ORIGINAL RESEARCH

Effect of COVID-19 on Household Food Insecurity and Poverty: Evidence from Ghana

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Abstract

Following the outbreak of COVID-19 and its heavy toll on the global community and humanity, a fierce debate on the pandemic and Sustainable Development Goals (SDGs) performance nexus has emerged. While the literature on this subject remains highly contested, evidence within the Ghanaian contest is sparse. Thus, we present micro-level evidence on how COVID-19 poses a threat to hunger and poverty as SDGs in Ghana. Precisely, we examined the effect of COVID-19 on households' food insecurity and poverty and further analysed gender and locational sub-samples for differential effects. Data on 3905 households were obtained via concurrent online survey and telephone interviews. The results indicate that, on several occasions, a significant number of the sampled households (57.76%) did not get enough food to eat due to the pandemic. The proportion of households that went on several times without clean water for home use and access medicines/medical treatments were 50.52% and 52.22%, respectively. About 60.72% of the sampled households affirmed that, on several times, they did not have enough income due to the pandemic. At the same time, the share of households that suffered food insecurity due to the pandemic was 69.04%. Instrumenting for COVID-19 using distance to the affected communities, we find that a standard deviation increase in COVID-19 is associated with a rise of 0.232 and 0.289 standard deviations in poverty and food insecurity, respectively. Our results are robust to alternative estimation approaches to addressing the endogeneity of COVID-19 and other sensitivity checks. We conclude that Ghana would need to develop a new spectrum of gender- and location-sensitive policies that engender social inclusion as a conduit to expediate the attainment of zero poverty and hunger.

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1 Introduction

The emergence of the novel Coronavirus disease 2019 (COVID-19) has generated public anxiety, which has forced governments all over the world to put in place a suite of measures to control the spread of the virus, in addition to the World Health Organization (WHO) preventive protocols. Eminent interventions so far include the closure of borders, a ban on public gatherings, personal hygiene, and physical/social distancing. Despite these relentless efforts by various stakeholders to curb the menace, COVID-19 is still exacting its heavy toll on the global economy. This has resulted in over 2.8 million deaths worldwide and continuous economic despair, including loss of jobs and high medical cost (WHO, 2021). In view of this development, a fierce debate on COVID-19-Sustainable Development Goals (SDGs)-performance nexus has emerged. While the literature on this subject remains highly contested, evidence within the Ghanaian context is sparse. Motivated by the paucity of literature on COVID-19-SDGs-performance nexus, we empirically examine how COVID-19 is stifling some of the SDGs, particularly poverty (SDG 1) and hunger (SDG 2) in the case of Ghana. Estimates from the World Bank suggest that COVID-19 will push 49 million people into extreme poverty in 2020 out of which 23 million are expected to be in sub-Saharan Africa. Other commentators have also underscored that, areas where the virus is taking its highest toll, depends primarily on two factors: (1) the impact of the virus on economic activity, and (2) the share of people living close to the global poverty line (Mahler et al., 2020).

Of great concern is that presently, COVID-19 has no cure, and this has several critical implications. First, the pandemic is making some of the SDGs, particularly poverty and hunger, more entrenched and harder to achieve in most sub-Saharan African countries, which are already performing worst on these SDGs. Before COVID-19, more than half of the extreme poor lived in sub-Saharan Africa (SSA) and alarmingly, the share of poor people in the region increased by 9 million (World Bank, 2018). Pre-COVID-19 projections were that, if the trend continues, by 2030, nearly 9 out of 10 extreme poor would be in SSA. With COVID-19, current estimates suggest that the world's progress in achieving zero poverty and hunger by 2030 in these countries will be set back by three more years due to the pandemic. Focusing on Ghana, most recent estimates from the Ghana Living Standards Survey (GLSS 7) suggest that the battle to end poverty in all its forms everywhere and achieve zero hunger is far from over, and in some regions, getting harder to achieve (Ghana Statistical Service [GSS], 2018). Accordingly, the proportion of Ghana's poor remains intolerably high. Poverty is increasingly becoming more deep-rooted, making it very challenging to eradicate from half of the sixteen regions which experienced worsening poverty incidence rates. Half of the nation's sixteen regions have their poverty rates above the national average of 24.5%. Further, the GLSS 7 report indicates that more Ghanaians are becoming extremely poor as the number of people living in extreme poverty increased from 2.2 million in 2013 to 2.4 million in 2017 based on the 2010 Population and Housing Census (PHC) projections (GSS, 2018. p. 5). The incidence of COVID-19 in the country is expected to further worsen these estimates largely because the pandemic has created layered vulnerabilities to poverty and thus, can render current policy efforts counterproductive or simply ineffective. For instance, recent estimates from GSS show that COVID-19 has resulted in over 42,000 loss of jobs in Ghana and drastically reduced the wage rates of over 770,000 employees in the country (GSS, 2020).

