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DEVELOPING PREDICTIVE MODEL FOR POVERTY AND COVID-19 INCIDENCES IN NIGERIA

By M.Y. Usman, V.I Matins, S.O. Akande and N.T.A. Abd'Razack

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ABSTRACT

Poverty is one of the greatest challenges facing the world today. This is because it is a major cause of ill-health by forcing people to live in dirty environments and a barrier to accessing health care, especially in the developing world. As a result of these, it was predicted that the outbreak of the COVID-19 pandemic will pose a devastating impact on households living beneath the economic, social, health and educational services thresholds. This impact will stem from the direct and indirect effects of the illness and the transmission control policies of governments. Consequently, this study assessed the COVID-19 preventive strategies adopted as well as the statistical relationship between the pre and post-lockdown household income poverty in Minna, Nigeria. The study similarly developed a predictive model for the nexus between poverty headcount ratio and the incidence of COVID-19 in Nigeria. Both the primary and secondary sources of data were employed for this study and the data were analysed using descriptive and inferential statistics (t-Test and regression techniques). The outcome showed that there exists a statistically significant difference between the pre-lockdown poverty rate and the post-lockdown poverty rate in Minna. The study also revealed that for each unit increase in poverty headcount ratio, the incidences of COVID-19 cases and its fatalities decreases by -42.5625 and -0.56077 units respectively. The study, therefore, recommended the domestication of the existing social intervention programmes of the Federal Government, by States Governments in order to enhance the standard of living of more households. It was also recommended that all stakeholders most partake in enlightenment and sensitization programmes on the need to adopt preventive measures to guard against the transmission of the virus.

KEY WORDS Developing, model, poverty, COVID-19.

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1. INTRODUCTION

Poverty, unfortunately, is a ubiquitous phenomenon and it is according to Badiane (2006), fast becoming a severe and pervasive urban feature. Thus, the United Nations (UN, 2014) asserted that it is one of the greatest challenges facing the world today. But its effects are more felt by the urban poor and rural dwellers. Nigeria, just like other developing countries, is suffering from the pangs of poverty, with 86.9 million of its populace (as at 2018) living in extreme poverty – the highest rate in the world (World Poverty Clock, 2019 in Iheonu and Urama, 2019). Poverty has however, always been a common feature in Nigeria since the first set of official poverty data was released in 1980 (Oseni *et al.*, 2012 in Usman, 2019). The high rate of poverty in Nigeria is in the opinion of Olatomide (2012), due to factors such as low economic growth performance, macroeconomic shocks and policy failure, labour markets deficiencies, migration, poor human resource development, ill-health/diseases, debt burden, poor governance, environmental degradation, and crime and violence.

The 2019 Poverty and Inequality report of Nigeria stated that its 2019 poverty headcount rate was 40.1%, with the urban and rural areas recording 18.0% and 52.1% poverty incidences respectively (National Bureau of Statistics, NBS, 2020). Poverty could thus be considered as a phenomenon ravaging both the urban and rural areas of Nigeria; though the urban areas are faring better. These disparities also exist between its sub-nationals - States and Local Government Areas (World Bank, 2016). Awojulugbe (2020) cited a 2016 report by the Bretton Wood Institution as stating that States in the northern part of the country accounts for 87% of its poor populace. This according to Ngbea and Achunike (2014) were borne out of factors such as income inequality, ethnic and civil unrest, corruption, high population and neglect of rural infrastructure in the northern part of the country. To this end, the World Bank (2016) averred that the widening gap in the regional disparity contributed to a rapid increase in inequality (in access to quality education and basic services among others).

Poverty, according to the UN (1995) takes various forms such as lack of income and productive resources to ensure sustainable livelihoods; hunger and malnutrition; ill health; limited or lack of access to basic services; increased morbidity and mortality from illness; homelessness and inadequate housing; unsafe environments, and social discrimination and exclusion. Lack of access to or poor health care system is, therefore, one of the dimensions of poverty. Aside the fact that poverty impedes access to effective health care system, it also by its nature creates ill-health by forcing people to live in dirty environments (World Health Organisation, 2017 in Milli *et al*. 2017). The high poverty rate in Nigeria has had a tremendous impact on its health care system, as majority of its people cannot afford it (Akpomuvie, 2010, and Akawu and Agum, 2018). In the light of this, Ubi and Ndem (2019) cited the United Nations Development Programme (UNDP, 2014) as stating that Nigeria fares worse in almost all of the key health outcomes compared to other sub-Saharan African (SSA) countries, as only 56.3% of its population accesses organized health care services. Poverty in Nigeria, therefore, has an inverse relationship with health and health care (Akpomuvie, 2010).

