Three-month Epidemiological Trend of Covid-19 in Nigeria – Rapid Review

K. A. Osakwe¹, O. C. Menkiti² and K. Ukaegbu²

¹RMIT University, School of Property, Construction and Project Management, 124 La Trobe St, Melbourne VIC 3000, Australia.
²Department of Occupational Health, Shell Petroleum Development Company of Nigeria, P.O. Box 263, Port Harcourt, Nigeria.

Authors’ contributions

This work was carried out in collaboration among all authors. Author KAO designed the study, conception, data extraction and approval. Author OCM managed the data acquisition, extraction and proofread. Author KU managed the heat mapped of data, part draft and proof read. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i2630899

Received 10 June 2020
Accepted 16 August 2020
Published 31 August 2020

ABSTRACT

Background: Since the confirmation of the index case of Covid-19 on the 27th of February in Nigeria, the spread from Lagos to other parts of the country has been on the climb without a plateau in sight.

Objective: To characterize and present epidemiological trends of Covid-19 pandemic in the first three months of index confirmation in Nigeria.

Methods: A descriptive epidemiological study involving a review of the first three-month Covid-19 situation reports and updates in Nigeria using primary data was analyzed by Spatio-temporal analysis with categorical variables reported in percentages and numbers.

Findings: Retrospective analysis revealed 8344 confirmed cases in 35 of the 36 states (with the federal capital territory inclusive), 249 fatalities, 2385 discharged cases, 48544 laboratory testing.
5710 total active cases, a mortality rate of 0.12 per 100,000 population, and a Case Fatality Rate (CFR) of 3. It further showed an increased number of confirmed cases in densely populated states. Transmission via contact with infected persons accounted for 23% of a confirmed case. Additionally, 17% (circa) of the tested population were confirmed positive.

Conclusion: Causation and spread are attributed to travel and contact risk factors. Early epidemiological patterning occurred along population density and outdoor exposure lines. Aggressive and continuous testing would reveal more cases especially asymptomatic cohorts in the population.

Keywords: COVID-19; pandemic; epidemiology.

ABBREVIATIONS
COVID-19: Coronavirus Disease
NCDC: Nigeria Centre for Disease Control
NPCN: National Population Commission of Nigeria,
NBS: National Bureau of Statistics
SARS-CoV-2: Severe Acute Respiratory Syndrome Coronavirus-2
FCT: Federal Capital Territory
CFR: Case Fatality Rate
PD: Population density

1. INTRODUCTION
The index case of COVID-19 in Nigeria was confirmed on the 27th day of February 2020 in Lagos as a returnee from Italy via an international flight [1]. Ensuing epidemiological events led to an uptick of confirmed cases in Africa’s most populous country. Coronavirus disease also called COVID-19 was initially reported in Wuhan, China on the 31st of December 2019 as an emerging and fast-spreading novel disease caused by a deadly pathogen belonging to a group of viruses called Coronavirus (CoV) [1,2,3]. An ensuing global spread with increasing morbidity and mortality was further reported in almost 100 countries before the World Health Organisation declared the outbreak of a pandemic disease [2]. On the 27th of February 2020, an index case was confirmed in Nigeria at the Human and Zoonotic Virology Laboratory of Lagos University Teaching Hospital [3]. Three months counting, index cases are being confirmed across the states in the country with increasing morbidity and mortality. As the COVID-19 pandemic is novel to Nigeria, there are a lot of unknowns with regards to the epidemiology and characteristics of spread in Nigeria. Several measures by federal and state governments, therapeutic measures [3] are being trialed without a firm understanding of the epidemiological pattern in Nigeria context. The causative pathogen referred to as Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) is known to be the deadliest in the coronoviridae family of viruses [4,5]. While the outbreak was confirmed on the 31st of December 2019, the disease spread was declared a pandemic on the 11th of March 2020 when over 100,000 persons had become infected in over 100 countries [4]. Although a zoonotic virus (from animals), the pandemic could be transmitted from person to person through inhalation of infected airborne droplets [3,4,5,6]. Establishing the epidemiological trend upon which a futuristic strategy could be built would require reflection on existing data [4]. This would further deepen the knowledge about its spread and thus reveal further preventive and therapeutic clues. Relatedly, the paucity of literature on the epidemiological characteristics of the Covid-19 pandemic in Nigeria necessitates a thorough review of available data to generate knowledge upon which significant inference can be derived. The study objective was to characterize and present epidemiological trends of Covid-19 pandemic in the first three months of confirmation from 27th February to 26th of May 2020 [2].

