

EFFECTS OF COVID-19 ON LIVING STANDARDS OF HOUSEHOLDS IN THE NORTH EAST REGION OF GHANA: A LINEAR MIXED EFFECTS MODEL APPROACH

Emmanuel ADOMBOR^{a*}, Gideon Mensah ENGMAN^b, Abukari ALHASSAN^c

^{a)} College of Nursing and Midwifery, Nalerigu, North-East Region, Ghana

^{b)} C. K. Tedam University of Technology and Applied Sciences, Navrongo, Upper East Region, Ghana

^{c)} University for Development Studies, Nyankpala Tamale, Northern Region, Ghana

Abstract

The world was severely hit by the novel coronavirus (COVID-19) in the latter part of 2019. The coronavirus is an ongoing global pandemic caused by severe acute respiratory syndrome coronavirus (SARS-CoV-2) and was first identified in Wuhan, China. The pandemic has devastated every sector of Ghana's economy and has significantly affected the living standards of people in the country. This study seeks to investigate the effects of COVID-19 on the living standards of households in Ghana using the North East Region as a case study. A sample of 399 respondents was drawn from the six (6) districts/municipalities using a single-stage cluster sampling technique. A linear mixed-effects model was used to investigate the fixed effects and the random effects in the study. Results from the study showed that variables such as the marital status of respondents, highest educational level of respondents, dependents, and employment status of respondents had significant fixed effects on the living standard of households in the Region. Overall, the study results showed that COVID-19 had significantly affected most households which has resulted in deteriorating living standards making the overall living standards worse in the Region. It was recommended in the study that a similar investigation be carried out in other parts of the country to get a more holistic view of the effects of the pandemic.

Keywords: COVID-19, Household, Living Standards, North East Region, Ghana

JEL Classification: C31, C39, I19

*Corresponding author, Emmanuel Adombor - e.adombor@gmail.com

1. Introduction

In the later part of 2019, the unique Corona virus had a devastating impact on the global population (COVID-19). The introduction of the pandemic has caused widespread destruction,

causing a global health and economic disaster that has resulted in millions of deaths, industrial shutdowns, massive job cuts or staff reductions, and catastrophic income shocks.

As a result of the pandemic, economic activity has been severely affected around the globe. Fear of the virus and strict social distancing policies have led to individuals in virtually all countries to modify their consumption and working habits. Economically vulnerable citizens of low-and-middle-income countries (LMICs), where the majority of the world's population resides, potentially face stark threats to their livelihoods (Egger *et al.*, 2021). Less attention has been paid to the impact of COVID-19 on the living conditions of most households in Ghana after the outbreak. Although most recent studies on the impact of COVID-19 on living standards have been empirically validated and, to a certain extent, over-researched in some unusual settings and countries (Kesar *et al.*, 2020; Mahler *et al.*, 2020; Malik *et al.*, 2020; Rahman and Matin, 2020), research in this area in Ghana is largely unknown and under-researched. In spite of this, the majority of research on the effects of COVID-19 in Ghana has focused on other sectors of the economy, such as health and education and little is known about the living standards of households.

Most economies today attribute the fall in living standards largely to the effects of COVID-19. While the majority of the aforementioned projections on the micro impact of COVID-19 on living standards have been empirically validated (Austrian *et al.*, 2020; Kesar *et al.*, 2020; Malik *et al.*, 2020) Durrizo *et al.*, (2020)'s study on the effects of the pandemic on families concentrated on urban poor households and was largely located in Accra, limiting the study's breadth. Their research was mainly on how poor people in urban areas mitigated their risk of the COVID-19 infections, rather than its effects on living standards, which are also significant policy indicators.

Even without COVID-19, it is expected that by 2030, Sub-Saharan Africa would contain nearly nine out of ten very impoverished households. It is anticipated that the introduction of COVID-19 and the continual appearance of new variants will put back the world's attempts to alleviate poverty in Sub-Saharan Africa by 2030 by seven years (Mahler *et al.*, 2020).

This study examined how COVID-19 endangers one of the Sustainable Development Goals, namely Ghana's living standards. The purpose of this study was to look at the influence of COVID-19 on Ghanaian households' living conditions especially in the Northeast Region. Although the majority of people have complained about the COVID-19 epidemic's negative effects on their resources, there is little actual data to back up this assertion. This study would go a long way in dissecting the effects of the pandemic on the living standards of households in the North East Region and Ghana at large.