On the side of achieving zero hunger in 2030, there are growing concerns that this SDG many elude Ghana, given that the country is already not doing well on food security.

Before the onset of COVID-19 in Ghana, the country was facing imminent food insecurity, as the average yield from the agricultural sector (the mainstay of the entire Ghanaian economy), was declining. Precisely, about 2 million people were vulnerable to becoming food insecure nationwide prior to COVID-19 (Darfour & Rosentrater, 2016; Nkegbe et al., 2017). Out of the 2 million Ghanaian populace that are vulnerable to food insecurity, 1.5 million live in more than half of the nation's sixteen regions (Darfour & Rosentrater, 2016). Further, 2.4 million Ghanaians live in abject poverty, as they cannot afford to spend up to GH¢3.00 a day on food (GSS, 2018). With the COVID-19 outbreak, a burgeoning literature (FAO, 2020; Gundersen et al., 2020; Mishra & Rampal, 2020; Pereira & Oliveira, 2020; Q&A, 2020; Siche, 2020) show that the current food insecurity situation globally, including Ghana, has heightened as both the supply and demand for food are significantly affected. By implication, COVID-19 has adversely affected the pattern of food consumption in the country and created layered vulnerabilities to hunger which is likely to render current policy efforts ineffective or simply counterproductive. Meanwhile, the SDGs have, at its heart, "to leave no one behind" and this implies understanding and addressing the 'last mile' of exclusion via a deeper knowledge of the root causes of poverty and hunger. Thus, this study aims to examine the impact of COVID-19 on household food insecurity and poverty in Ghana. We hypothesize that households affected by COVID-19 (i.e., those that are unemployed or lost their jobs due to the pandemic) will experience a significantly higher levels of poverty and food insecurity compared to their unaffected counterparts. Further, we postulate that while households in rural settings whose heads are unemployed or lost their jobs due to the pandemic will be significantly worse off on poverty than affected households in urban settings, the latter will be worse off than the former on food insecurity. Finally, we hypothesize that COVID-19 will have a significant gender differential effect on poverty and food insecurity with female-headed households largely disadvantaged.

The rest of the paper is structured as follows: section two focused on the literature review, where empirical studies have been critiqued and synthesized. Next is section three, which mainly presented the methodological issues surrounding the study, while section four is devoted to the results and discussion of the study. Section five gives the conclusion as well as the recommendations and policy implications of the study.

2 Literature

Although literature on COVID-19 abound, it is heavily skewed towards the management and containment of the pandemic and also on macro-level effects with very little attention on its influence at the micro-level. For example, Lau et al. (2020) examined the positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. They found that domestic air traffic negatively correlates with the spread of COVID-19, although the relationship is weak. At the same time, Chinazzi et al. (2020) observed that travel quarantine of the epicent (Wuhan) of the pandemic delays the overall epidemic spread by an average of five days, and this effect was much higher at the international front where imported cases reduced drastically by approximately 80 until mid-February. Considering the highly infectious rate of COVID-19, some scholars (see Anderson et al., 2020) had already postulated that world governments would be overwhelmed by both deaths from coronavirus and its economic impact. Probably motivated by Anderson et al. (2020)'s assertion, Lipsitch et al. (2020) underscore that primary research is needed to address several critical questions. Principal among such pertinent questions are what the full spectrum

of COVID-19 severity within and across countries is? Who are the most affected? (i.e., gender, rural–urban, age group, and other demographics). In this paper, we address some of these questions in the case of Ghana. Following lessons from Italy and China, some scholars (see Lazzerini & Putoto, 2020; Remuzzi & Remuzzi, 2020) have also stressed that empirical studies are required to support decision-making and build public awareness. According to Gilbert et al. (2020), the management and control of a country's COVID-19 importation heavily depend on its health capacity. Concerning preparedness and vulnerability against the importation of COVID-19 in Africa, the authors found that countries like Ghana, Ethiopia, Sudan, Angola, Tanzania and Kenya are at moderate importation risk and high vulnerability risk.

As argued by Development et al. (2019) and FAO (2019), food insecurity is the lack of physical, social and economic access to adequate food to meet nutritional needs and food preferences to lead active and healthy lives. Food insecurity is attributable to several factors across countries and social groups. The causes of food insecurity span across four-core pillars—food availability, access, utilisation, and stability (Bashir et al., 2013; FAO, 2012). At the national level, local food production and importation determine the availability of food and can be influenced by political instability, trade dislocations, war, civil strife and shocks like COVID-19 (Vermeulen et al., 2012). At a more micro level, a household's food security is determined by circumstances like COVID-19 that lead to inadequate food production and access to food physically and economically. Poverty is also known to be the fundamental cause of food insecurity because of how closely linked it is to a household's command of adequate food resources (Gundersen et al., 2011). Low-income households in developing countries such as Ghana can spend up to 80% of their income on food alone and, thus, are particularly sensitive to rising food prices or income volatility. These difficulties are worse in rural areas, where decent employment and market accessibility make it hard to procure food and other kinds of stuff and, thus, about 70% of the world's hungry people live in such deprived areas (Bashir et al., 2013; FAO, 2012).