2. METHODS
2.1 Study Location
This study focused on the COVID-19 initial epidemiology in Nigeria which includes the thirty-six states and the federal capital territory, Abuja (see Table 1). With a projected population of about 205,019,764 in 2020 and counting [7,8]. Nigeria is the most populous country in Africa and potentially vulnerable to a pandemic spread of COVID-19 magnitude and a potential epicenter in Africa.

2.2 Design and Statistical Analysis
A descriptive epidemiological study involving reflection on the first three months COVID-19
situation reports and updates in Nigeria using primary data from the Nigeria Centre for Disease Control (NCDC), National Population Commission of Nigeria (NPCN), National Bureau of Statistics (NBS) and grey literature. Data were analyzed by Spatio-temporal analysis with categorical variables reported in percentages and numbers. A three months review was adopted as a minimum number of months required to establish a trend and pattern in an ongoing event such as Covid-19. It involved the use of descriptive statistics to present cumulative confirmed and discharged cases, and deaths in the thirty-six states of Nigeria including the federal capital territory within the study period (see Fig. 1). To elucidate reported statistics by NCDS, Microsoft Excel 2016 was used to generate charts. Charts were used to compare confirmed, discharged, and death cases. Additionally, to understand the potential impact on the population density vis-à-vis pandemic spread of the COVID-19, a heat map analysis of the population density and disease statistic was undertaken (see Fig. 3).

2.3 Data Exclusion

Unconfirmed results by polymerase chain reaction (rRT-PCR) test.

3. RESULTS

This study revealed that in the period between 27 February 2020, and 26 May 2020 (3-months), a total of 8344 COVID-19 cases were confirmed and 249 deaths with a case fatality rate of 3% were recorded in Nigeria (Table 1). Further epidemiological trends showed the most affected gender was the male sex, the most affected age group is between 31 and 40 years, a mortality rate of 0.12 per 100,000 persons, 2385 discharged cases, and 35 states including the capital territory had confirmed (Table 1).

A deeper look into the pattern of spread showed that Lagos state had the highest confirmed, death and discharge cases across the states in Nigeria, thus the epicenter of Covid-19 pandemic in Africa’s most populous country (Fig. 1). However, Lagos State and Kano state top the leader board of states with the number of confirmed cases in Nigeria (Fig. 2, Table 2).

While densely populated states like Lagos, Kano, Katsina, Borno, and Oyo had a significant number of confirmed cases of 3756, 923, 335, 256, 250 respectively [7, 8]; the Federal Capital Territory (FCT), Abuja with comparatively lesser population had significant confirmed cases (519) (Fig. 2, Table 2). Active cases of Covid-19 were consistently lesser than confirmed cases. Daily, new, recovery, and death cases were confirmed across the states [3, 9].

Heat map of epidemiological data on the states shows that densely populated states [7, 8, 11, 12] had the highest numbers of confirmed Covid-19 cases with corresponding high number of deaths and discharges [2] (Fig. 2 – i-iv).