The emergence of the COVID-19 has however impacted the global health care system negatively, with the World Bank (2020) suggesting that it will likely have "long-lasting economic and social impacts of global proportions stemming from the direct and indirect effects of (the) illness, the preventive behaviours of people and the transmission control policies of governments." Onyekwena and Ekeruche (2020) similarly asserted that the weak capacity of health care systems in the developing countries will likely exacerbate the COVID-19 pandemic and its impact on their economies. As a result of the foregoing, there were fears globally that the outbreak of the COVID-19 would gravely affect the developing countries, especially those of the SSA. The fears were borne out of its high poverty incidence and poor health care system. This was however not to be as it still respectively has the least incidences of confirmed cases and fatalities of all the regions. This in the opinion of the World Health Organisation (WHO, 2020) in the Guardian (2020) was probably because of its "low population density, hot and humid climate, the high level and the percentage of youths combined."

The pandemic, using every parameter has affected economies and livelihoods, but its most devastating impacts were felt by households living beneath the economic, social, health and educational services thresholds (Buheji *et al.*, 2020). Projections from the World Bank indicated that COVID-19 will push 49 million people into extreme poverty in 2020 out of which 23 million are expected to be in SSA (Mahler *et al*., 2020 in Bukari *et al*., 2020). The lockdown order enforced due to the outbreak of the virus has likewise resulted in labour market shocks, and this according to the International Labour Organisation (ILO, 2020), has affected not only supply (production of goods and services) but also demand (consumption and investment).

The impact of the virus is thus overwhelming (Lima *et al.,* 2020 and Amzat *et al.,* 2020), because it has caused a shift from the normal lifestyle (Haleem *et al.,* 2020) and predisposed households and communities, with poor access to healthcare to the debilitating effects of the pandemic (Shadmi *et al.,* 2020). This in the opinion of Shadmi *et al* (2020) is because they may delay or even forgo being tested when they come down with COVID-19 related symptoms and only seek medical care in advanced stages, resulting in poorer outcomes. Consequently, this paper appraised the coronavirus preventive strategies adopted by households and as well, comparatively assessed the pre and post-lockdown household income

poverty in Minna, Nigeria. The study similarly developed a predictive model that established the nexus between poverty ratio and the incidence of COVID-19 in Nigeria.

2. RESEARCH METHODOLOGY

This research exercise employed the use of both the primary and secondary sources of data. The primary data were collected through questionnaire administration, while the secondary information was contrastingly sourced from relevant literatures. Both the descriptive and inferential statistics were used in the data analysis exercise.

2.1. Sample population

According to Martins (2019), Minna had a 2019 projected population size of 539,213 (projected from the 2006 population census figure). Thus, using the 3.2% national population growth rate (National Population Commission - NPC, 2016), the projected 2021 population size of Minna is 574,272. This was calculated using the geometric growth formula shown in equation 1:

$$P_1 = P_0 (1+r)^n \quad (1)$$

Where:

P_1 = the projected population;

P_0 = base year population;

r = population growth rate;

^{n} = number of years/interval

2.2. Sample size

In order to establish the number of households in Minna, its 2021 projected population figure was divided by its average household size of six (NPC, 2011 in Martins, 2019). Its estimated number of households is, therefore, 95,712. The survey system (2012) – an online sample size calculator - was thereafter used in obtaining the sample size of the study. The sample size is 2,342 households at 2% pre-determined margin of error. The sample size, estimated number of households and projected population figures of the neighbourhoods - calculated based on the 2019 estimated figures in Martins (2019) - are shown in Table 1.

Table 1: Projected 2021 population figures of all the neighbourhoods in Minna

Clusters	Projected Population	Estimated No. of Households	Sample Size
Angwan Daji	20,930	3,488	85
Barkin Sale	18,576	3,096	76
Bosso Estate	5,755	959	23
Bosso Town	55,204	9,201	225
Chanchaga	37,151	6,192	152
D. Kura Gwari	12,820	2,137	52
D. Kura Hausa	18,837	3,140	77
Fadikpe	6,279	1,046	26
F-Layout	6,802	1,134	28
GRA	4,971	829	20
Jikpan	12,296	2,049	50
Kpakungu	24,594	4,099	100
Limawa	38,197	6,366	156
Maitumbi	19,622	3,270	80
Makera	43,692	7,282	178