The evidence available suggests that the COVID-19 pandemic has impacted food insecurity through food demand and food supply (Barrett, 2020; Bui, 2020; High Level Panel of Experts on Food Security and Nutrition (HLPE), 2020; Mouloudj et al., 2020). On the demand for food, the pandemic has caused economic downturn of most economies resulting in lost of jobs and diminished family income and money transfers (Bui, 2020). The reduced income levels, due to COVID-19, have significantly affected the purchasing power of families, thereby limiting their ability to purchase and access enough food. Poor households operate on tight budgets with little or no discretionary spending, suggesting that in the absence of social safety nets, spending on food declines as incomes dwindles (HLPE, 2020). On the supply side, shut down and mobility restriction measures adopted to curb the spread of the virus adversely affected food availability and stability over time. Local food production declined due to suspension of some agricultural activities by farmers and farm workers (Mouloudj et al., 2020). The effects extend to other areas of the food supply chain, including transportation, storage and distribution. The disruptions in food supply chains at the back of lockdown measures have affected the availability, pricing and quality of food (Barrett, 2020). According to HLPE (2020), the COVID-19 pandemic has intensified food insecurity in diverse ways: disruption to food supply chains, loss of income and livelihoods, widening of inequality, disruption to social protection programs, and altered food environments and even food prices.

Associations between social and demographic factors, poverty and food insecurity have gained increasing attention in recent years, and have consistently shown to play a critical role in food insecurity and poverty outcome. Studies have emphasized the role of higher

education, smaller households, being employed and located in urban settings to be negatively associated with food insecurity and poverty (Imai et al., 2011; Mukherjee & Benson, 2003; Peng et al., 2019; Rupasingha & Goetz, 2007; Smith et al., 2017; Stevans & Sessions, 2001). Varying levels of pathways may play a role in both poverty and the food insecurity gender bias, including women's lack of access to education and employment opportunities, limited autonomy, and lower intra-household allocation of resources (Alon et al., 2020; Wenham et al., 2020; Kimura, 2013). Intra-household distribution of food may favour particular genders or ages; in some settings, young children appear the most disadvantaged, whereas in others, they are the most favoured (Kerr et al., 2012). Along poverty lines, females continue to experience severe deprivations in labour markets partly due to substantial family obligations and the fact that markets and labour flexibility provide a competitive advantage for males (Michie & Sheehan, 2003, 2005). With the unprecedented COVID-19, some studies (Alon et al., 2020; Wenham et al., 2020) have postulated that existing gender inequalities will further exacerbate. In the present study, we test whether this COVID-19-gender heterogeneity proposition holds for Ghana.

In the food insecurity-location nexus, many studies point out the protective effects of rural living. Some demonstrate the opposite, while others find null differences in the food security-location nexus (Bashir & Schilizzi, 2013). In the literature on poverty and location issues, rural areas are usually deprived. Thus, studies (Emanuel et al., 2020; Kashnitsky & Aburto, 2020; Van Dorn et al., 2020) have underscored that to overcome or contain the impact of COVID-19, there is the need for a fair allocation of scarce resources, taking into account deprived areas. Motivated by these assertions and findings, this study tests whether the differential effect of COVID-19 exists across rural-urban locations in Ghana.

3 Methods

3.1 Design and Data

This study adopted a quantitative approach and, thus, was guided by the positivism research paradigm. The ex post facto design was used to examine the effect of the COVID-19 pandemic on poverty and food insecurity of Ghanaian households. It helped to compare the before-and-after situation of Ghanaian households regarding their poverty levels and food insecurity. Descriptive design was also used to describe the effect of the COVID-19 pandemic on poverty and household food insecurity of Ghanaians. This was very important, as little is known about the micro-effects of the pandemic in Ghana.

3.2 Sampling Procedure and Survey Tool

Data on poor households were drawn from the most recent GLSS 7 conducted in 2017/2018 to set as a sample frame for the selection of our representative sample across the regions. All the ten regions in GLSS 7 formed our sample size. However, our available respondents in the Volta and Brong-Ahafo regions came from Oti and Bono, respectively. Oti and Bono regions were originally part of the Volta and Brong-Ahafo regions respectively prior to the GLSS 7. From a total of 13,582 households, 4015 households, stratified at and to each region were randomly selected. The primary respondents were household heads who were 18 years or older at the time of the survey. Consistent with GSS, a household head must first satisfy three key conditions. Head of household refers to a member of a household

who is: (i) either a male or female, (ii) primarily responsible for making major decisions on the household's provisions for food and other essentials, and (iii) acknowledged by members of the household as the head. All heads in the survey first satisfied these conditions before we elicited responses from them. In addition to these criteria, the household head must continuously live with the household for at least five months at the time of the survey. The basis for the five-month reference period was that COVID-19 started in Ghana two months preceding the survey (*12 March 2020 to 12 May 2020*). Hence respondents who had continuously lived with the household for at least three months before the outbreak of the pandemic and had continuously lived with the household during the COVID-19 period for at least two months preceding the survey would be able to compare the living conditions of the household for both periods. The exclusion criteria were household heads who were either below 18 years or had not continuously lived with the household for the past five months preceding the survey (to reduce recall bias).