Table 1. Covid-19 epidemiological data

| S/N | Epidemiological Measures                        | Quantity                      |
|-----|------------------------------------------------|-------------------------------|
| 1   | Male                                           | 5684 (68%)                    |
| 2   | Female                                         | 2660 (32%)                    |
| 3   | Most Affected Age Group                        | 31 - 40 (25%)                 |
| 4   | Confirmed Fatalities                           | 249 – 3% CFR                  |
| 5   | Confirmed Global Fatality                      | 343,514                       |
| 6   | Projected Population                           | 205,019,764                   |
| 7   | National Cumulative Confirmed Cases            | 8344 (276)                    |
| 8   | Global Cumulative Confirmed Cases              | 5,404,512                     |
| 9   | Case Fatality Rate (CFR)                       | 3                             |
| 10  | Mortality Rate                                 | 0.12 per 100,000              |
| 11  | Discharged Cases                               | 2385 (74)                     |
| 12  | Affected Nigerian States                       | 35 (including FCT)            |
| 13  | Affected countries                             | 213                           |
| 14  | Samples tested in Nigeria                      | 48544                         |
| 15  | Travel history                                 | 210 (3%)                      |
| 16  | Contact history                                | 1908 (23%)                    |
| 17  | Nil Epidemiological Link                       | 4622 (55%)                    |
| 18  | Active Cases                                   | 5710                          |
| 19  | Transmission                                   | Community                     |

Source - Adapted from NCDC [3], WHO [10]
Fig. 1. State spread

Fig. 2. Confirmed cases vis-à-vis state population

4. DISCUSSION

The index case of Covid-19 in Nigeria was confirmed on 27 February 2020 in Lagos as a returnee from Italy. This makes travel history a central risk factor to the spread of COVID-19 in Nigeria. 3-months thereafter, ensuing epidemiological events resulted in 8344 confirmed cases in 35 of the 36 states (with the FCT inclusive), 249 fatalities, 2385 discharged cases, 48544 laboratory testing, 5710 total active cases, a mortality rate of 0.12 per 100,000 population, and a Case Fatality Rate (CFR) of 3.
The heat map of states shows that there was an increased number of confirmed cases in densely populated states like Lagos and Kano [2,7,8]. Although the spread in Nigeria is still in the early phase, it is postulated that the density population is a potential risk factor in the spread of Covid-19. Albeit, FCT (Abuja) with a less dense population of 371,674 seems to be an outlier to the population density (PD) postulation with 519 cases when compared with a densely populated state like Oyo with a population of 3,452720 but 250 confirmed cases. While the population density claim might be contended, it potentially enhances breathing zone encroachment between an actively infected person and a supposed receiver. Population density (PD) refers to people per square kilometer of land [12]. Globally, the leading hotspot for Covid-19 includes Lagos with PD of 47,027 per square mile (PSM), New York with PD of 27,900 psm, Sao Paulo in Brazil with PD of 23,294 psm and London with PD of 13,210 psm. The higher the population density the more people are clustered in an area [12]. This could potentiate exhalation and inhalation cascade of transmission thus a risk factor [12,13]. Besides, physical distancing is potentially impossible with an increase in population density. The breathing zone is