Clusters	Projected Population	Estimated No. of Households	Sample Size
Minna Central	37,151	6,192	152
Nasarawa	37,674	6,279	154
New GRA	1,046	174	4
New Maitumbi	1,832	305	7
Nykangbe	6,279	1,046	26
Sabon-Gari	47,354	7,892	193
Sauka Kahuta	9,942	1,657	41
Shango	9,680	1,613	39
Talba Estate	785	131	3
Tayi Village	13,343	2,224	54
Tudun Fulani	14,912	2,485	61
Tudun Wada North	32965	5,494	134
Tudun Wada South	29,826	4,971	122
Tunga Low-Cost	5,755	959	23
Minna town	574,272	95,712	2,342

Source: Calculated based on Martins (2019)

2.3. Sampling technique

A multistage sampling technique, made up of the clustered, stratified and random sampling techniques, was employed for this study. The respective neighbourhoods of Minna served as the clusters, while each of the clusters was divided into strata, that is, streets or block of houses (where there are no clearly defined streets). The questionnaires for each stratum were thereafter proportionally administered on household heads or their representatives using the random sampling technique. Data for the study were collected with the aid of 'KoBoCollect' data collection tool - a mobile digital data collection tool used on Android, iOS, and many other devices.

2.4. Methods of data analysis

The descriptive and inferential statistics were used to analyse the data and information collected. While the descriptive statistics was analysed with the aid of both the numerical and graphical tools, the inferential statistics was made up of the T-test and regression techniques. The essence of the t-test analysis was to determine the existence of any statistically significant difference in the household poverty rates of the pre and post lockdown periods in Minna, whereas the regression technique was used to predict the relationship between the incidences of poverty and COVID-19 in Nigeria. These analyses were all executed with the aid of the Statistical Package for Social Science (SPSS) - a computer-based statistical analysis tool. The sets of data analysed for this study are discussed thus:

2.4.1. HOUSEHOLD PREVENTIVE STRATEGIES AND POVERTY INCIDENCE DATA

Two folds of data were collected for this objective. The first was the data on the COVID-19 preventive strategies adopted by households while the second was on household poverty incidence of Minna. Poverty is a multifaceted phenomenon and as a result, its dimensions are as varied as there are its definitions. Babatunde et al. (2008) conceived it as a broad, multidimensional, partly subjective phenomenon, often viewed as both the cause and symptom of underdevelopment. Weisfeld-Adams and Andrzejewski (2008) contrastingly opined that most of its definitions fall into either one or both of the broad categories of income and human poverty (material and social deprivations) classified by the UN. Thus, the Naira equivalent of the international income poverty line of $1.90/capita/day was used in the household poverty income assessment. Household income data covering two periods, that is, days preceding the imposition and days after the suspension of the lockdown order on Minna were respectively collected for the household headcount ratio assessment. The Naira equivalent of the US's $1.90 as at the date of the lockdown imposition (23rd April, 2020) was ₦720.63 (exchange-rates.org, 2020), while that of the suspension date (20th May, 2020) was ₦732.28 (poundsterlinglive.com, 2020). The household monthly equivalents of these were therefore ₦129,713.40 and ₦131,810.40 respectively. These household monthly income poverty lines were obtained by multiplying the respective Naira equivalents of $1.90 by the product of six (average household size of Minna) and 30 (average number of days in a month).

Data on the incidences of poverty in Nigeria and its sub-nationals were sourced from the 2019 Poverty and Inequality in Nigeria report of the NBS. The report however asserted that owing to the multidimensionality of poverty, the 2018-19 Nigerian Living Standards Survey (NLSS) adopted the consumption expenditures approach as opposed to the income approach in its assessment. This is because according to the report, consumption expenditures reflects better the achievement of a particular level of welfare by a household than the income approach, which basically represents the opportunity of reaching a certain level of well-being.

The "consumption aggregate" used in the NLSS 2018-19 was the monetary value of the following food and non-food goods and services consumed by the household:

- Expenditures on food, from all sources, including from purchased, self-production and gifted, and meals;
- Schooling and education expenditures;
- Expenditures related to health care of household members;
- Housing expenditures; and
- Expenditures on other non-food goods and services, like clothing, small appliances, fuel, recreation, household items and repairs, among others.