The study was conducted from 12 May 2020 to 2 June 2020 via online and telephone surveys. Before the roll-out of the study, the instrument was first pilot-tested among 20 participants with a similar socio-economic background in the Western North Region which was not part of the sample to ensure its feasibility and the validity of the content of the questionnaire having met the Institutional Review Board (IRB) of University of Cape Coast standard safeguards on research ethics. The pilot group was first requested to complete the online questionnaire and comment on the comprehensibility of the questions. This led to some minor modifications in the questionnaire to improve understanding. The questionnaire was structured into four sections: socio-demographics, and COVID-19's impact on poverty, food insecurity, and living standards. Questions on poverty were adopted from the Afro barometer survey, which uses six main questions to measure lived poverty. Questions on food insecurity also adopted from the GLSS 7. The GLSS 7 has eight key questions for assessing household food insecurity in Ghana. The precise questions asked under poverty and food insecurity sections are presented in the supplementary material.

The data were collected with the use of online survey (questionnaire) and telephone interview or calls (i.e. reading out the online questionnaire to respondents and selecting their choice of responses), which ran concurrently for three and a half weeks. The household heads with accounts on social media platforms, specifically WhatsApp, Facebook or Gmail, were engaged for the online survey, while those without accounts were engaged through telephone interviews (calls). The telephone interviews (calls) mainly targeted poor households with no formal education or, at most, primary education and without social media accounts. Prior to the start of the telephone interviews, households based on the sample frame were contacted through door-to-door visitations to explain the purpose of the study to them. The visits also enabled the research team to seek the informed consent of the households before requesting their phone numbers for the telephone interviews. A similar arrangement was followed for the online survey where the Informed Consent Form was sent to participants on their WhatsApp, Facebook or Gmail accounts via a link generated for them to show their interest to participate after going through the Consent Form. The online survey link was sent to all households who consented to participate in the study. Though each household was first contacted to consent to the study before taking the telephone contact, the research team still ensured that respondents were not forced to participate in the study. Thus, participation in the study was purely on a voluntary basis. Overall, we called 1680 households and out of this number, 25.1% did not answer, 11% declined to participate, 6.2% were wrong numbers and 4.1% were invalid. In total, 53.6% responded to the telephone survey resulting in 900 households, while the online survey recorded 3015 households. However, the online survey had a few (10) missing observations. As a result,

the observations from the online survey reduced to 3005 after data cleaning. This, therefore, gave a total sample size of 3905 household for the analysis. The sociodemographic characteristics of our sample is presented in Table B in the Appendix.

3.3 Sample Decription

A glimpse of Table 8 in the Appendix indicates that households in our sample are either poor or very poor. While 35.09% of the households in our sample live below the poverty line of Ghc 792.05, majority (56.02%) of the household live below the upper poverty line of Ghc 1,314.00. By implication, 35.09% and 56.02% of households in the sample are in extreme poverty and absolute poverty, respectively. About 33.64% of the households have either loss their jobs or are unemployed due to COVID-19. While 19.59% have no formal education, only 15.31% completed primary education with about 24.5% having secondary education. Essentially, 58.92% representing the majority do not have tertiary education. The location and gender dimensions of the sample were as follows: rural versus urban were 1841 and 2064 representing 47.14% and 52.86%, respectively. The females were 1878, while the males were 2027, giving 48.09% and 51.91%, respectively.

3.4 Measurement of Variables

3.4.1 Dependent Variables

The dependent variables were poverty and food insecurity.

3.4.1.1 Poverty As stated earlier, the study adopted the six Afro barometer questions as indicators for poverty. These six questions were used to construct an index called the Lived Poverty Index (LPI) which is an experiential measure that is based on a series of questions about how frequently individuals actually go without basic necessities during the course of a year (during COVID-19 in the case of our study). The rationale behind LPI is that the value of one's standard of living or poverty lies in the living itself and, thus, people are the best judges of their own interests and quality of life (Mattes et al., 2016; Sen, 2001). The precise questions that were asked under poverty are provided in the supplementary material.