| States  | Confirmed Cases | Discharged Cases | Deaths | Total active-cases | Days since last reported Case |
|---------|-----------------|------------------|--------|-------------------|-------------------------------|
|         | Cumulative | New | Cumulative | New | Cumulative | New | |
| Lagos   | 3756       |       | 161    | 658 | 0       | 47 | 5       | 3051 | 0   |
| Kano    | 923        | 4    | 134    |     | 0       | 38 | 0       | 751  | 0   |
| FCT     | 519        | 0    | 156    |     | 0       | 14 | 0       | 349  | 1   |
| Katsina | 335        | 0    | 51     |     | 0       | 14 | 0       | 270  | 1   |
| Borno   | 256        | 1    | 145    |     | 0       | 25 | 0       | 86   | 0   |
| Oyo     | 250        | 6    | 76     |     | 0       | 6  | 2       | 168  | 0   |
| Jigawa  | 241        | 0    | 78     |     | 0       | 4  | 0       | 159  | 4   |
| Ogun    | 241        | 1    | 109    |     | 6       | 9  | 0       | 123  | 0   |
| Bauchi  | 233        | 1    | 203    |     | 38      | 7  | 2       | 23   | 0   |
| Edo     | 218        | 27   | 58     |     | 0       | 9  | 2       | 151  | 0   |
| Kaduna  | 208        | 19   | 128    |     | 12      | 6  | 1       | 74   | 0   |
| Rivers  | 157        | 36   | 32     |     | 0       | 11 | 2       | 114  | 0   |
| Gombe   | 150        | 2    | 118    |     | 0       | 3  | 0       | 29   | 0   |
| Sokoto  | 116        | 0    | 90     |     | 0       | 14 | 0       | 12   | 4   |
| Plateau | 95         | 0    | 43     |     | 16      | 2  | 0       | 50   | 1   |
| Kwara   | 79         | 0    | 34     |     | 0       | 1  | 0       | 44   | 2   |
| Zamfara | 76         | 0    | 63     |     | 0       | 5  | 0       | 8    | 8   |
| Nasarawa| 56         | 10   | 18     |     | 0       | 2  | 0       | 36   | 0   |
| Delta   | 49         | 3    | 14     |     | 0       | 7  | 0       | 28   | 0   |
| Yobe    | 47         | 0    | 8      |     | 0       | 7  | 0       | 32   | 4   |
| Osun    | 44         | 0    | 35     |     | 0       | 4  | 0       | 5    | 1   |
| Ebonyi  | 36         | 3    | 6      |     | 0       | 0  | 0       | 30   | 0   |
| Imo     | 33         | 0    | 7      |     | 0       | 0  | 0       | 26   | 1   |
| Kebbi   | 32         | 0    | 17     |     | 0       | 4  | 0       | 11   | 9   |
| Niger   | 28         | 0    | 9      |     | 0       | 1  | 0       | 18   | 2   |
| Adamawa | 27         | 0    | 18     |     | 0       | 2  | 0       | 7    | 5   |
| Akwa Ibom| 24        | 0    | 13     |     | 0       | 2  | 0       | 9    | 2   |
| Ondo    | 24         | 1    | 19     |     | 0       | 2  | 1       | 3    | 0   |
| Ekiti   | 20         | 0    | 14     |     | 0       | 2  | 0       | 4    | 6   |
| Enugu   | 18         | 0    | 8      |     | 0       | 0  | 0       | 10   | 3   |
| Taraba  | 18         | 0    | 10     |     | 0       | 0  | 0       | 8    | 6   |
| Bayelsa | 12         | 0    | 6      |     | 0       | 0  | 0       | 6    | 1   |
| Anambra | 10         | 0    | 3      |     | 2       | 1  | 1       | 6    | 1   |
| Abia    | 8          | 1    | 3      |     | 0       | 0  | 0       | 5    | 0   |
| Benue   | 5          | 0    | 1      |     | 0       | 0  | 0       | 4    | 10  |
| Total   | 8344       | 276  | 2385   | 74  | 249      | 16 | 5710    | NA   |     |

Source – Adapted from NCDC [3]
i. Population Density [1011]

ii. Confirmed Cases [2]
iii. Total Death [2]

iv. Total Discharged [2]

Fig. 3. Spatial distribution of population density & Covid-19 cases in Nigeria (adapted from National Bureau of Statistics [10,11] and NCDC [3])
an area of a 10-inch radius around an individual mouth and nose [13]. Urban areas with high population density are at greater risk for the quick spread of viruses [13,14]. Lagos and Kano are megacities with over 10 million inhabitants and both recording high daily increase in confirmed cases. The compact hustling and bustling of Lagos and Kano engender unavoidable physical contact. Transmission through contact with infected persons accounted for 23% of confirmed cases, thus making contact history a crucial consideration.