Subsequent sections in this study include the methods with focus on the study setting, study design, study population and sampling, data analysis, results and discussion.

The study setting emphasizes where the study was conducted highlighting the geographical location of the setting. The study design also looks at the specific research design adopted in this study. Subsequently, the study population looks at the target population for the study which then leads us to the data analysis, results and discussion.

2. Literature Review

COVID-19, a novel coronavirus, is a member of the largest coronavirus family, Nidovirales (Banerjee *et al.*, 2019; Zhang and Liu, 2020). It is one of the diseases that is transmitted by personal contact. Consequently, geographical distance plays an important role in its spread. Before the disease was found in Ghana, it was present in all neighbouring countries. Ghana documented the first two cases of COVID-19 on March 12, 2020 (Ghana Health Service, 2020).

The major survey conducted to ascertain the living standards of households in Ghana is the Ghana Living Standards Survey (GLSS). This is an important source of data on the living circumstances of Ghanaian families. The Ghana Living Standards Survey (GLSS) was carried out in 2018, making it the most recent iteration of the survey. All of this information was painstakingly gathered, including but not limited to: demographic characteristics, education, health, employment, migration and tourism, housing, household agriculture, spending and income, government, peace and security, financial services, credit, and assets (GSS, 2018).

Since the Great Depression (1929-1939), which was an economic shock that affected most countries around the world leading to economic depression, there has been much interest in the relationship between poverty and pandemics, but in recent years, the COVID-19 pandemic has reignited the discussion on how pandemics affect living standards. Recent research has endeavoured with vigour to identify the channels by which COVID-19 affects poverty in order to stimulate policy discussions. Studies by Martin *et al.* (2020) in the United States, Kesar *et al.* (2020) in India, Malik *et al.* (2020) in Pakistan, Austrian *et al.* (2020) in Kenya, Human Sciences Research Council (HSRC), (2020) in South Africa, Le Nestour *et al.* (2020) in Senegal, and Durizzo *et al.* (2020) in South Africa and Ghana are among the significant studies associated with this agenda, where various statistical and economic models such as logistic regression, quantile regression, linear mixed-effects model among others were adopted. Three significant gaps were noted in the present literature: As the bulk of research on the pandemic are significantly weighted toward health and macro ramifications, it is too early to infer that the health impact of COVID-19 is bigger than its economic impact. An urgent examination of the micro effects of COVID-19 is required to better comprehend how the pandemic affects the lives of individuals, particularly the poor and vulnerable (Owusu and Frimpong-Manso, 2020). This study by Owusu and Frimpong-Manso (2020) adopted the mixed-effects model technique in examining the effects of the pandemic on individuals and households. While there is universal agreement that the developing world's progress toward eliminating poverty by 2030 would stall by seven years (International Labour Organization [ILO], 2020; Lakner *et al.*, 2019, 2020; World Bank, 2020), there is a dearth of research on how the pandemic is disproportionately impacting the lives of the poor.

In a study by Austrian *et al.* (2020), using Ordinary least squares, Probit model and simultaneous quantile regressions, micro-level evidence has shown that the pandemic has to a large extent increased poverty and lowered living standards in a variety of ways. These include lower incomes, job losses, inadequate access to basic health services, and a reduction in per capita household consumption of food and non-food items. However, this is not the situation in Ghana. (Austrian *et al.*, 2020; Malik *et al.*, 2020) The second cause of concern, according to the research, is that the impact of COVID-19 on impoverished families is anticipated to vary by gender, with male-headed households being better equipped to deal with the shock than

female-headed households (Acheampong *et al.*, 2020; Alon *et al.*, 2020). If this hypothesis is correct, then more gender-specific poverty reduction efforts will be necessary after COVID-19. It is crucial to note that gender discrepancies in poverty have a long history, with women being treated unfairly throughout time (Betti *et al.*, 2020; Depew and Price, 2018). Because family responsibilities and labour markets usually prevent women from competing economically with men, there has been a rise in concern around the COVID-19 pandemic (Wenham *et al.*, 2020). Wenham *et al.* (2020) emphasized that the unequal impact of COVID-19 on women is due to discrepancies in work status since the majority of women are involved in informal care within the family, hence restricting their employment and economic opportunities.

In a study by Maldonado (2012), the linear mixed-effects model was used in a direct application to the behavioural sciences and adolescent community health. It was realized that adolescents with an anxiety disorder had a significantly lower average self-esteem than healthy adolescents.