Consistent with the measurement of LPI, all the six items were used to compute a composite LPI using Principal Components Analysis (PCA) (Mattes et al., 2016). A Cronbach's alpha (scale reliability coefficient) of 0.89 was obtained prior to the generation of the composite score. As shown in Table 1, only one factor (component) had an Eigenvalues greater than 1, indicating that all the items loaded on one construct. Based on Kaiser's criterion, we retained this factor which also explained almost 69% of the variance in the response variable. The indicators were coded from 0-never to 4-always and, thus, higher scores on the response variable corresponded to lower poverty level. The likelihood ratio test indicated a good model fit.

Another main interest of the study was to explain how the COVID-19 pandemic is affecting household food insecurity. Therefore, food insecurity was another dependent variable. As stated earlier, the GSS eight core questions of household insecurity were adopted. All the eight-core questions were included in the computation of a household food insecurity variable through PCA. As shown in Table 1, a Cronbach's alpha (scale reliability coefficient) of 0.87 was obtained prior to the generation of the composite score. (The precise questions asked under household food insecurity are presented in the supplementary material).

Table 1 Principal components analysis for poverty and food insecurity

Component	Eigenvalue	Difference	Proportion	Cumulative
Lived poverty index (LPI)				
Comp1	3.469	2.620	0.694	0.694
Comp2	.849	.474	0.170	0.864
Comp3	.3746	.179	0.075	0.938
Comp4	.196	.084	0.039	0.978
Comp5	.112		0.022	1.000
N	3905			
KMO overall	0.820			
Food Insecurity Index (FII)				
Comp1	4.516	3.084	0.565	0.565
Comp2	1.432	.553	0.179	0.744
Comp3	.879	.365	0.110	0.853
Comp4	.514	.234	0.064	0.918
Comp5	.280	.030	0.035	0.953
Comp6	.250	.161	0.031	0.984
Comp7	.089	.049	0.011	0.995
Comp8	.039		0.005	1.000
N	3905			
KMO overall	0.717			

3.4.2 Independent Variable

The independent variable for the study was COVID-19. Here, COVID-19 is measured as a dummy variable with value 1 if the household head is unemployed or lost his/her job due to the pandemic and 0 if otherwise.

3.4.3 Covariates

We controlled for individual and household characteristics. They included employment status, sex, education, the region of the household, household income, expenditure and presence of dependents in the household. The definition and measurement of all the variables used in the study are presented in Table 7 in the Appendix.

3.5 Empirical Model Specification and Estimation Strategy

The empirical model estimated is specified in Eq. (1) as;

$$Y_i = \beta_0 + \beta_2 X + \varepsilon_i \tag{1}$$

where Y_i represents the poverty level or food insecurity of household i. β_s is a vector of unknown parameters and ε_i is the error term, which is normally distributed with mean zero and a constant variance. X is a vector of individual and household characteristics that affect the poverty level or food insecurity of a household. These variables include age, employment status, and education of the household head, as well as the size and presence of dependents in the household. The study also included households' regional and rural/urban

locations to control for disparities in the labour markets. Tables 7 in the Appendix shows the definitions and summary statistics of these variables.

Estimating Eq. (1) using Ordinary Least Squares (OLS) may lead to bias estimates because of likely issues of endogeneity in the link between COVID-19 impact and poverty or food insecurity. For instance, a key potential source of endogeneity in Eq. (1) could be omitted variable bias which could lead to either underestimation (downward bias) or overestimation (upward bias) of the coefficient on COVID-19 (job lost or unemployed due to the pandemic). In addition, in multivariate regression framework, as in the case of our study, it is difficult to rule out more than one omitted variable and hence it is impossible to explicitly predict the direction of bias (Forbes, 2000). For instance, in the case of our study, an example of an omitted variable which is impossible to control is people's attitudes towards the pandemic in general. Attitudes are argued both theoretically as the fundamental cause of poverty (Blank, 2003) and empirically as the primary factor that is making it difficult for governments to control the spread of COVID-19 (Durizzo et al., 2020). Similarly, a burgeoning literature shows that individual attitudes significantly affect household food insecurity (Metallinos-Katsaras et al., 2009; Park et al., 2020; Webb et al., 2009; Wolfson & Leung, 2020). Given the proven and expected link between attitudes, poverty, food insecurity and COVID-19, we expect that positive attitudes such as having higher education and small family size will be associated with higher welfare outcomes (lower poverty and food insecurity). In the same vein, positive attitudes such as obeying government regulation and other COVID-19 protocols should limit the spread of the pandemic. Further, if your workplace or business is located at the epicentere of COVID-19, the likelihood of losing your job is higher compared to your counterparts who work in environments where there is no COVID-19. Therefore, in Eq. (1) that includes COVID-19, the presence of the pandemic may actually be accounting for the effect of negative attitudes as well. Thus, intuitively, the coefficient on COVID-19 should result in downward bias. In contrast, it is also possible that the effect of attitudes captured in Eq. 1 may be positive and hence the coefficient on COVID-19 should result in upward bias. Besides, there may be several unobserved and unknown variables that are likely to result in either overestimation or underestimation and, therefore, the overall direction of bias from omitted variable (both observed and unobserved) cannot be either theoretically or empirically determined (Churchill et al., 2020; Forbes, 2000).

