examined 72,314 cases the outcome showed that children of less that 10 years old were infected (<1%) with the virus (Wu and McGoogan, 2020). In Wuhan, China, it was reported that over 12% children of ages 1day to

15 years out of 1391 children tested positive to SARS-CoV-2 infection between January 28 and February 26, 2020. Over 60% of the kids were male, while 39.2% were female. The age distribution that was mostly affected were, 6-10 years (33.9%) and 11-15 years (24.6%) (Lu et al., 2020).

In light of the above and concerning the impact of the SARS-CoV-2 on a global scale, this paper fills a gap in the understanding of its impartation in developing countries. This paper is an evaluation of the impact of the virus in Nigeria. The paper dealt with the effects on age and sex distributions.

2.Materials and Methods

Nigeria is a Federal Republic comprising 36 states and the Federal Capital Territory (FCT), where the capital, Abuja, is located (Figure 1)(Course Hero, 2020). Nigeria is the most populous country in Africa with a projected population of 206, 630, 269 (Course Hero, 2020; UN, 2017) with Lagos as the largest city and the seventh most populous country in the world, Nigeria has the third-largest youth population in the world, after India and China, with more than 90 million of its population under the age of eighteen (Course Hero, 2020; Library of Congress, 2008). The area is 923,769 km^2, density (218/km^2), and a time zone of UTC+01:00 (WAT). Nigeria a multinational state consists of over 250 ethnic groups who speak over 500 languages. The three common ones are Hausa, Igbo, and Yoruba, but the official is English (Course Hero, 2020).

The private sector and the government (local, state, and federal) of Nigeria discharge all the duties in Health care delivery using community-based methods (Eldis, 2006; Rais, 1991), which has increased accessibility to more efficient and equitable provision of services. The health services render in Nigeria have positive effects thereby reducing or total eradication of Lassa fever, malaria. In Nigeria, over half of the citizen do not have access to potable water. This greatly affected them thereby reducing the life expectancy to average of 52.62 years. As of 2010, the infant mortality is 8.4 deaths per 1000 live births *(*United Nations Population Fund, 2011).

Nigeria is one of the countries affected by Covid-19. The virus has affected the health, economy, social, religion, and politics of the populace. To determine the impact of the SARS-CoV-2 pandemic in Nigeria, this paper has relied on the data released by The Nigeria Center for Disease Control (NCDC) on their website between February 29th and June 20th, 2020. The data gather includes confirmed, active, discharged, and death cases. The information gathered was statistically (pie chart, and basic descriptive statistics) analyzed using excel 2013 version. The results generated were compared with the WHO and other global reports.

Figure 1. Map of Nigeria showing 35 states and FCT affected by Covid-19. Source: Adebowale (2020)

3.Results

The descriptive summary of the details of discharged, confirmed, active and death cases are actually depicted in Figure 2. The minimum as well as maximum of all of the parameters are 0-6718, 1-85375, 0-12584, and 0-506 respectively. At 95% confidence interval the mean as well as median of the discharged cases are 1279.5 and 230.5; confirmed cases (4340.5 and 1227.5); active (4300.4 and 2154.5), and deaths (123.90 and 37.5) respectively. The boxplots are skewed to the right. Table 1 depicted the reported cases for sates and capital cities from the month of February to June 2020. From the table, it was observed that Lagos, FCT, Kano, Rivers, and Oyo States topped the higher confirmed cases with 8407, 1549, 1184, 866, and 860 respectively, while they had discharged cases in this order 1436, 475, 712, 356, and 282 respectively. Only Kogi State had no death reported.

