

APPLICATION OF ANALYSIS OF VARIANCE ON THE CAUSE SPECIFIC DEATH RATE DUE TO CASES OF COVID-19

^{1*}Adeniji, L. A.; ¹Akintola, O. E; ²Nwagwo, A; ¹Bamidele, G. I; ²Olusan, B. O. and Ayodeji, A. A.

¹Department of Statistics, Yaba College of Technology, Yaba Lagos

²Department of Mathematics, Yaba College of Technology, Yaba Lagos

*Corresponding author: lasisi.adeniji@yabatech.edu.ng +2348024401067

Manuscript received 27/09/22 and accepted 26/10/22

ABSTRACT

Coronavirus disease 2019 (COVID-19), a fatal illness with traits similar to those of severe acute respiratory syndrome (SARS), first identified in Nigeria by NCDC on February 29, 2020. In March 2020, Nigeria was put under lockdown to stop the disease's spread. By August 2020, the lockdown had been lifted, allowing all activities to resume normally. Descriptive and analytical research design was used. The information was obtained from the Nigeria Center for Disease Control's website by state. The information includes the number of cases that have been confirmed in laboratories, the number of deaths, and the mid-year population as of March 21st 2022. By geopolitical region, the data were organized into homogeneous strata, and the research used an epidemiological tool, analysis of variance, and graphical depiction. The analysis was carried out using EPI-Infov7 and SPSSv25. Prevalence and the death rate by cause were the epidemiological characteristics that were used. The findings showed that there were 119 infected people per 100,000 people at risk during the pandemic. The CSDR of COVID 19 in the six geopolitical zones of Nigeria showed no significant difference (F-statistic = 1.509, p-value > 0.05). There is no significant difference in the means of CSDR of COVID19 of the six regions. The graphical representation showed that south-west has the highest mortality rate due to COVID-19 pandemic. Then recommended that there should be more health education intervention in the region like south-west where there is highest record of mortality rate due to pandemic disease.

Keywords: Analysis of Variance, Coronavirus, Epidemiological Tool, Homogeneous Strata, Lockdown

INTRODUCTION

Novel coronavirus disease 2019 (nCOVID-19), a fatal illness with traits similar to those of severe acute respiratory syndrome (SARS), was first identified in Wuhan, in the Chinese province of Hebei, in late December 2019. (Abayomi et al., 2021). The infection can spread through coughing, sneezing, or touching contaminated objects. When an infected person coughs, sneezes, or touches any contaminated thing, it spreads from person to person. The condition causes a mild to serious respiratory illness with signs (such a cough) and breathing problems, which ultimately results in the patient's death (Ruan et al., 2020). The deadly virus's current prevalence has had a significant impact and will likely continue to do so. Nigeria is one of the countries on the African continent with

the worst economic effects. According to the Nigeria Centre for Disease Control (NCDC) website, as of February 28, 2021, the outbreak had claimed 1,907 lives and caused 155,657 confirmed cases in Nigeria. The government has put a full and, more recently, a partial restriction on businesses and people moving around in order to stop the virus from spreading. These lockdown measures have led to a significant uptick in unemployment and a clear disruption in our social wellbeing (Adegboye et al., 2020). By February 28th, 2021, the virus has infected more than 114 million people and caused roughly 2,538,681 fatalities worldwide (WHO, 2021). Even more ominous data appear to be coming, based on estimates of infection and transmission on a global scale. However, this forecast of impending spread cannot be

confirmed because widespread vaccination campaigns are currently underway, particularly in Ghana (the first country in Africa), the United States, Europe, Asia, and the Middle East.