3. Methods

3.1 Setting

The North East Region is located in Ghana West Africa and is part of the sixteen (16) Regions in Ghana and also part of the six new Regions created in December 2018 after a referendum was voted upon to break it off the Northern Region. Its regional capital is situated in Nalerigu (Ngon, 2018). The North East Region is bordered on the north by the Upper East Region, on the east by the eastern Ghana-Togo international border, on the south by the Northern Region and the west by the Upper West Region. North East Region is made up of four (4) Districts and two (2) Municipalities namely; the West Mamprusi Municipality, East Mamprusi Municipality, Bunkpurugu-Nakpanduri District, Yunyoo-Nasuan District, Chereponi District and the Mamprugu Moagduri Districts. Figure 1 presents the map of the study setting.



Figure no 1: Study Setting
Source: GSS, 2018

3.2 Study Design

A descriptive cross-sectional study design was adopted for this study in April 2022 among selected heads of household in the six (6) districts/municipalities in the North-east Region of Ghana.

3.3 Study Population and Sampling

The target population for this study was heads of household who were 18 years or older and had lived continuously in the household during the COVID-19 period for at least two months preceding 12th March 2020. A sample size of 384 respondents using the Cochran sample size estimation formula (1977) was adopted for this study with 50% of households expected to have high living standards in the North East Region, a 5% margin of error, and a 95% confidence interval. Single-stage cluster sampling technique was adopted for this study. The Districts/Municipalities were divided into clusters in the region and households were selected in each stratum. This was necessary since the various households in the districts/municipalities in the region are widely geographically dispersed.

3.4 Data Analysis

Data collected was analyzed using STATA 15 and Minitab 16 statistical software. Stata and Minitab are general-purpose statistical software packages for data manipulation, visualization, statistics, and automated reporting which are mostly used by researchers in many fields such as biomedicine, epidemiology, sociology, and science. The study adopted the six (6) Afrobarometer indicators for the Living standards score (LSS) of respondents which was the dependent variable. The average of the six (6) items was determined and a Cronbach's alpha (scale reliability coefficient) of 0.79 was obtained. The independent variables in the study comprise; the age of the respondent, gender of the respondent, highest educational attainment of the respondent, dependents (less than 16 years and greater than 59 years), household size and household total monthly income. A Linear mixed effects model was used to determine the effects of COVID-19 on the living standards of households. Completely randomized block design technique was adopted for this study. The linear mixed effect model adopted a general form:

$$y_{ij} = \beta_1 x_{1ij} + \beta_2 x_{2ij} + \dots + \beta_n x_{nij} + b_{i1} z_{1ij} + b_{i2} z_{2ij} + \dots + b_{in} z_{nij} + \varepsilon_{ij} \quad (1)$$

where

- y_{ij} = the value of the outcome variable for a particular ij case
- β_1 through β_n = Fixed effects coefficients
- x_{1ij} through x_{nij} = Fixed effects variables (predictors for observation j in i)
- b_{i1} through b_{in} = Random effects coefficients (Assumed to be multivariate normally distributed)
- ε_{ij} = Error for case j in group i (each group's error is assumed to be multivariate normally distributed).

3.5 Data and Variables

Table no. 1: Description of variables in the study

Variable	Description
Age of respondent	Age of the respondent in completed years
Gender of Respondent	Where 1= male or 2=female
Highest Educational Level of Respondent	No education=1 which is the least and postgraduate =7 which is the highest
Respondent's place of residence	Whether rural=1 or urban=2
Household total Monthly income (GH@)	Amount in Ghana cedis
Dependents (less than 16 years and greater than 59 years)	Whether yes=1 or no=2
Employment status of respondents	Whether employed=1, unemployed due to COVID-19=2 or unemployed due to other reasons=3
Living standard indicators	
Ability to get medical care when you need it	Rated on a likert scale ranging from 1-5 where; 1=much worse, 2=worse, 3=same, 4=better and 5=much better
Ability to eat healthy and nutritious food when you need it	
Income	
Cost of living	
Access to electricity	
Overall standard of living (education, health, food, etc)	

Source: Field survey, 2024

3.6 Results and Discussions

Results of the socio-demographic characteristics of the respondents in this study as seen in table no.2 revealed that the majority (65.7%) of the heads of households who took part in this study are males compared to females (34.3%). Also, the majority of the respondents are rural folks which accounted for about 60.4% of the respondents with no education at all (26.8%). Results for the marital status of respondents showed that a significant majority of the respondents (76.4%) are married with only 3 (0.8%) respondents separated or divorced. Another key variable that was observed was the presence or absence of dependents (children <16 years and aged >59 years), with the results showing most (87.2%) of the heads of household who are respondents in this study have dependents.