Table 1. Reported cases from states and capital city between February and June 2020

States	Confirmed Cases	Discharged Cases	Deaths	Total Active cases
Lagos	8407	1436	123	6848
FCT	1549	475	28	1046
Kano	1184	712	50	422
Rivers	866	356	30	480
Oyo	860	282	9	569
Edo	779	161	31	587
Ogun	623	358	15	250
Kaduna	552	286	10	256
Delta	501	124	17	360
Borno	466	353	31	82
Gombe	451	226	14	211
Bauchi	447	322	11	114
Katsina	426	233	22	171
Jigawa	317	191	6	120
Ebonyi	234	137	0	97
Abia	221	93	3	125
Plateau	220	114	5	101
Imo	205	21	3	81
Nasarawa	184	88	6	90
Kwara	180	122	6	52
Bayelsa	155	29	9	117
Sokoto	135	115	14	6
Ondo	134	42	16	76
Enugu	126	29	5	92
Zamfara	76	71	5	0
Kebbi	67	40	6	21
Anambra	66	51	9	6
Niger	66	33	2	31
Akwa Ibom	65	40	2	23
Yobe	56	45	8	3
Osun	54	46	4	4
Adamawa	42	37	4	1
Benue	39	12	0	27
Ekiti	54	28	2	4
Taraba	18	10	0	8
Kogi	3	0	0	3
Total	19808	6718	506	12584

Source: NCDC 2020

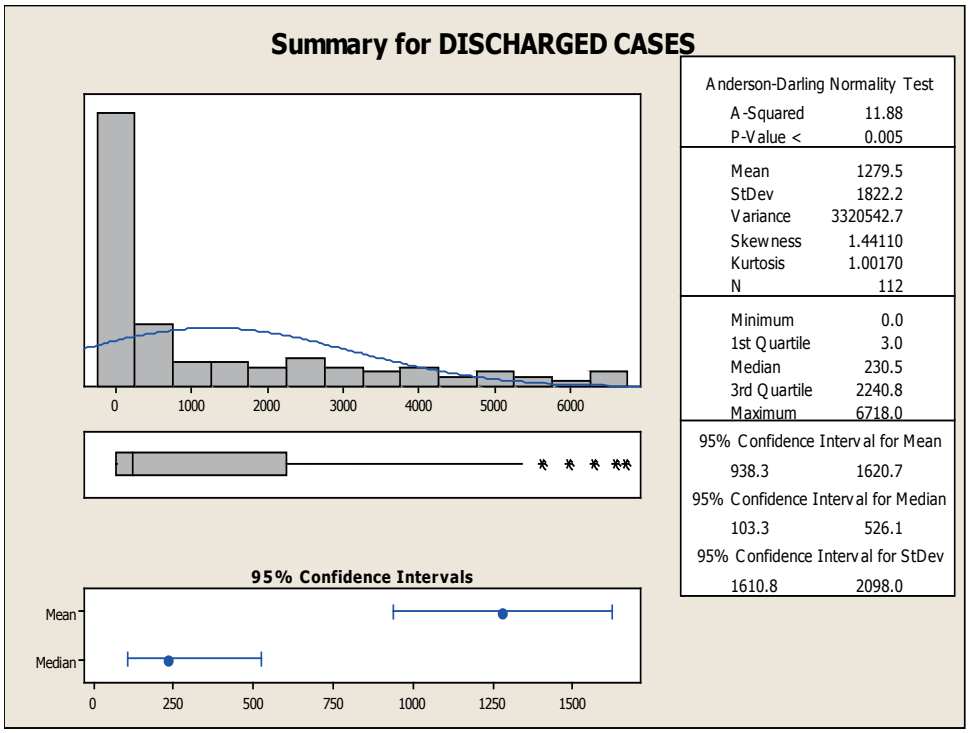
Figure 3 showed the gender distributions of confirmed cases. The figure showed that men were the most affected with 51% and female just had 49%. Table 2 showed the comparison of death and confirmed cases of Nigeria with other countries. Out of the 10 countries compared with Nigeria, six of the countries showed, like Nigeria that men were highly affected than female. Only The Netherlands reported 50% (men) and 50% (female). Figure 4 showed the age mostly affected was 31-40 years for both male and female. The boxplots of all the cases indicate they are non-symmetrical since they are skewed to the right. This suggests that there was large distributions (variations) between the minimum as well as maximum. The larger distributions are established with the standard deviations and also the variances of every one of the cases.