The national poverty line established by the report was ₦137,430/capita/annum. The implication of this is that any household whose average per capita consumption is less than ₦137,430/annum (or ₦11,452.50/month) is considered poor by national standard. The NLSS 2018-19 also calculated the headcount ratios of all the States and the Federal Capital Territory (except that of Borno State that has been ravaged by the activities of the Boko Haram insurgents).

2.4.2 COVID-19 incidences data

Data on the respective incidences of the confirmed cases and fatalities resulting from coronavirus infections at the sub-national level (as at Monday 9:43 am September 21, 2020) were obtained from the official website of the Nigerian Centre for Disease Control (NCDC). Although there is a set of data for Borno State in this instance, it was excluded from the analysis because the NLSS 2018-19 did not cover it.

2.5. Assumptions

This study is premised on the following assumptions:

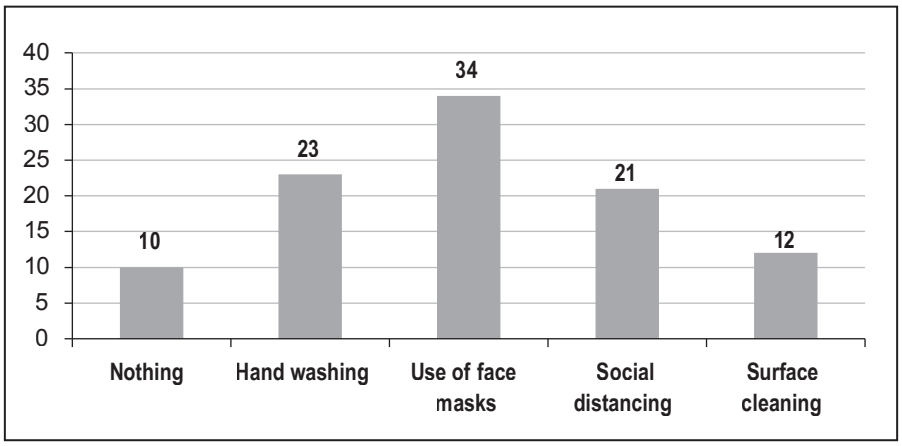
- All States in Nigeria have same levels of port and border accessibility;
- All States have adequate testing capacities (relative to their population);
- Testing facilities are accessible whenever the need arises;
- All the infected cases were detected and recorded; and
- The phased and gradual ease of lockdown was simultaneously implemented across the whole country.

3. DATA ANALYSIS AND PRESENTATION

3.1. Most widely used COVID-19 preventive strategies

Owing to the high-spread factor of the virus, households needs to adopt some strategies (aside the lockdown imposed by government) in order to curb its spread. All the sampled households affirmed that they employ at least a strategy to keep the virus at bay, but the policing of the strategies are however poorly executed in Minna. This in effect means that the adoption of the strategies by households in Minna is borne out of their level of awareness and consciousness of their health. Hence, they were asked to state their most preferred and widely used strategy. As shown in Figure 1, the use of face masks (34%) and hand washing (23%) are the most preferred strategies used while 10% of the households said they do not employ any preventive strategy.

Figure 1: Most widely used COVID-19 preventive strategies in Minna



3.2. Variations in the pre and post lockdown household monthly income poverty

Data on the pre and post lockdown headcount ratio, presented in Table 2 revealed that although the high rate of household income poverty in Minna predates the outbreak of COVID-19, the post lockdown poverty rate of Minna is more alarming. A breakdown of the analysis showed that while 14 neighbourhoods, that is, 48.3% of the neighbourhoods of Minna recorded 100% poverty incidences in the period preceding the imposition of the COVID-19 induced lockdown, six more neighbourhoods slid into the 100% poverty rate during the lockdown period. Thus, 70% of the neighbourhoods were observed to have recorded 100% poverty incidence after the suspension of the lockdown order. A critical look at the Table indicated that there was no improvement in the post-lockdown performance of all the neighbourhoods. However, the performance of F-Layout remained unchanged within the periods under review. The Table further revealed that while the pre-lockdown household income poverty rate of Minna was 93.6%, the post-lockdown poverty rate is 97.6%.