Finally, more than half of the respondents (51.1%) are gainfully employed as opposed to the rest that is unemployed. Interestingly, about 5.8% of the unemployed respondents are attributing it to COVID-19 which could be highly significant in this study since this study is evaluating the effects of the deadly pandemic on their living standards. On average, most of the respondents are approximately 37 years with the minimum age being 15 years and the maximum age 64 years. Also, the average household total monthly income is GH¢ 725.20 with the highest earning household earning around GH¢10,000 and some households earning absolutely nothing.

Table no. 2: Descriptive statistics of variables in the study

Variable		Frequency (N=399)	Percent (%)
Gender	<i>Female</i>	137	34.3
	<i>Male</i>	260	65.7
Respondent's place of residence	<i>Rural</i>	241	60.4
	<i>Urban</i>	158	39.6
Highest Educational Level of Respondent	<i>No Education</i>	107	26.8
	<i>Primary</i>	33	8.3
	<i>JSS/JHS</i>	59	14.8
	<i>SSS/SHS</i>	87	21.8
	<i>Diploma</i>	66	16.5
	<i>Degree</i>	31	7.8
	<i>Post Graduate</i>	10	2.5
	<i>Others</i>	6	1.5
Marital Status	<i>Single</i>	76	19
	<i>Married</i>	305	76.4
	<i>Separated/Divorced</i>	3	0.8
	<i>Widow/Widower</i>	15	3.8
Dependents (<16 years, >59 years)	<i>Yes</i>	348	87.2
	<i>No</i>	51	12.8
Employment Status of Respondents	<i>Employed</i>	204	51.1
	<i>Unemployed due to COVID-19</i>	23	5.8
	<i>Unemployed due to other factors or reasons other than COVID-19</i>	172	43.1

Source: Field survey, 2024

Descriptive Statistics of Age, Household Size, and Household Total Monthly Income

From Table 3, it could be seen that on average, most of the respondents are approximately 37 years with the minimum age being 18 years and the maximum age 64 years. Also, the average household total monthly income was GH¢ 725.20 with the highest earning household earning around GH¢10,000 and some households earning absolutely nothing.

Table no.3: Descriptive statistics of variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Skewness
Age of respondent (In completed years)	399	18	64	36.66	22.191	10.959
Household total Monthly income (GH¢)	399	0	10000	725.2	983.783	4.034
Household size	399	1	28	5.59	3.409	1.463

Source: Field survey, 2024

Preliminary Analysis

Reliability analysis was performed for the dependent variable; Living standard to check for internal consistency of the responses for the six (6) items under the variable. A Cronbach's alpha value of 0.786 was obtained which showed a significantly high level of internal consistency among the data and further shows that responses to similar or homogenous

indicators are about 79% of the time consistent with one another. Also, the analysis of variance results showed that the reliability test is significant at a 5% level of significance.

For the model checks or diagnostics, a test for normality was conducted to determine if the dataset was well-modeled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed. The histogram of residuals was done which showed that the dependent variable was normal. Also, another key assumption of the linear mixed effects model in the form of homoscedasticity (equality of variance) was tested which showed homogeneity of variance through the data. From Figure no.3, it can be seen that there is a variation of residual values at different levels of the response variable (LSS). Evidently, the distribution of values does not show any extreme variation over the range of possible living standard scores (LSS). This suggests that there is no significant difference in the variances at different levels. We do have homogeneity of variance through the data. A Bartlett test p-value of 0.788 ($p\text{-value} > 0.05$) confirms we do not reject the hypothesis and accept there is equality of variance at different levels.

Overall, preliminary analysis and tests revealed the validity of both assumptions (normality and equality of variance conditions), since this is so we can conveniently say that the data points in this study are independent of each other and predictor and response variables are linear in the model. Generally, the model was adequate and fit for prediction. All these tests were done to verify the robustness of the estimates and to ascertain the quality of the data gathered before the model was adopted.