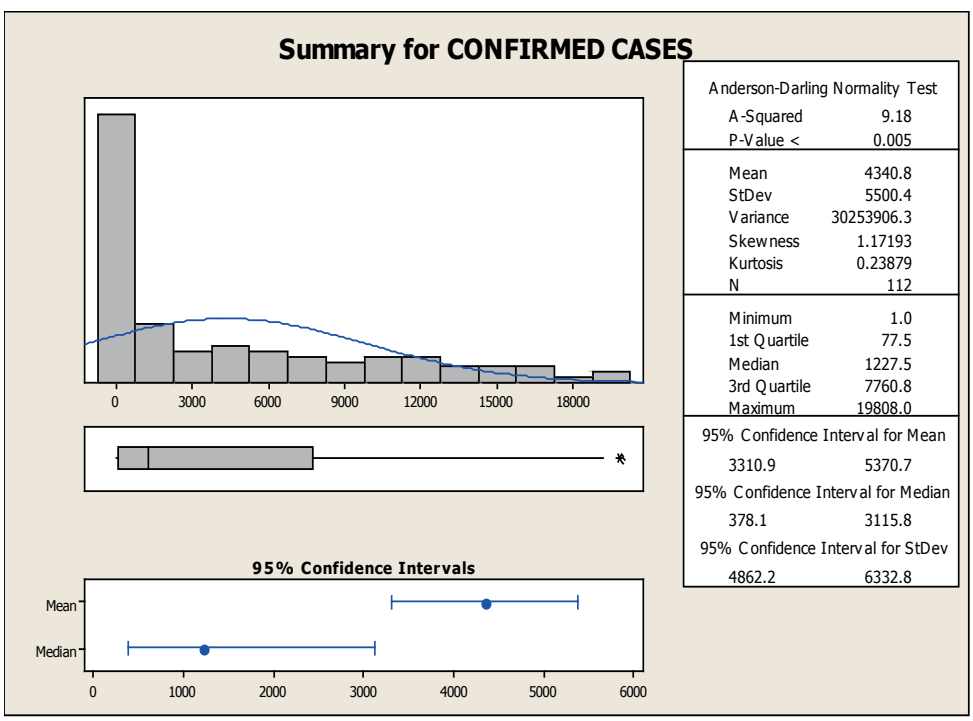
Table 2. Comparison of Nigeria confirmed and death cases with other countries