The virus first surfaced in Nigeria, according to the Nigeria Centre for Disease Control (NCDC), on February 29, 2020, when an Italian national traveled to a factory in Ogun state after arriving in Lagos on an airplane from Milan, Italy. The case was termed a “index case” since 58 contacts were being followed up on. In four states of Nigeria on March 3, 2020, a total of 15 suspicious cases were found. With Lagos, Ogun, the Federal Capital Territory, and Kano being identified as high-risk locations because to their populations and closeness to an international airport, this was considered as the beginning of the epidemic spreading to other parts of the country (except Ogun with no international airport but shares border with Lagos). On March 8, 2020, one of the index case’s 40 asymptomatic contacts was determined to be positive, and on March 16, 2020, a person returning to Lagos from the United Kingdom was determined to be positive. Five (5) new cases of the virus were reported on March 18, 2020, with one, three, and one case each in the Federal Capital Territory (FCT), Lagos, and Oyo. As of the time of our current investigation, on February 28, 2020, there were 240 confirmed cases, continuing the growing trend in verified instances. These instances originated in 13 distinct Nigerian states. They are Anambra, Lagos, Osun, Ogun, Kwara, FCT, Abia, Borno, Edo, Bayelsa, Kaduna, and Rivers. There have been 1,907 overall fatalities, 133,768 discharges (recoveries), and 155,657 confirmed cases. Every state in Nigeria had been affected by the virus as of February 28, 2021, with the exception of Kogi, which had only five confirmed cases. Governments and authorities all across the world have implemented lockdown (Lin et al., 2020), social distance (Thu et al., 2020), hand washing, the use of alcohol-based sanitizer, face mask use, and other attempts to stop the

epidemic (Alshammari et al., 2020). These actions have been proven to work well in places where they are strictly implemented. The measures, however, have not had much of an impact in Nigeria because people still seem to break the law despite receiving government help, such as palliatives, which were supplied to some designated poor persons in order to keep them at home and adhere to the lockdown regulations. The analysis of the spread to visualize its results and possibly help decision-makers comprehend the spread’s dynamics is the main contribution of this research. Similar studies have been conducted on the spread of COVID-19 in Nigeria (Adegboye et al., 2020). But their scope and depth of study are different from ours. However, their scope of investigation and time frame are different from ours. The objective of this study is to demonstrate analysis of variance on the cause specific death rate (CSDR) due to covid-19 pandemic in the six geopolitical zones in Nigeria and identified the most affected region.

METHODOLOGY

The study considered descriptive and analytical research design. The cases of COVID19 report was collected based on the thirty six (36) states in Nigeria was sourced from Nigeria Centre for Disease Control (NCDC). Also the forecasted population for March 21st 2022 from the 2006 census was gotten from National Bureau of Statistics (NBS) annual publication.

For the data analysis, the research classified the data collected into different clusters, each cluster represent each geopolitical zones. Meaning that all the six geopolitical zones are the clusters. The data was analyzed using analysis of variance (ANOVA) with the aid of statistical package for social sciences (SPSS) version 25. Some epidemiological statistics was part of this present study, this include prevalence and cause specific death rate (CSDR). According to Chigbu et al. (2021), the prevalence and cause specific death rate (CSDR) were defined below

$$Prevalence = \frac{\text{All new and pre – existing cases during the period}}{\text{Population during the time period}} \times 10^n$$

$$\text{and CSDR} = \frac{\text{Total number of death in given time due to the disease}}{\text{Total population at risk}}$$

RESULTS

Table 1: Cause specific death rate (CSDR) for the cases of COVID 19

GEO ZONE	1	2	3	4	5	6	7	Average
NC	8.12	1.80	1.35	0.41	0.29	0.04		2.00
NE	1.67	0.29	0.72	0.94	0.65	0.25		0.75
NW	0.99	0.82	0.36	0.44	0.24	0.29	0.15	0.47
SE	0.62	0.32	1.06	0.82	0.99			0.76
SS	2.06	6.72	1.97	0.88	1.10	0.57		2.22
SW	5.70	2.53	1.29	2.05	2.07	0.78		2.40