Table 2: Variations in the pre and post lockdown household monthly income poverty in Minna (%)

Clusters	Pre-lockdown poverty rate	Post-lockdown poverty rate	Clusters	Pre-lockdown poverty rate	Post-lockdown poverty rate
Angwan Daji	94.1	98.8	Minna Central	100.0	100.0
Barkin Sale	97.4	100.0	Nasarawa	100.0	100.0
Bosso Estate	73.9	91.3	New GRA	75.0	100.0
Bosso Town	96.0	100.0	New Maitumbi	100.0	100.0
Chanchaga	100.0	100.0	Nykangbe	100.0	100.0
D. Kura Gwari	100.0	100.0	Sabon-Gari	90.2	99.0
D. Kura Hausa	98.7	100.0	Sauka Kahuta	100.0	100.0
Fadikpe	92.3	100.0	Shango	92.3	100.0
F-Layout	96.4	96.4	Talba Estate	100.0	100.0
GRA	55.0	65.0	Tayi Village	83.3	94.4
Jikpan	84.0	98.0	Tudun Fulani	100.0	100.0
Kpakungu	98.0	100.0	Tudun Wada North	100.0	100.0
Limawa	100.0	100.0	Tudun Wada South	100.0	100.0
Maitumbi	100.0	100.0	Tunga Low-Cost	87.0	87.0
Makera	100.0	100.0	Minna town	93.6	97.6

The implication of the higher post-lockdown poverty rate is that it has led to a further deterioration in household capabilities in Minna, thereby limiting their financial choices. These high pre, and post-lockdown poverty rates are however, coming on the hills of the introduction and rejigging of some social interventions programmes such as tradermoni, N-Power, Marketmoni, Farmermoni, and condition cash transfer by the Federal Government. The outcome of the t-test analysis, statistically comparing the pre and post-lockdown household income poverty in Minna is shown in Table 3. According to the analysis, the relationship recorded a p-value of 0.002022. Hence, the p-value is less than the significance level of 0.05. The implication of this is that the H0 is rejected, and the H1 is accepted. This in other words means that there exists a statistically significant difference between the pre-lockdown poverty rate and the post-lockdown poverty rate in Minna.

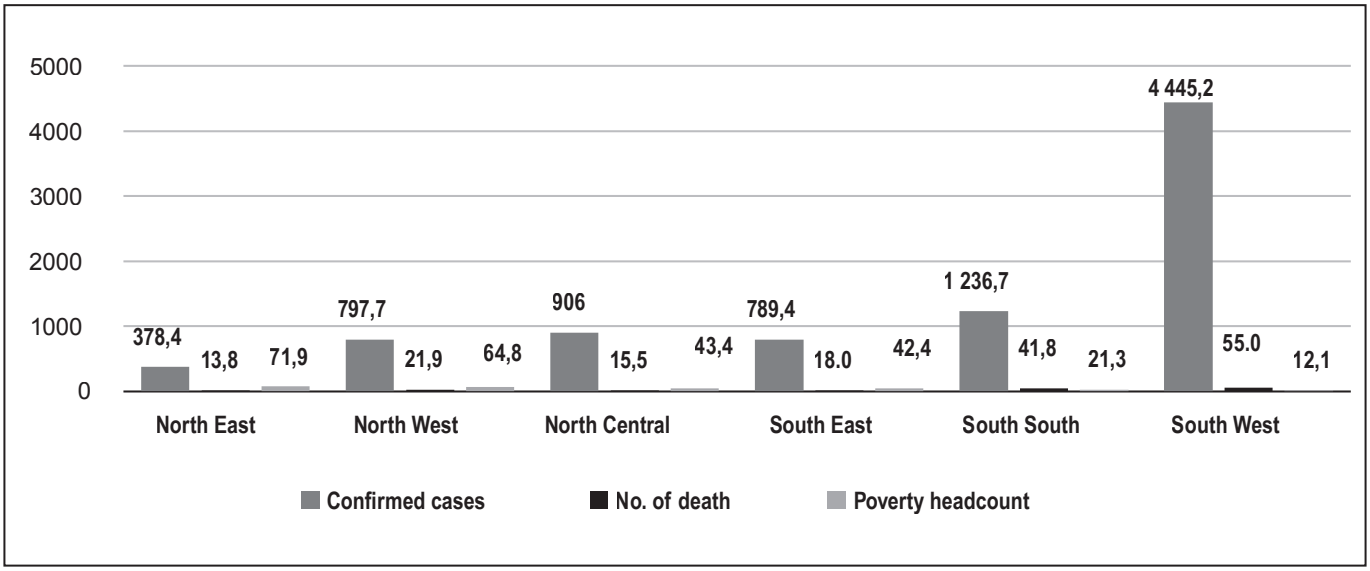
Table 3: t-Test: Paired Two Sample for Means (pre and post lockdown)