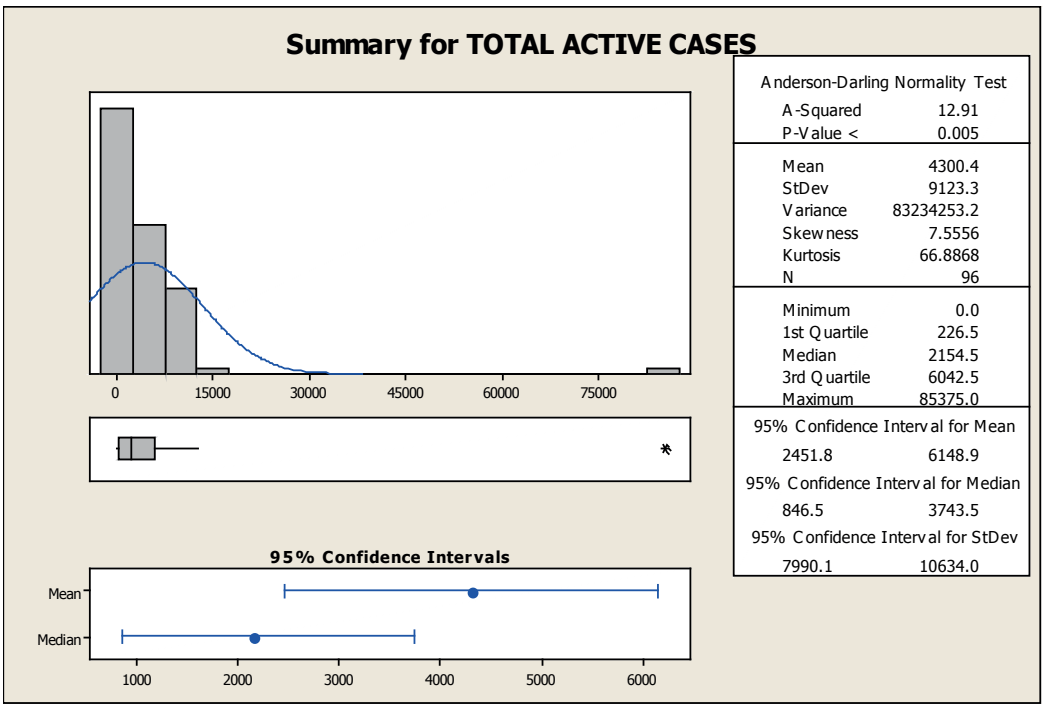
Countries	Confirmed Cases		Deaths	
	Male	Female	Male	Female
Nigeria	51	49	N/A	N/A
China	51	49	64	36
Iran	57	43	59	41
Portugal	45	54	59	31
Sweden	52.5	48	58	42
Belgium	47	52	58	41
Austria	51	49	N/A	N/A
Australia	51.4	49	N/A	N/A
The Netherlands	50	50	61	39
Canada	51	49	N/A	N/A
France	47	53	58	42

Source: Gebhard et al. (2020)

Figure 2. The descriptive summary of the data of discharged, confirmed, active and deaths cases






Summary for TOTAL ACTIVE CASES
0
15000
30000
45000
60000
75000
95% Confidence Intervals
Mean
Median
1000
2000
3000
4000
5000
6000
Anderson-Darling Normality Test
A-Squared 12.91
P-Value < 0.005
Mean 4300.4
StDev 9123.3
Variance 83234253.2
Skewness 7.5556
Kurtosis 66.8868
N 96
Minimum 0.0
1st Quartile 226.5
Median 2154.5
3rd Quartile 6042.5
Maximum 85375.0
95% Confidence Interval for Mean
2451.8 6148.9
95% Confidence Interval for Median
846.5 3743.5
95% Confidence Interval for StDev
7990.1 10634.0