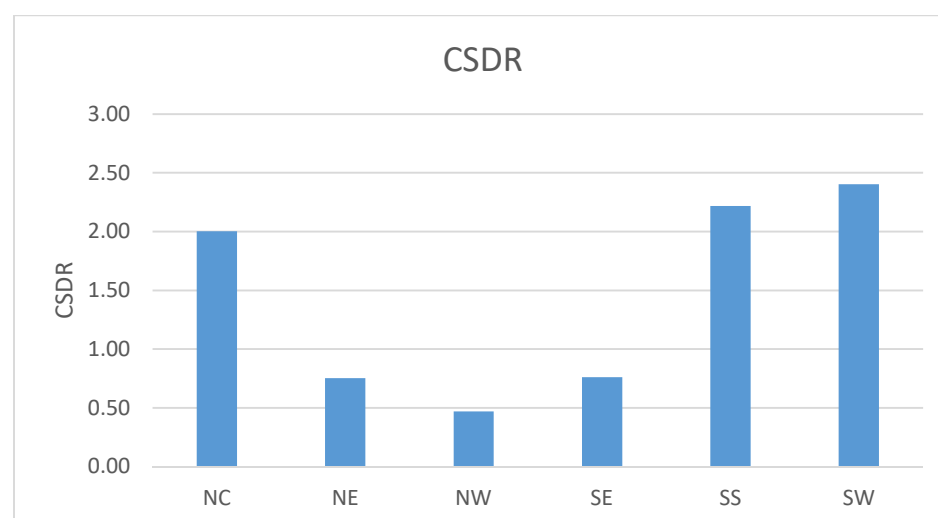


Figure 1: Histogram representing cause specific death rate (CSDR) mean in the six geopolitical zone in Nigeria.

More than any other geopolitical region, the south west (SW) is significantly impacted by the cause-specific death rate as a result of COVID 19.

$$Prevalence = \frac{\text{All new and pre – existing cases during the period}}{\text{Population during the time period}} \times 1000000$$

$$= \frac{257637}{216798900} * 100000 = 118.84 = 119 \text{ persons}$$

The prevalence is 119 persons per one hundred thousand persons at risk of COVID 19 in the population contracted the diseases.

Hypothesis:

H₀: There is no significant difference in the means of CSDR due to COVID 19 in the six geo-political zones in Nigeria.

H_A: There is significant difference in the means of CSDR due to COVID 19 in the six geo-political zones in Nigeria.

Table 2: Analysis of variance for means OF CSDR

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.143	5	.229	1.390	.256
Within Groups	4.932	30	.164		
Total	6.074	35			

The above analysis of variance table showed that there is no significant different in the means of cause specific death rate (CSDR) due to COVID-19 in the six geopolitical zones since the p-value (0.256) is more than 0.05 level of significance.

DISCUSSION

The prevalence of COVID-19 contacts in this study's population at risk in Nigeria is 119, which suggests that out of every 100,000 people at risk for COVID, only 119 will actually contract the pandemic illness. According to a study by Shorunke et al. (2022) in Lagos, Nigeria's southwest, veterinary professionals are at a comparatively high risk of COVID-19 infections. Furthermore, a gender-based analysis of COVID-19 incidence and mortality in Nigeria by Olusola-Makinde and Makinde (2021) revealed that males are more frequently infected than females.

The analysis of variance was employed in the study to examine whether there were any notable differences between the means of the cause specific death rate (CSDR) in the six geopolitical zones. The findings indicated that there is no significant statistical difference among the means of mortality due to COVID-19 pandemic (p-value > 0.05). This means that the rate of mortality occurrence because of COVID-19 disease pandemic are similar across the six geopolitical zones in Nigeria.

The cause specific death rate (CSDR) by COVID-19 varies by political zone, with the south-west having the highest cause specific mortality by COVID-19 compared to all other political zones, with an average CSDR of 2.40, followed by the south-south with an average CSDR of 2.22, and the north-west with the lowest average CSDR. This study's findings were in line with those of Ezeibe et al. (2020), who determined that the states most severely impacted by the pandemic disease were Lagos, Oyo, Kano, Rivers, and the Federal Capital Territory (FCT) of Abuja. And it so happened that Lagos and Oyo were two of the states in the southwest region of Nigeria.

CONCLUSION AND RECOMMENDATION

It was determined that there are no appreciable differences between the six geographical regions in the average cause specific death rate (CSDR) caused by COVID 19.

The study's analysis revealed that the south west region has a higher COVID 19 mortality rate than any other region.

When compared to Nigeria's population size, the prevalence of people with COVID 19 is low. However, it is advised that greater health education interventions be made in areas like the south-west where there is a high record of pandemic disease-related mortality rates.