	Pre-lockdown	Post-lockdown
Mean	93.57241	97.58276
Variance	111.7085	48.25005
Observations	29	29
Pearson Correlation	0.815242	
Hypothesized Mean Difference	0	
Df	28	
t Stat	-3.40387	
P(T<=t) one-tail	0.001011	
t Critical one-tail	1.701131	
P(T<=t) two-tail	0.002022	
t Critical two-tail	2.048407	

3.3. Comparative performances in the average incidences of poverty and COVID-19 in the six geo-political zones

Data on the performances of the six geopolitical zones of Nigeria in the average incidences of poverty and COVID-19 are displayed in Figure 2. According to the Figure, the north-east and south-west respectively had the highest and least mean poverty headcount ratios as per the 2018-19 NLSS. As shown in the Figure, 71.9% of the households in the north-east (largely ravaged by insurgency) are subsisting beneath the national poverty line while the south-west (housing Lagos State, the commercial and economic nerve of the country) recorded a poverty headcount ratio of 12.1%. The Figure similarly showed that inversely to the headcount ratio, the south-west and north-east respectively recorded the highest and least mean incidences of the confirmed COVID-19 (as well as its related death) cases. The average number of the confirmed cases of COVID-19, according to the Figure is 4,445.2 in the south-west, while that of the north-east is 378.4. In the same vein, data on the average number of coronavirus related fatalities as shown in the Figure is 55.0 in the south-west and 13.8 in the north-east.

Figure 2: Comparative performance in the average incidences of poverty (%) and COVID-19 in the six geo-political zones of Nigeria



A further look at Figure 1 indicated that the south-south region, which is next to the south-west in term of the least poverty headcount ratio, likewise trails it in both the incidences and fatalities of the COVID-19. It is also discernible from the Figure that the north-west region (with the second highest incidence of poverty headcount ratio), similarly recorded the second least incidence of the virus. The outcome of this analysis shows an inverse relationship between the incidences of poverty and coronavirus in Nigeria. This scenario may likely be explained by the fact that northern Nigeria has a lower population density and its climate is comparatively harsher and more humid. This thus lends credence to the assertion of the WHO (earlier cited in this study).

3.4. Comparative analyses of the incidences of poverty and COVID-19 in the Northern and Southern regions

Data on the performances of States in the northern and southern regions in poverty headcount ratio and COVID-19 cases are respectively presented in Table 4. The Table indicated that the average number of coronavirus cases in the south is 2,237.5, while that of the north is 717.3. This in effects means that for every case of COVID-19 in the north, there are 3.1 incidences in the south. The Table similarly revealed that the average numbers of deaths in the northern and southern regions are 17.5 and 39.5 respectively. This implies that the ratio of COVID-19 related death between the northern and southern regions is 1:2.6. On the incidence of poverty headcount ratio, the analysis showed that northern and southern regions had a ratio of 1:0.4. That is, for every four poor households in the south, there are 10 households in the north living beneath the national poverty line.

Table 4: Comparative performance between Northern and Southern States in the incidences of poverty (%) and COVID-19

Northern States	Confirmed COVID-19 cases	Number of death	Poverty Headcount Rate
Adamawa	234	16	75.41
Bauchi	689	14	61.53
Benue	473	10	32.90
Gombe	799	25	62.31
Jigawa	322	11	87.02
Kaduna	2,348	34	43.48
Kano	1,734	54	55.08
Katsina	848	24	56.42
Kebbi	93	8	50.17
Kogi	5	2	28.51
Kwara	1,025	25	20.35
Nasarawa	448	13	57.30
Niger	254	12	66.11
Plateau	3,231	31	55.05
Sokoto	161	17	87.73
Taraba	95	6	87.72
Yobe	75	8	72.34
Zamfara	78	5	73.98
Average	**717.3**	**17.5**	**59.6**

Southern States	Confirmed COVID-19 cases	Number of death	Poverty Headcount Rate
Abia	881	8	30.67
Akwa Ibom	288	8	26.82
Anambra	232	19	14.78
Bayelsa	394	21	22.61
Cross River	85	9	36.29
Delta	1,799	49	6.02
Ebonyi	1,038	30	79.76
Edo	2,611	105	11.99
Ekiti	317	6	28.04
Enugu	1,234	21	58.13
Imo	562	12	28.86
Lagos	18,943	205	4.50
Ogun	1,766	28	9.32
Ondo	1,597	35	12.52
Osun	817	17	8.52
Oyo	3,231	39	9.83
Rivers	2,243	59	23.91
Average	**2,237.5**	**39.5**	**24.3**