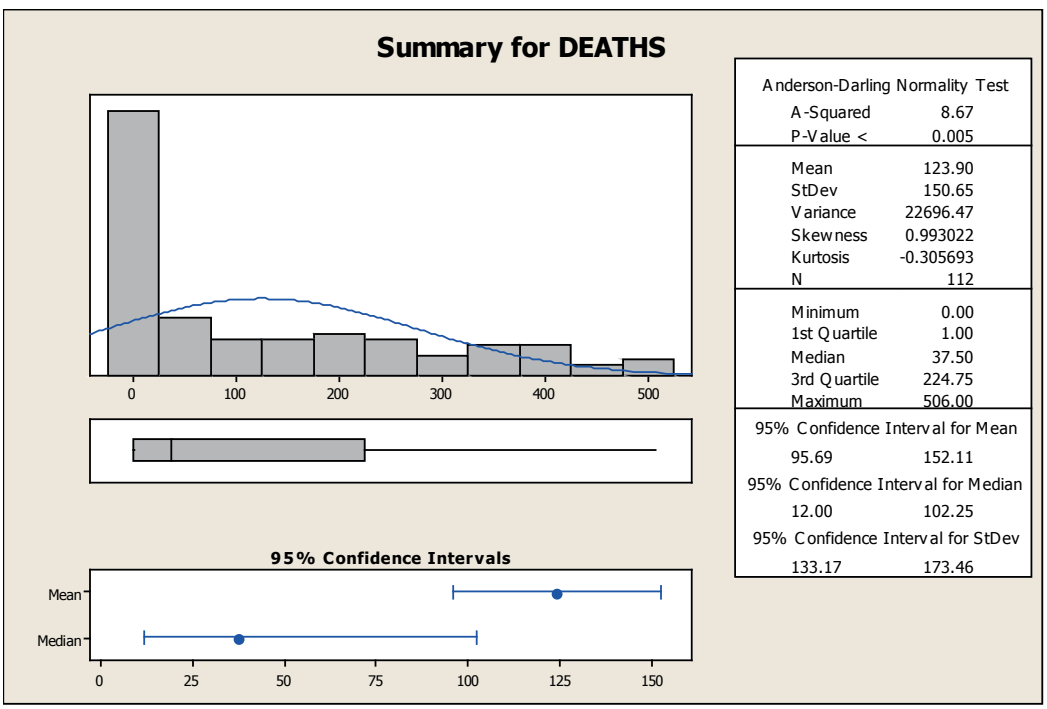
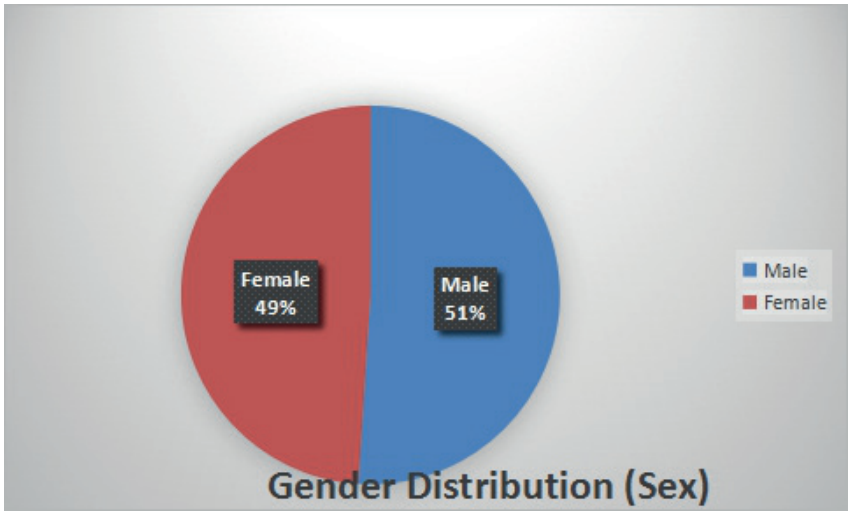
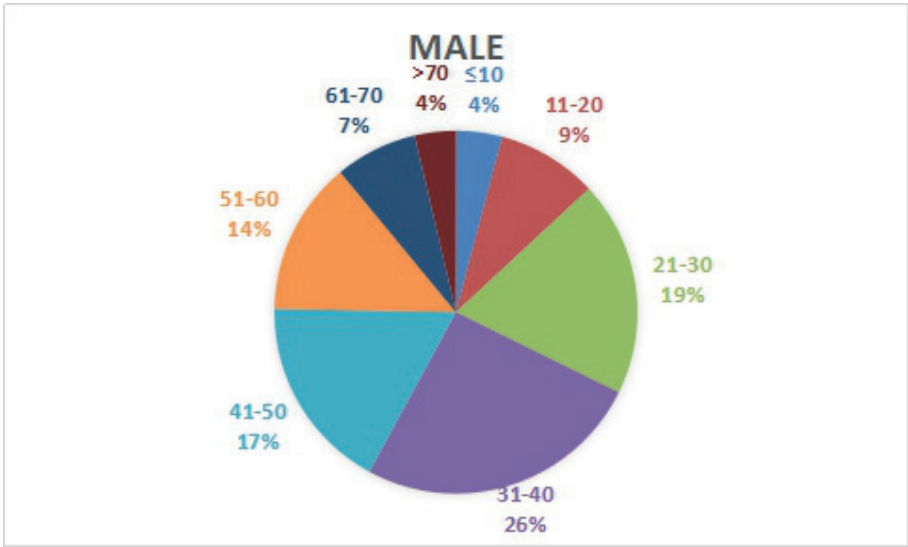