4.1 Principal Results

The male gender was found to be predominantly infected with a 68% infection rate when compared to the female with 32%. This could be attributed to the fact that females are socially contact averse, males undertake more personal, social, and business travel and thus more exposed. Anecdotal sources reveal that cultural and religious practices would potentially buoy transmission through contact. Prevalence in males has been reported in Afghanistan, Argentina, Costa Rica, Haiti, Ecuador, Iran, Pakistan, and the Philippines [15]. Conversely, Jin J, et al. opined in their study that men and women have the same prevalence [16]. The youthfulness of the most affected age group of 31 years – 40 years could further explain why contact is a risk factor as this group is more erratic, itinerant, and venturesome. Conversely, it was earlier opined that older individuals are vulnerable and more susceptible to contracting Covid-19 [17].

Out of 48,544 conducted laboratory tests, 8344 cases were confirmed positive, thus 17% (circa) of the tested population. While this is significant, it further gives credence to the clamor for more aggressive test campaigns which could confirm more cases in the population. Out of 8344 confirmed cases, 5710 persons were active with 2634 (32%) asymptomatic, however, Oran and Topol reported 40-45% of infected will remain asymptomatic [18]. Asymptomatic cases are individuals with no history of clinical signs or symptoms or have not developed any detectable symptom [17,18]. This makes them carriers of the virus with prolonging the period of virus shedding thus making it difficult to curb [19]. Asymptomatic cases remain the underpinning link in community transmission [20-25]. The strength of this study lies in the use of data derived from accredited laboratories and the Centre for Disease Control (NCDC) of Nigeria.

The NCDC is the National Public Health Institute of Nigeria organizing a response to any disease outbreak. It is a World Health Organization collaboration center and has an accredited network of laboratories across the country.

5. LIMITATIONS

As this study focused on 3-month data in an ongoing pandemic might constitute a potential limitation on epidemiological patterns. Nevertheless, as COVID-19 is a novel pandemic, findings would be a veritable tool for making future postulation. Additionally, the cases might have been under-reported given that only 48,544 in a country with a population of 205,019,764.

6. CONCLUSIONS

Three months of reflection of the COVID-19 outbreak in Nigeria revealed causation and spread is attributable to travel and contact risk factors. To stem the tide of further transmission, states, and national governments should design and establish bespoke barriers on travel and contact pathways. Early epidemiological patterning occurred with population density and exposed groups. Aggressive and continuous testing would reveal more cases especially passive cohorts of infected persons. Further epidemiological studies will be required to track ongoing spread with emphasis on epidemiological patterns, route of index cases in 35 states, occupational health impacts, and gauging of responses.

CONSENT

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

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ohia C, Bakarey AS, Ahmad T. Covid-19 and Nigeria: Putting the realities in context. International Journal of Infectious
Diseases: IJID: Official publication of the International Society for Infectious Diseases. 2020;95:279–281. Available: https://doi.org/10.1016/j.ijid.2020.04.062

2. Anjorin AA. The coronavirus disease 2019 (Covid-19) pandemic: A review and an update on cases in Africa. Asian Pac J Trop Med. 2020;13(5):199-203.

3. Nigeria Centre for Disease Control (NCDC); 2020. Available: https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID-19%20outbreak%20in%20Nigeria [Accessed 08 April, 2020]

4. Zhai P, Ding Y, Wu X, Long, Zhong Y, Li Y. The epidemiology, diagnosis and treatment of Covid-19. International Journal of Antimicrobial Agents. 2020; 55:105955.

5. Tian S, Hu N, Lou J, et al. Characteristics of Covid-19 infection in Beijing. Journal of Infection. 2020;80:401–406.

6. Singhal T. A review of coronavirus disease-2019 (Covid-19). The Indian Journal of Paediatrics. 2020;87(4):281–286.

7. World Population Review; 2020. Available: https://worldpopulationreview.com/countries/nigeria-population/ [Accessed 10/06/2020].