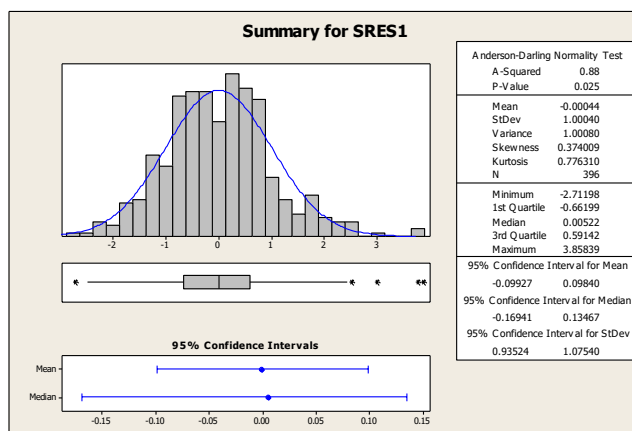


Figure no.2: Histogram of Residuals
Source: Field survey, 2024

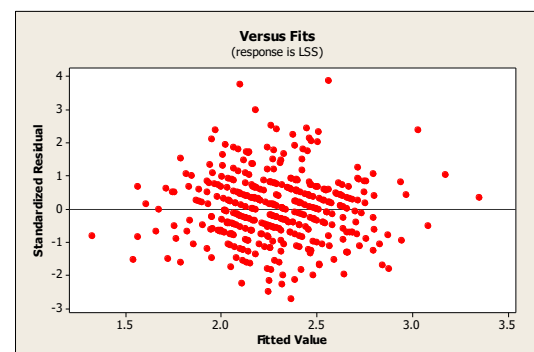


Figure no.3: Scatter plot of Residuals vs. Fit Source: Field survey, 2024
Source: Field survey, 2024

Linear Mixed Model of Fixed and Random Effects

Model Dimension

In the model dimension in Table no.4, the results showed the number of levels for all the fixed effects with the household size variable having the most number of levels (18) with 17 parameters. The random effect is the district which has six (6) levels with one parameter with the variance components.

Table no. 4: Model dimension

		Number of Levels	Covariance Structure	Number of Parameters
Fixed Effects	Intercept	1		1
	Gender of Respondent	2		1
	Highest educational level of respondent	8		7
	Marital status of respondents	4		3
	Dependents less than 16 years and greater than 59years	2		1
	Household size	18		17
	Employment status of respondents	3		2
Random Effects	District	6	Variance Components	1
Residual				1
Total		44		34

Source: Field survey, 2024

Test of Fixed Effects

Table no.5 shows the type III test of significance for the fixed effects in the model. From the test, four (4) out of the six (6) fixed effects identified in the study are significant at a 5% level of significance. Fixed effects such as; the highest educational level of respondents ($0.001 < 0.05$), marital status of respondents ($0.018 < 0.05$), dependents ($0.010 < 0.05$), and employment status of respondents ($0.022 < 0.05$) showed significant influence on the living standards of households during the pandemic era. This means that these variables had significant effects on the households' living standards during the pandemic. Also, variables such as gender and household size of the respondents that were not significant showed they had the lowest F values which were less than 1 (0.65 and 0.905).

Table no. 5: Type III tests of fixed effects

Source	Numerator df	Denominator df	F	Sig.
Intercept	1	53.970	231.820	0.000
Gender of Respondent	1	366.307	0.650	0.421
Highest educational level of respondent	7	365.442	3.526	0.001*
Marital status of respondents	3	364.238	3.378	0.018*
Dependents less than 16 years and greater than 59years	1	365.815	6.695	0.010*
Household size	17	363.583	0.905	0.569
Employment status of respondents	2	354.369	3.867	0.022*

Dependent variable: Living Standards Score (LSS), significant at 5%

Source: Field survey, 2024

Estimates of Fixed Effects

The estimates of the fixed effects of COVID-19 on the living standards of households are shown in table no.6. The results from the estimates of the fixed effects show the various

variables and their significance levels. It was observed earlier in Table 2 that variables such as highest educational level, marital status, dependents, and employment status showed significant influence on the living standards of households. Hence in Table 3, it could be seen that a respondent's highest educational level significantly predicts his or her standard of living during the pandemic period. Heads of households with a postgraduate certificate or degree tend to have their living standards score increase by 0.69 units (95% CI from 0.3156 to 1.0663, $p < 0.05$) compared to households whose heads have SHS/SSS certificate as their highest qualification. Also, another significant predictor of the living standards of households during the pandemic was the marital status of heads of households with households heads who are separated or divorced having their living standards score reduced by 0.634 units (95% CI from 1.3197 to 0.05109) compared to head of households who are widows or widowers.