Summary for DEATHS
0
100
200
300
400
500
95% Confidence Intervals
Mean
Median
0
25
50
75
100
125
150
Anderson-Darling Normality Test
A-Squared 8.67
P-Value < 0.005
Mean 123.90
StDev 150.65
Variance 22696.47
Skewness 0.993022
Kurtosis -0.305693
N 112
Minimum 0.00
1st Quartile 1.00
Median 37.50
3rd Quartile 224.75
Maximum 506.00
95% Confidence Interval for Mean
95.69 152.11
95% Confidence Interval for Median
12.00 102.25
95% Confidence Interval for StDev
133.17 173.46

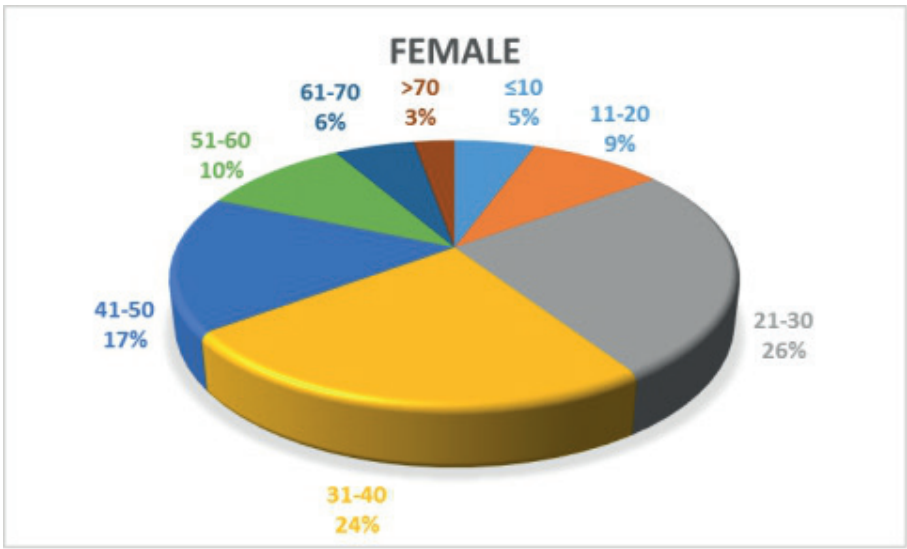
Figure 3. Gender distribution of SARS-CoV-2 confirmed cases in Nigeria



Source: NCDC 2020

Figure 4. Age and sex distributions of confirmed cases





Source: NCDC 2020

4. Discussion

In a comparison of results of the total confirmed cases with African countries, Nigeria has the second high values (19808 individuals), after South Africa with 87715 individuals while others follow: Ghana (13203), Algeria (11504), Cameroon (10638), Cote d'Ivoire (6874), Senegal (5639), and Democratic Republic of the Congo (DRC) (5476). The total death cases reported as at 20 June 2020, shows that South Africa has probably the highest figure of 1831 followed by Algeria (825), Nigeria (506), Cameroon (282), DRC (121), Kenya (119), Mali (108), as well as other with less than 100 (WHO 2020d).

Also, the cumulative case infection rate for Nigeria is lower compared to the outcomes of many nations outside Africa. For instance those of USA (2,172,212), Brazil (978,142), Peru (244,388), Chile (231,393), Mexico (165,455), Canada (100,220), Colombia (60,217), Argentina (37,510), Dominican Republic (25,068), Panama (23,351), and Bolivia (21,499). The figures captured for these areas are far higher compared to the ones in Nigeria (between 1 and > 200).