8. Worldometer; 2020. Available: https://www.worldometers.info/coronavirus/country/usa/

9. World Health Organisation. Coronavirus disease (Covid-19) Situation Report – 127. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200526-covid-19-sitrep-127.pdf?sfvrsn=7b6655ab_8 (accessed 26th May 2020)

10. National Bureau of Statistics (Nigeria, NBS). Demographic Statistic Bulletin National Bureau of Statistics. Population 2006 – 2016; 2017. Available: https://nigerianstat.gov.ng/elibrary?queries[search]=population (Accessed 26 June 2020).

11. Shang YD, Inthavong, Tu JY. Detailed micro-particle deposition patterns in the human nasal cavity influenced by the breathing zone. Computers & Fluids. 2015; 114:141–150

12. Kolb E. 75,000 people per square mile? These are the most densely populated cities in the world 75,000 people per square mile? These are the most densely populated cities in the world. USA Today. 2019. Available: https://www.usatoday.com/story/news/world/2019/07/11/the-50-most-densely-populated-cities-in-the-world/39664259/

13. Ojima J. Gaseous contaminant distribution in the breathing zone. Industrial Health. 2012;50:234-238

14. Olsen H. The United States might have a secret weapon against coronavirus. The Washington Post; 2020. Available: https://www.washingtonpost.com/opinions/2020/03/19/united-states-might-have-secret-weapon-against-coronavirus/ UN Women. Sex-disaggregated case data for select countries; 2020. Available: https://data.unwomen.org/resources/covid-19-emerging-gender-data-and-why-it-matters (Accessed 16 August 2020).

15. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, Liu S, Yang JK. Gender differences in patients with Covid-19: Focus on Severity and Mortality. Front. Public Health. 2020; 8:152. DOI: 10.3389/fpubh.2020.00152 (Accessed 16 August 2020).

16. Long Q, Tang X, Shi Q, Li Q, Deng H, Yuan J, Hu J, Xu W, Zhang F, Gong J, Wu B, Liu X, Li J, Qiu J, Chen J, Huang A. Clinical and immunological assessment of asymptomatic SARS-CoV-2 infections. Nat Med; 2020.

17. Tabata S, Imai K, Kawano S, Ikeda M, Kodama T, Miyoshi K, Obinata H, Mimura S, Kodera T, Kitagaki M, Sato M, Suzuki S, Ito T, Uwabe Y, Tamura K. Clinical characteristics of Covid-19 in 104 people with SARS-CoV-2 infection on the diamond princess cruise ship: A retrospective analysis; 2020.

18. The Lancet Infect Dis. 2020;1473-3099(20):30482-5. Available:https://doi.org/10.1016/

19. Gandhi M, Yokoe D, Havlir D. Asymptomatic Transmission, the Achilles’ Heel of current strategies to control Covid-19. N Engl J Med. 2020; 382:2158-2160.
22. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung K, Lau E, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu Feng Z. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected Pneumonia. The New England Journal of Medicine. 2020;382(13):1199–1207. https://doi.org/10.1056/NEJMoa2001316

23. Grant R, Malik MR, Elkholy A, Kerkhove M. A Review of asymptomatic and subclinical middle east respiratory syndrome coronavirus infections. Epidemiol Rev. 2019;41:69–81.

24. Lithander F, Neumann S, Emma Tenison E, Lloyd K, Welsh T, Rodrigues J, Higgins J, Scourfield L, Christensen H, Haunton V, Henderson E. Covid-19 in older people: A rapid clinical review. Age and Ageing. 2020;1–15.

25. Africa centre for strategic studies. Mapping Risk Factor for the Spread of Covid-19 in Africa; 2020. Available:https://africacenter.org/spotlight/mapping-risk-factors-spread-covid-19-africa/ (Accessed 26 June 2020).

© 2020 Osakwe et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.