Measurement error in estimating COVID-19 is another potential source of endogeneity which could bias our estimates in Eq. (1). This could occur if an individual attributes their job lost or unemployment to COVID-19 solely. Besides, there may be other reasons other than COVID-19 informing employers to lay off workers during the pandemic.

To overcome the concerns of endogeneity, we implemented instrumental variable estimation using distance to COVID-19 epicenters as instruments. We first calculated for the distance between the individual's workplace to the nearest COVID-19 city or area using latitudes and longitude coordinates. Literature provides evidence on the association between distance to COVID-19 communities and massive job losses and closure of businesses in Ghana (Amoah-Nuamah et al., 2020; Schotte et al., 2021). From this viewpoint, distances to COVID-19 towns are clearly strong predictors of job lost or unemployment during the pandemic. If the distance to affected communities of the pandemic change, the mechanism through which those changes will affect poverty or food insecurity should be through the share of people who have lost their jobs/businesses or those who are unemployed due to the pandemic. Therefore, by intuition, the potential channel through which COVID-19 will affect poverty or food insecurity should be via distances to the epicenters of the pandemic. Another reason that makes our instrument a valid one is that majority of

the affected communities in Ghana experienced partial lockdowns resulting in the collapse of businesses (Ghana Statistical Service, 2020; Schotte et al., 2021). We implemented the Lewbel (2012) two-stage least squares (2SLS) approach as an alternative to instrumenting with external instruments. The Lewbel (2012) 2SLS approach does not require any exclusion restriction to be satistfied, rather, it utilizes internally generated instruments based on a heteroskedastic covariance restrictions. The Lewbel (2012) 2SLS framework has been widely used in extant literature as a robustness check on findings with external instruments or when there are virtually no external instruments altogether (Bukari et al., 2020; Churchill & Marisetty, 2019; Churchill et al., 2020; Koomson et al., 2020). A key precondition for identification in the Lewbel (2012) framework is the presence of heteroskedasticity, which we confirm exist based on our Pagan-Hall and Breush and Pagan (1979) tests.

4 Results and Discussion

4.1 Percentage Distribution of Households' Experiences by Poverty Indicators and Food Insecurity Status

As stated in the previous section, six-core questions from the Afro barometer survey on lived poverty were adopted. Figures 1 and 2 show the distribution of responses on how COVID-19 has affected households by poverty indicator, including food insecurity status. Each indicator consisted of two panels: the first showing the current impact of the pandemic on the indicator, while the second illustrates a comparison between pre-COVID-19 and COVID-19 era on the same indicator. As illustrated in panel A of Fig. 1, majority (57.76%) of the households indicated that in COVID-19 era, there were several or many times they had to go without enough food to eat due to the pandemic. Panel B indicates that the household food insufficiency situation is worse in the COVID-19 era compared to the pre-COVID period. Again, about 50.52% of the households (see panel C of Fig. 1) had indicated that they went several times without clean water for home use in the COVID-19 period. From Panel D, it is evident that the household water problems had worsened in the COVID-19 period compared to the pre-COVID-19 period.

Moreover, most (52.22%) of the households (see panel E of Fig. 1) had at least reported several times of not being able to access medicines or medical treatments due to COVID-19. Those who reported of never experiencing such situations were just 18.05%. Compared to the pre-COVID-19 period (see Panel F), the majority (52.27%) of the households indicated the medical care situation in the COVID-19 period is worse, implying that the pandemic is genuinely having a deleterious effect on their medical conditions. Evidently (see panel G of Fig. 2), most of the households had on several times gone without enough fuel to cook food for the households and about 52.7% (see panel H) confirmed that the situation is worse in the COVID-19 era compared to the pre-COVID-19 era. About 60.72% (see the panel I) of the households had at least on several times gone without enough cash income for the household. Remarkably, approximately 45% had indicated that the situation is worse (see panel J) in the COVID-19 period compared to the pre-COVID era.

Panel K indicates that only 30.96% of the households were food secured. The remaining 69.04% were food insecure due to the pandemic.

Panel A: No. of times household had gone without enough food to eat due to COVID-19 (past two months)

Panel B: Now, comparing Pre-COVID-19, would you say this current food situation is?

Panel C: No. of times household had gone without enough clean water for home use due to COVID-19 (past two Months)

Panel D: Now, compared to Pre-COVID-19, would you say your current water situation is?

Panel E: No. of times household had gone without medicines/medical treatment due to COVID-19 (past two Months)

Panel F: Now, compared to Pre-COVID-19, woulld you say your current medicines/medical treatment situation is?