** Borno State in the North, and the Federal Capital Territory, Abuja not included*

3.5. Poverty headcount ratios and confirmed COVID-19 cases model

Predicting a reliable and effective relationship between the incidences of poverty and COVID-19 might not be practicable because of some factors earlier highlighted. But in spite of this inherent shortcoming, this analysis is expedient because it will predict the likely pattern of the association between household income poverty characterised by the inability of households to meet their food, education, health care, and housing needs (as spelt out in the 2018-19 NLSS) and COVID-19. To this end, the variables of the poverty headcount ratio and confirmed COVID-19 incidence in Nigeria (displayed in Table 5) were loaded in order to predict the rate of change in the confirmed cases of the latter when the former increases or decreases at a given rate. As shown in the Table, the headcount income poverty is the independent variable, while the incidence of confirmed cases of COVID-19 is the dependent variable.

Table 5: Poverty headcount ratio and confirmed COVID-19 cases in Nigeria

States	Confirmed COVID-19 cases	Poverty Headcount Rate	States	Confirmed COVID-19 cases	Poverty Headcount Rate
	Dependent	Independent		Dependent	Independent
Abia	881	30.67	Katsina	848	56.42
Adamawa	234	75.41	Kebbi	93	50.17
Akwa Ibom	288	26.82	Kogi	5	28.51
Anambra	232	14.78	Kwara	1,025	20.35
Bauchi	689	61.53	Lagos	18,943	4.50
Bayelsa	394	22.61	Nasarawa	448	57.30
Benue	473	32.90	Niger	254	66.11
Cross River	85	36.29	Ogun	1,766	9.32
Delta	1,799	6.02	Ondo	1,597	12.52
Ebonyi	1,038	79.76	Osun	817	8.52
Edo	2,611	11.99	Oyo	3,231	9.83
Ekiti	317	28.04	Plateau	3,231	55.05
Enugu	1,234	58.13	Rivers	2,243	23.91
Gombe	799	62.31	Sokoto	161	87.73
Imo	562	28.86	Taraba	95	87.72
Jigawa	322	87.02	Yobe	75	72.34
Kaduna	2,348	43.48	Zamfara	78	73.98
Kano	1,734	55.08	FCT	5,551	38.66

** Borno State not included*

The output of the linear regression presented in Table 6a revealed that the analysis recorded a correlation coefficient (R value) of 0.346462 and a correlation of determination (R2) value of 0.120036. This implies that income poverty explains 12.0% of the variation in the confirmed cases of coronavirus in Nigeria. The relationship between the variables is weak, but statistically significant as it recorded a p-value less than 0.05 at 95% confidence level (see Table 6b). The model for the regression analysis developed from the coefficient of the independent variable is presented in equation 2. The model (equation 2) showed that poverty headcount ratio has an inverse association or contribution to the confirmed cases of COVID-19, that is, the lower the poverty headcount ratio, the higher the confirmed cases of coronavirus. This in effects means that States with high rates of household income poverty recorded lower confirmed cases of the virus. The implication of the association is that for each unit increase in poverty headcount ratio, the confirmed cases of coronavirus decreases by -42.5625 units.

$$Y = 3372.04 - 42.5625xi \quad (2)$$

Where xi = poverty headcount ratio

Table 6a: Model summary

Model	R	R Square	Adjusted R Square	Standard Error
1	0.346462	0.120036	0.094155	3050.178

Table 6b: Coefficients

	Coefficients	Standard Error	t Stat	P-value
Intercept	3372.04	979.2914	3.443346	0.001543
Poverty headcount ratio	-42.5625	19.76349	-2.15359	0.038451

In a similar study carried out (over a period of four different dates) during the first 10 weeks of the outbreak of COVID-19 in the United States by Finch and Finch (2020), it was established that at the first three dates, the relationship between poverty index and COVID-19 cases was negative. The number of confirmed cases overall was however relatively small at these dates. But the

outcome of the fourth date indicated that the relationship between the variables was positive, indicating that counties with lower levels of reported poverty had a larger number of confirmed COVID-19 cases. The outcome of the analysis of the fourth date, therefore, validates the outcome of this study.

3.6. 3.6 Poverty headcount ratio and COVID-19 death model

The variables loaded in order to determine the rate of variation in COVID-19 related death when poverty headcount ratio is increased or decreased in Nigeria are presented in Table 7. As indicated in the Table, the poverty headcount ratio is the independent variable, while data on the confirmed cases of death resulting from the COVID-19 pandemic is the dependent variable.