Table no. 6: Estimates of fixed effects of COVID-19 on Living Standards of households ($\alpha = 0.05$)

Parameter		Estimate	Std. Error	df	t	Sig.
Intercept		1.896	0.586	366.571	3.234	0.001
Gender of respondents [ref = Female]	Male	-0.050	0.062	366.307	-0.806	0.421
Highest education qualification [ref = SSS/SHS]	Degree	0.133	0.114	364.012	1.165	0.245
	Diploma	0.119	0.092	365.311	1.297	0.196
	JSS/JHS	-0.078	0.092	365.752	-0.847	0.398
	No education	-0.132	0.081	366.451	-1.625	0.105
	Others	-0.107	0.225	364.569	-0.476	0.635
	Postgraduate	0.691	0.191	366.677	3.620	0.000
	Primary	-0.010	0.111	365.599	-0.093	0.926
Marital status of respondents [ref = widow/widower]	Married	0.221	0.147	363.333	1.508	0.133
	Separated/Divorced	-0.634	0.349	364.948	-1.820	0.020
	Single	0.086	0.173	364.082	0.497	0.619
Dependents (<16, >59 years) [ref = yes]	No	0.318	0.123	365.815	2.587	0.010
	1	0.150	0.562	362.563	0.267	0.790
Household size [ref = 28]	2	0.376	0.562	362.435	0.670	0.503
	3	0.242	0.556	362.365	0.435	0.664
	4	0.231	0.558	362.504	0.413	0.680
	5	0.216	0.558	362.367	0.387	0.699
	6	0.220	0.557	362.335	0.395	0.693
	7	0.280	0.558	362.367	0.503	0.616
	8	0.193	0.561	362.312	0.343	0.732
	9	0.119	0.568	362.505	0.210	0.834
	10	0.340	0.565	362.565	0.602	0.548
	11	-0.068	0.584	362.585	-0.116	0.908
	12	0.302	0.591	362.261	0.510	0.610
	13	0.103	0.632	362.502	0.163	0.871
	14	0.118	0.594	362.346	0.199	0.842
	15	-0.115	0.671	362.694	-0.172	0.864
	18	1.647	0.763	362.782	2.157	0.832
	21	-0.030	0.762	362.392	-0.040	0.968
Employment status of respondents [ref = unemployed due to other factors other than COVID-19]	Employed	-0.044	0.068	335.980	-0.646	0.519
	Unemployed due to COVID-19	-0.347	0.125	366.999	-2.780	0.006

Dependent variable: Living Standards

Source: Field survey, 2024

Also, the presence or absence of dependents in a household is a significant predictor of living standards for that particular household during the pandemic with heads with no

dependent having their living standards score increase by 0.318 (95% CI from 0.076 to 0.560) compared to heads with dependents. Finally, the last predictor that has an effect on the living standards of households during the pandemic was the employment status of respondents. Household heads who lost their jobs due to COVID-19 saw their living standards score drop significantly by 0.347 units (95% CI from -0.5921 to -0.1015) compared to heads who lost their jobs as a result of other factors or reasons other than the pandemic. Findings from this study were in line with Le Nestour *et al.*, (2020). These heads could have either been jobless before the pandemic, lost their job during the pandemic but not because of the pandemic, or might have never worked before.

Estimates of Random Effect

Table no.7 shows the result of the random effect in the model. From the result, it is evident that the random effect (District) is not significant (p-value>0.05) at a 5% level of significance with a p-value of 0.201 and a Wald Z-value of 1.278. Interclass correlation coefficient (ICC) was used to describe the amount of variance in the outcome that is attributed to the differences between districts. An ICC of 0.084 (0.0238/0.0238+0.2602) was obtained suggesting that about 8.4% of the total variation in the living standard scores of households during the pandemic was due to inter-district differences which is very low. Since the random effect is insignificant and also has a smaller ICC, this suggests that it may not be necessary to model the nested data structure in this model.

Table no. 7: Estimates of the Random Effect

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Residual	0.260202	0.020722	12.557	0.000	0.222598	0.304158
District Variance	0.023844	0.018655	1.278	0.201	0.005145	0.110498

Dependent variable: Living Standards Score (LSS)

Source: Field survey, 2024

Estimated Marginal Means

The estimated marginal means for the various factors at different categories or levels were obtained which were used to observe the mean response for various factors in the model. This was used to compare the living standards of the respondents in various categories of a factor.