Fig. 1 Distribution of households' experiences by poverty indicators (food, clean water & medical care)

4.2 Baseline Results

Table 2 presents baseline results for the effect of COVID-19 on household poverty and food insecurity. In this analysis, both poverty and food insecurity are composite indices. Here, COVID-19 is measured as a dummy with values 1 if the household head is unemployed or lost his/her job due to the pandemic and 0 if otherwise. Therefore, for easy interpretation,

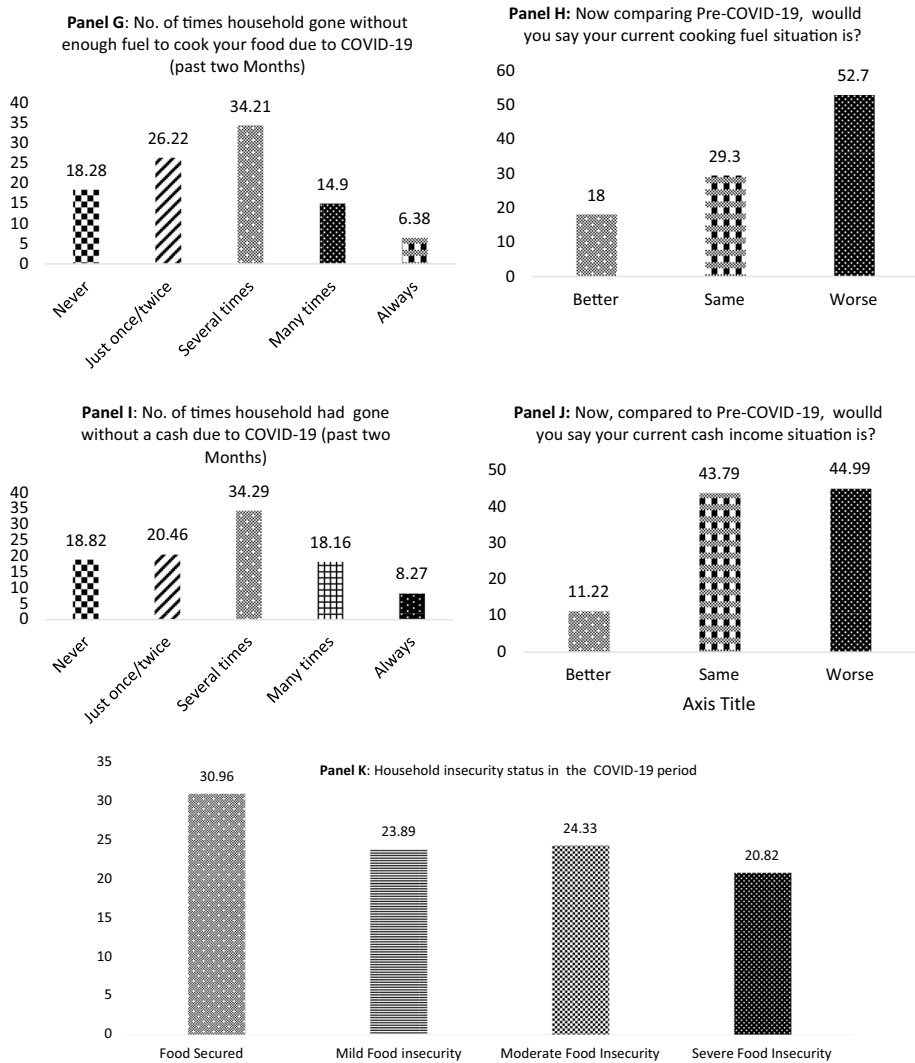**Panel G**: No. of times household gone without enough fuel to cook your food due to COVID-19 (past two Months)

Never: 18.28
Just once/twice: 26.22
Several times: 34.21
Many times: 14.9
Always: 6.38

Panel H: Now comparing Pre-COVID-19, woulld you say your current cooking fuel situation is?

Better: 18
Same: 29.3
Worse: 52.7

Panel I: No. of times household had gone without a cash due to COVID-19 (past two Months)

Never: 18.82
Just once/twice: 20.46
Several times: 34.29
Many times: 18.16
Always: 8.27

Panel J: Now, compared to Pre-COVID-19, woulld you say your current cash income situation is?

Better: 11.22
Same: 43.79
Worse: 44.99

Axis Title

Panel K: Household insecurity status in the COVID-19 period

Food Secured: 30.96
Mild Food insecurity: 23.89
Moderate Food Insecurity: 24.33
Severe Food Insecurity: 20.82

Fig. 2 Distribution of households' experiences by poverty indicators and food insecurity (cooking fuel, cash income & food insecurity)

a 'COVID-19 household' refers to a household whose head is affected (i.e., unemployed or lost his/her job due to the pandemic), while a 'non-COVID-19 household' is a household whose head is not affected. As shown in Table 2, we find that COVID-19 is positively associated with poverty and food insecurity. Specifically, compared to a non-COVID-19 household, the poverty and food insecurity levels of a COVID-19 household increase significantly by 55.7 percentage points and 28.9 percentage points, respectively. By implication, COVID-19 exacerbates the poverty and food insecurity status of households. Similar findings have been reported in other contexts (Pereira et al. 2020; Mishra & Rampal, 2020; Gundersen et al. 2021).