Table 7: Poverty headcount ratio and COVID-19 death in Nigeria

States	Number of death	Poverty Rate	States	Number of death	Poverty Rate
	Dependent	Independent		Dependent	Independent
Abia	8	30.67	Katsina	24	56.42
Adamawa	16	75.41	Kebbi	8	50.17
Akwa Ibom	8	26.82	Kogi	2	28.51
Anambra	19	14.78	Kwara	25	20.35
Bauchi	14	61.53	Lagos	205	4.50
Bayelsa	21	22.61	Nasarawa	13	57.30
Benue	10	32.90	Niger	12	66.11
Cross River	9	36.29	Ogun	28	9.32
Delta	49	6.02	Ondo	35	12.52
Ebonyi	30	79.76	Osun	17	8.52
Edo	105	11.99	Oyo	39	9.83
Ekiti	6	28.04	Plateau	31	55.05
Enugu	21	58.13	Rivers	59	23.91
Gombe	25	62.31	Sokoto	17	87.73
Imo	12	28.86	Taraba	6	87.72
Jigawa	11	87.02	Yobe	8	72.34
Kaduna	34	43.48	Zamfara	5	73.98
Kano	54	55.08	FCT	76	38.66

** Borno State not included*

The output of the regression analysis presented in Table 8a revealed that it recorded an R value of 0.394794 and R2 value of 0.155863. This means that poverty headcount ratio explains 15.6% of the variation in COVID-19 related death in Nigeria. Although the relationship between the variables is weak, Table 8b showed that it is statistically significant, as its p-value is less than 0.05 at 95% confidence level. As shown in the Table, poverty headcount ratio has inverse relationship or contribution to COVID-19 related death. The effect of this is that States with higher rates of household income poverty recorded fewer cases of COVID-19 related deaths. The model for the regression analysis was developed from the coefficient of the independent variable, and it is presented in equation 3. The relationship between the variables, according to the generated equation entails that for each unit increase in poverty headcount ratio, COVID-19 related death cases decreases with -0.56077 units. The outcome of this is also in conformity with that of the fourth date of the Finch and Finch (2020) study.

$$Y = 53.24939 - 0.56077xi \quad (3)$$

Where xi = poverty headcount ratio

Table 8a: Model summary

Model	R	R Square	Adjusted R Square	Standard Error
2	0.394794	0.155863	0. 131035	34.54184

Table 8b: Coefficients

	Coefficients	Standard Error	t Stat	P-value
Intercept	53.24939	11.09002	4.801562	3.1E-05
Poverty headcount ratio	-0.56077	0.223812	-2.50555	0.017178

4. CONCLUSION AND RECOMMENDATIONS

The study has indicated that the there exists a statistically significant difference between the pre-lockdown poverty rate and the post-lockdown poverty rate in Minna, while the average poverty headcount ratios in the north-east and south-west are 71.9% and 12.1% respectively. It similarly revealed that there is an average of 3.1 incidences of coronavirus in the south to every single case in the north. The study established that for every four poor households in the south, there are 10 households in the north living beneath the national poverty line. The outcome of the regression analysis showed that poverty headcount ratio respectively explains 12.0% and 15.6% of the variations in the confirmed cases and fatalities of coronavirus in Nigeria. The nexus between poverty and the respective incidences of the confirmed cases and fatalities of coronavirus are however weak but statistically significant.

The models developed for the study indicated that for every unit increase in household poverty headcount ratio, there are corresponding decreases of -42.5625 and -0.56077 units in the incidences of COVID-19 cases and fatalities respectively. Poverty as established in this study is an enabler to ill-health and hinders accessibility to health care. But it cannot be an effective means of predicting the incidences of some diseases because of the interplay of other factors. In other words, the models developed might not be completely valid as there are many varied factors that affect the outbreak and control of the coronavirus pandemic. Be that as it may, there is the potentiality of high poverty rates and incidences of COVID-19 weighing down every part of the country. To this end, the following recommendations, aimed at improving household capabilities (income and access to health care facilities) in Nigeria have been put forward:

- The existing social intervention programmes of the Federal Government should be domesticated by States Governments in order to enhance the standard of living of more households and businesses;
- Carrying out enlightenment and sensitization programme by stakeholders on the need to adopt preventive measures to guard against the outbreak of the virus; and
- The Nigerian government should ensure improved access to basic facilities and services that would guarantee the wellbeing of communities.

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