REFERENCES

- Abayomi O. A., Ayodeji S. M., Samuel M. A., Omolayo A. A., & Omanma C. U. (2021). *A Comprehensive Analysis of COVID-19 Spread in Nigeria. International Conference on Information Technology in Education and Development. 4th Ed. Vol.17* 120-126.
<https://www.researchgate.net/publication/352682208>
- Adegboye, O. A., Adekunle, A. I., & Gayawan, E. (2020). Early Transmission Dynamics of Novel Coronavirus (COVID-19) in Nigeria. *International Journal of Environmental Research and Public Health*, 17(9), 3054.
<https://doi.org/10.3390/ijerph17093054>
- Alshammari, T. M., Altebainawi, A. F., & Alenzi, K. A. (2020). Importance of early precautionary actions in avoiding the spread of COVID-19: Saudi Arabia as an Example. *Saudi Pharmaceutical Journal*.
<https://doi.org/10.1016/j.jsps.2020.05.005>
- Chigbu, B. C., Edikpa, E. C., Onu, E. A., Nwabueze, A. I., Aneke, M. C., Vita-Agundu, U. C., & Adepoju, E. B. (2021). Analysis and forecasting of confirmed, death, and recovered cases of COVID-19 infections in Nigeria. *Medicine*, 100(31), e26776.
<https://doi.org/10.1097/md.00000000000026776>
- Ezeibe, C. C., Ilo, C., Ezeibe, E. N., Oguonu, C. N., Nwankwo, N. A., Ajaero, C. K., & Osadebe, N. (2020). Political distrust and the spread of COVID-19 in Nigeria. *Global Public Health*, 15(12), 1753–1766.
<https://doi.org/10.1080/17441692.2020.1828987>
- Fanelli, D., & Piazza, F. (2020). Analysis and forecast of COVID-19 spreading in China, Italy and France. *Chaos, Solitons & Fractals*, 134(134), 109761.
<https://doi.org/10.1016/j.chaos.2020.109761>
- Lin, Q., Zhao, S., Gao, D., Lou, Y., Yang, S., Musa, S. S., Wang, M. H., Cai, Y., Wang, W., Yang, L., & He, D. (2020). A conceptual model for the coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China with individual reaction and governmental action. *International Journal of Infectious Diseases*, 93, 211–216.
<https://doi.org/10.1016/j.ijid.2020.02.058>
- Nigeria Centre for Disease Control (2020). COVID-19 Outbreak in Nigeria Situation Report; NCDC: Abuja, Nigeria, 2020. Available online: [Ncdc.gov.ng](https://ncdc.gov.ng).
<https://ncdc.gov.ng/diseases/sitreps/?cat=14&name=An%20update%20of%20COVID19%20outbreak%20in%20Nigeria>
- Olusola-Makinde, O. O., & Makinde, O. S. (2021). COVID-19 incidence and mortality in Nigeria: gender based analysis. *PeerJ*, 9, e10613.
<https://doi.org/10.7717/peerj.10613>
- Ruan, Q., Yang, K., Wang, W., Jiang, L., & Song, J. (2020). Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. *Intensive Care Medicine*, 1–3.
<https://doi.org/10.1007/s00134-020-05991-x>

Shorunke, F. O., Okolocha, E. C., Kia, G. S., Usman, A., Akano, O., & Awosanya, E. J. (2022). Prevalence and risk factors associated with SARS-CoV-2 infections among veterinary practitioners and dogs patients, June-August 2020, Lagos, Nigeria. *One Health Outlook*, 4(1). <https://doi.org/10.1186/s42522-022-00062-1>

World Health Organization. (2020). *Coronavirus Disease (COVID-2019) Situation Reports*.

<https://www.who.int/emergencies/diseases/novelcoronavirus-2019/situation-reports>

Zhao, Z., Li, X., Liu, F., Zhu, G., Ma, C., & Wang, L. (2020). *Prediction of the COVID-19 spread in African countries and implications for prevention and control: A case study in South Africa, Egypt, Algeria, Nigeria, Senegal and Kenya*. *Science of the Total Environment*, 729, 138959.