Table no.8 shows the estimated marginal means of the various fixed effects or factors at various levels or categories with their corresponding standard errors and confidence intervals. From the results, it is evident that the average living standards score (LSS) is almost the same for male-headed households and female-headed households contrary to the findings in a study by Betti *et al.*, (2020) where male-headed households had better living standards compared to their female compatriots. This is supported by a mean LSS of 2.11 and 2.16 respectively. Also, the living standards of household heads who had no education at all were much worse (1.93) compared to the other categories during the pandemic. Also in the education category,

household heads with primary education tend to have a slightly better LSS (2.05) compared to heads with other types of academic certificates or qualifications (1.95). Also, there was not much difference in the living standards of heads with diplomas (2.18) and Degrees (2.19), and the same was also seen for primary (2.05) and SSS/SHS (2.06). Furthermore, another significant factor or effect in the study was the marital status of respondents.

Table no. 8: Estimated marginal means of fixed effects

Variable	Mean	Std. Error	df	95% Confidence Interval	
				Lower Bound	Upper Bound
<i>Gender of Respondent</i>					
Female	2.11	0.143	57.699	1.84	2.40
Male	2.16	0.144	59.650	1.87	2.45
<i>Highest educational level of respondent</i>					
Degree	2.19	0.170	100.779	1.85	2.53
Diploma	2.18	0.156	77.337	1.87	2.49
JSS/JHS	1.98	0.147	63.797	1.69	2.27
No education	1.93	0.143	57.109	1.64	2.21
Others	1.95	0.257	251.646	1.45	2.456
Postgraduate	2.75	0.218	187.767	2.318	3.179
Primary	2.05	0.165	94.305	1.720	2.375
SSS/SHS	2.06	0.149	67.310	1.760	2.356
<i>Marital status of respondents</i>					
Married	2.44	0.116	26.748	2.200	2.676
Separated/Divorced	1.58	0.330	321.921	0.932	2.232
Single	2.30	0.134	45.020	2.034	2.572
Widow/Widower	2.22	0.185	133.081	1.850	2.583
<i>Dependents (less than 16 years and greater than 59 years)</i>					
No	2.29	0.167	97.282	1.963	2.625
Yes	1.98	0.138	50.043	1.699	2.253
<i>Household size</i>					
1	2.04	0.157	78.606	1.731	2.358
2	2.27	0.164	90.051	1.946	2.596
3	2.14	0.143	57.137	1.850	2.422
4	2.13	0.150	66.334	1.827	2.424
5	2.11	0.151	70.286	1.809	2.413
6	2.12	0.149	66.500	1.818	2.412
7	2.18	0.157	79.104	1.863	2.487
8	2.09	0.164	91.902	1.762	2.413
9	2.01	0.183	125.891	1.653	2.375
10	2.23	0.174	110.560	1.889	2.579
11	1.83	0.227	211.673	1.379	2.275
12	2.20	0.253	253.911	1.698	2.695
13	2.00	0.333	329.407	1.342	2.653
14	2.01	.256	256.344	1.510	2.516
15	1.78	.396	349.496	1.001	2.558
18	3.54	.542	365.556	2.475	4.607
21	1.86	.540	365.746	.802	2.927
28	1.90	.559	366.227	.795	2.994
<i>Employment status of respondents</i>					
Employed	2.22	.142	56.776	1.936	2.506
Unemployed due to COVID-19	1.92	.176	110.153	1.570	2.267
Unemployed due to other factors or reasons other than COVID-19	2.23	.141	53.552	1.983	2.547

Dependent variable: Living Standards Score

Source: Field survey, 2024

The estimated marginal means of this factor shows that household heads who were separated or divorced had the lowest LSS (1.58) which meant that their living standards were much worse during the pandemic compared to the other categories of heads. Also, another significant factor in this study was the effect of the presence or absence of dependents. The estimated marginal means show that the living standards score of heads without dependents (2.29) is higher than those with dependents (1.98) which means that the living standards of the former during the pandemic however worse were manageable compared to the latter. Finally, the last significant factor in this model was the employment status of respondents. It was observed that household heads who were unemployed due to COVID-19 saw their living standards dwindle (1.92) during the pandemic compared to the other categories which made them much worse during the pandemic. Similar findings were observed in a study by Martin *et al.* (2020) and Malik *et al.* (2020) in Pakistan.