The reasons the outcomes differ for various countries might be because of the following assumptions: firstly, Nigeria and lots of the other nations have acted slower compared to others in applying stricter steps as lockdowns as well as the public willingness to comply with stringent measures, culture, and values (Oliver, 2020a). For a lot of places, like Japan as well as Sweden, the rapid launch of solid interventionist policies is actually restricted by their constitutions (Oliver, 2020a). Secondly, in a number of countries, the announcement of an upcoming lockdown led to considerable human movement (e.g. men and women returning back to their hometowns. These moves could be one of the causes for the spreading of the virus within many countries. Thirdly, in several places of the globe, Nigeria inclusive, there continues to be a dearth of facemasks, personal protective equipment (PPE), respirators as well as ICU beds to be used by Covid-19 patients. Without these accessible definitely, a lot of individuals are going to contract the virus. Fourthly, many countries have no accurate information, and poor understanding about the number of individuals who have been infected with the virus, and exactly how many people have died in residences as well as the community and homes from Covid-19 (Oliver, 2020b). Due to this, the data are going to be defective. Working with defective details might have an effect on remedies, planning, and treatments. Non-availability of data (quality, accuracy, completeness, consistency, timeliness, and validity) is very likely the primary reason why the true death toll is simply not reflected in the statistics. Fifthly, comorbidities are actually another reason the death toll in the developing world ought to be greater. Individuals with hypertension (21%), diabetes (10%), cardiovascular disease (8%), and respiratory system disease (1%) are actually prone to SARS-CoV-2. Based on Schellekens and Sourrouille (2020), all these are extremely common in the developing world. Sixthly, environmental elements for instance temperature, population density, sanitary conditions, and quality of health care are another factors that can bring about differences in data generated by different countries during the pandemic (Schellekens and Sourrouille, 2020).

Kretcmer (2020) found that nations as well as continents which have more youths tend to be more likely to record low cases of death as the elderly tend to be more predisposed to the virus attack as opposed to the younger ones. A good example is the situation of Africa which has a significantly younger population compared to Europe. This points out the reason behind the few number confirmed deaths (Kretcmer, 2020). Once again, there are striking variations of the spread of Covid-19 between rural and urban areas

within a nation. The denser the population of the people in a country, the more the transmission to taking place (Kretcmer, 2020).

Figure 3 shows the gender distribution of confirmed cases in Nigeria. The result shows that out of the recorded figures only 51% were males while females contributed 49% to the total figures. The epidemiological data from the 2002–2003 SARS epidemic and recent Middle East respiratory syndrome outbreak confirmed that males were mostly affected meaning that there is sex-dependent differences in the pandemic outcomes (Channappanavar et al., 2020; Ravi and Kapoor, 2020). To buttress the sex differences, Channappanavar and his team researched on mice (male and female) of different age groups by infecting them with SARS-CoV with a view of finding out their reactions to the virus. The outcome confirmed that the males were more prone to virus infection when compared with age-matched females and the infection increased with age increase.

Table 2 shows the comparison of Nigeria confirmed cases with some parts of the world. It is observed that China, Iran, Sweden, Austria, Australia, and Canada (male and female) compared with Nigeria results (51 and 49, 57 and 43, 52.5 and 48, 51 and 49, 51.4 and 49, and 51 and 49) respectively. In the cases of Portugal, Belgium, and France did not agree with that of Nigeria, the opposite was the case ie female was higher than male (54:45, 52:47, and 53:47) respectively. The reason for these differences could be due to the biological and behavioral nature of women in the countries. Mainwhile, The Netherlands' result was 50% male and 50% female. In the cited literatures, there were no records of deaths for Nigeria, Austria, Australia, and Canada, but the available information for China, Iran, Portugal, Sweden, Belgium, France, and the Netherlands showed that deaths recorded were higher in males than females. The death rates announced in China, Italy, Spain, France, Germany, and Switzerland are generally homogeneous and extend between 1.7–1.8. This backs the view that a predictable natural marvel is working, representing the higher death rate in men (Emergency Response Epidemiology Team, 2020; Istituto Superiore di Sanità, 2020).