Pairwise Comparison of Living Standards Score among Factors

The pairwise comparison which is an Analysis of Variance (ANOVA) technique was used to do multiple comparisons for various categories or levels of each factor. This allowed us to examine all pairs of levels for a factor and compare the living standards for various levels taking into account the confidence interval and the p-value for each pair. This was calculated using the estimated marginal means for categories of factors and the Bonferroni method for adjusting multiple comparisons. The pairwise comparisons allows us to view any significant differences in living standards score between categories of factors of various households. Results showed that there exists significant differences in living standard scores of heads of households with postgraduate qualifications and those with No education, Primary, JSS/JHS and SSS/SHS. This means that heads with postgraduate academic qualifications as their highest educational qualification have significantly higher living standard scores compared to the others mentioned earlier during the pandemic. This result is in line with the results on the estimates of fixed effects seen earlier in Table 3. Also, it could be seen that significant differences exists in the pairwise comparisons between respondents who were separated/divorced and those who were married during the pandemic. This meant that the living standard scores of respondents who were separated/divorced dropped compared to those who were married. This could be significant in the sense that household heads who were separated/divorced could still have dependents and hence struggled to take care of them alone during the pandemic compared to those who were married and had support from their spouse.

Also as anticipated, another factor that was significant in the model was the presence or absence of dependents in the households. Also significant difference (p-value = 0.010), exists between household heads who had dependents and those who didn't during the pandemic. It was evident that heads with dependents saw their living standards score drop significantly during the pandemic compared to the other heads without dependents during the pandemic. Lastly, the pairwise comparison test showed significant differences between respondents who were lost their jobs due to COVID-19, those who lost their jobs due to other factors, and those who were gainfully employed during the pandemic (0.050 and 0.017). The results showed that the living standards score of household heads who were unemployed due to COVID-19 dropped significantly compared to those who were unemployed during the period due to other

factors or reasons other than the pandemic and those who were employed. The results of the pairwise comparison test is very much the same as those seen earlier in other tests in this model.

Information Criteria

The three (3) models adopted in this study were the variance component model (model 1), the unstructured covariance model (model 2), and the compound symmetry model (model 3). Based on the results in Table 6, it was observed that the smallest values in the three main fit criteria (i.e., -2 Restricted Log Likelihood [-2RLL], Akaike's Information Criterion [AIC], and the Bayesian Information Criterion [BIC] were found in the variance component model, hence the adopted model for this study. This model often offers the best fit and it is the most parsimonious.

Table no.9: Model information criteria

Information Criteria	Model 1	Model 2	Model 3
-2 Restricted Log Likelihood	653.347	708.4022	653.347
Akaike's Information Criterion (AIC)	657.347	766.4022	659.347
Hurvich and Tsai's Criterion (AICC)	657.38	771.5654	659.413
Bozdogan's Criterion (CAIC)	667.158	908.6577	674.063
Schwarz's Bayesian Criterion (BIC)	665.158	879.6577	671.063

Source: Field survey, 2024

4. Conclusion

This paper empirically shows the effects of the COVID-19 pandemic in Ghana using primary obtained from the North East Region. It was realized from the study that COVID-19 has negatively affected the living standards of households and that the adverse effects were much higher for heads of households who were married compared to those who were separated or single. The study also found supportive evidence of the educational qualification of respondents as a significant predictor of living standards in the Region. Heads of households with postgraduate degrees had somewhat better living standards compared to the others in the Region. Also, the study showed that the adverse effects of the pandemic were much higher for the unemployed compared to the employed, and household heads with dependents were significantly affected compared to heads without dependents.

Overall, the pandemic significantly affected the living standards of various households in the entire Region. The ability of household heads to afford necessities such as medical care, healthy and nutritious meals, education, and among others were worse off during the pandemic compared to other periods. Conclusively, apart from health and education, which had their effects extensively felt which involved measures like rationalizing health staff and the complete shutdown of schools across the country, overall living standards of households were massively affected during the pandemic. From the research, it was realized that male-headed households were living a bit better than female-headed households, hence female household heads should be empowered through training and other entrepreneurial activities to boost their ability to cater for themselves and their dependents. We caution that findings from this study were based on cross-sectional responses from the respondents and not a comparative study of both the pre and post-COVID era. Since COVID-19 has further widened the gap between the educated and the

illiterate, we recommend, more tailor-made policies for all categories of people to possibly close this new gap and minimize the existing ones. It is also recommended that household heads with no formal education or even heads who are educated to any level and unemployed should be advised to take up entrepreneurship to help better their livelihoods.

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