From this paper, it is observed that males are susceptible to the virus than females. Several reasons including biological and behavioral reasons may explain this observation. The first reason may be because men are smokers. Men are into cigarettes, marijuana, and other forms of smoking. For example in China, men (adults) and women do smoke, with a ratio of 54% and 2.6% respectively (Liu et al., 2017; Ravi and Kappor, 2020). It is reported that about 41% of South Korean, Spanish, and US men are smokers, while their women smoke less (6%), but the difference in smoking habits between genders in Germany is not much (The World Bank, 2020). Secondly, reports indicate that circulating levels of angiotensin-converting enzyme (ACE2) are more in men who are healthy, diabetic, and those having renal problems as against women (Patel et al., 2013). Data show an association between comorbidities (chronic lung disease, hypertension, and cardiovascular disease, and severity of Covid-19 (Global Health 5050, 2020). Globally, these morbidities are higher among men than women (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018), except for older age groups. Thirdly, generally and biologically, the males and females response to many RNA and DNA virus infections are different (Channappanavar et al., 2017; Klein and Flanagan, 2016), the males has low immune responses that makes them susceptible to different infectious agents (Garcı´a-Go´mez et al., 2013). Although the epidemiological data from severe acute respiratory syndrome (SARS)-CoV and the Middle East respiratory syndrome (MERS)-CoV outbreaks show males are bias in disease susceptibility (Alghamdi et al., 2014; Karlberg et al., 2004).

Figure 4 depicts the age and sex distributions of cases reported during the outbreaks of SARS in Nigeria, despite a high confirmed case of SARS in the adults (male and female), there were little or no figures for the pediatric patients. Similar reports from across China in February 2020, gave the statistics as 416 (0.9%) in <10 years children (Zhang, 2020). As time goes on, the virus spreads to the family especially the adult members. In this case, there was the possibility of intra-familial transmission especially from the adults to the children. With the increase in infected adults, there will also be increase infections in children and young adults (Cao et al., 2020).

The confirmed cases occurred in children and the older people. This shows that Covid-19 cases cut across all age groups, which varied with time. Figure 4 shows that younger age groups have low infection rates.

Epidemiological studies have shown that case fatality rates (CFR) are more affected by men than women (Karlberg et al., 2004; Leong et al., 2006). Similarly, data from recent MERS outbreaks showed high incidence and CFRs among men (Alghamdi et al., 2014). Alghamdi et al. (2014) and Karlberg et al. (2004) revealed that sex-dependent increase in disease severity after pathogenic CoV infection was more pronounced with advancing age. Throughout the world, women and girls are at risk of the pandemic and for this singular reason, they need to be protected. From experience, they are prone to violence during disasters and crises. During quarantine or stay-at-home measures, women and children who live with violent are exposed to danger (Linde and Gozalez, 2020). Again, about 70% of the women and girls make up the staffs of health and social-services globally in this regard, they need to be empowered providing more resources to them for carrying out their responsibility for domestic work and caring the more for infected family members, this makes them susceptible to more risk. Globally, women are not economically buoyant as men this makes them economically less secure in the labor market, especially during the lockdown (Linde and Gozalez, 2020).

Conclusion

The study was on the impact of Covid-19 also known as SARS-CoV-2 on age and sex distributions in Nigeria. The data on confirmed, discharged, deaths, and active cases used for the study was supplied by the NCDC. The results as at June 2020, revealed that the death cases was 506, while the confirmed was 19808. The confirmed cases recorded for the states were highest in Lagos, while the death rate was least in Adamawa. The sex distributions of SARS-CoV-2 of the confirmed cases showed that male had a higher number in comparison to female, while in the age distributions, it was observed that the age groups most affected were: 21 - 30, 31 - 40, 41 - 50, 51 - 60 for both male and female. The higher values reported for males than females could be deduced to the attitude of men like smoking, susceptibility to viruses, circulating levels of ACE2, and many other factors. The age and sex distributions observed in Covid-19 depict the importance of understanding of the impact of age and sex on incidence and case fatality of the virus and to tailor treatment according to age and sex.

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Conflict of Interest

The authors declare no conflict of interest.

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