Table 2 Baseline regression estimates on the effect of COVID-19 on poverty and food insecurity

Variables	Poverty	Food insecurity
	Full	Full
COVID-19	0.557***	0.289***
	(0.048)	(0.036)
Female head (ref = male head)	0.063**	0.039**
	(0.030)	(0.022)
Rural (ref = urban)	0.105***	−0.145***
	(0.035)	(0.022)
Household size	0.023**	0.026**
	(0.005)	(0.003)
Dependents (ref = no dependents)	0.185***	0.078***
	(0.035)	(0.026)
Household income	−0.303***	−0.324***
	(0.035)	(0.026)
Age	−0.003***	−0.015**
	(0.001)	(0.072)
Age squared	−0.006	−0.008
	(0.002)	(0.007)
Primary education	−0.152***	−0.032
	(0.050)	(0.039)
Secondary education	−0.216***	−0.039
	(0.047)	(0.033)
Tertiary	−0.282***	−0.056*
	(0.043)	(0.031)
Household income	−0.011***	−0.590***
	(0.018)	(0.013)
Western Region	0.186***	−0.005
	(0.056)	(0.041)
Central Region	−0.087	−0.105**
	(0.072)	(0.046)
Oti Region	0.007	−0.115**
	(0.070)	(0.048)
Bono Region	0.193***	−0.046
	(0.060)	(0.047)
Ashanti Region	−0.036	−0.031
	(0.057)	(0.039)
Eastern Region	−0.162**	−0.026
	(0.068)	(0.051)
Northern Region	0.225***	−0.050
	(0.062)	(0.049)
Upper East Region	0.266***	−0.101*
	(0.069)	(0.058)
Upper West Region	0.403***	−0.180***
	(0.067)	(0.052)
Constant	−0.092	3.885***
	(0.148)	(0.109)
N	3905	3905

Table 2 (continued)

Variables	Poverty Full	Food insecurity Full
R-squared	0.131	0.637

COVID-19 captures those who lost their jobs or are unemployed due to the pandemic. The reference group for the region is Greater Accra. The reference group for education is without formal education

Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

4.3 Gender and Location Dimensions to the Effect of COVID-19 on Poverty and Food Insecurity

In Table 3, we present baseline results for the Effect of COVID-19 on poverty and food insecurity along gender and location dimensions. Generally, a glimpse of Table 3 reveals mixed findings. First, in terms of poverty, female-headed households who are affected by the pandemic suffered more than their male counterparts. Specifically, while the poverty levels of female-headed households increased by 58 percentage points, poverty levels of male-headed households increased by 54.3 percentage points. However, the differential magnitude of 3.7 percentage points in favour of males is significant at one percent indicating the relevance of such variations.

A similar trend holds for poverty by location dimensions as we find supportive evidence that COVID-19's impact on poverty levels of affected rural dwellers is relatively higher compared to their affected urban counterparts. It is significant to underscore that in terms of scale, COVID-19 affected more households in urban areas than households in rural areas. However, in terms of impact, affected households in rural settings suffered 22 percentage points more compared to affected households in urban settings. This holds only for poverty, but not food insecurity.

Regarding household food insecurity and COVID-19 by location, we find that the effect of COVID-19 on the food insecurity status of urban households is substantially higher compared to their rural counterparts.

Table 3 Gender and location dimensions to the effect of COVID-19 on poverty and food insecurity

Variables	Poverty				Food insecurity			
	Gender		Location		Gender		Location	
	Male	Female	Urban	Rural	Male	Female	Urban	Rural
COVID-19	0.543***	0.580***	0.450**	0.670**	0.227***	0.348***	0.306***	0.277***
	(0.070)	(0.067)	(0.069)	(0.067)	(0.050)	(0.053)	(0.051)	(0.053)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1878	2027	1841	2064	2027	1878	1841	2064
R-squared	0.1	0.136	0.145	0.107	0.622	0.654	0.641	0.634

COVID-19 captures those who lost their jobs or are unemployed due to the pandemic. The reference group for the region is Greater Accra. The reference group for education is without formal education

Robust standard errors in parentheses. ***$p<0.01$, **$p<0.05$, *$p<0.1$

Specifically, the differential magnitude of 2.9 percentage points in favour of rural households is indicative of their resiliency in the areas of food insecurity compared to their urban equals. This is consistent with findings in other settings (van Dorn et al., 2020; Kashnitsk & Aburto, 2020; Emanuel et al., 2020). In terms of COVID-19 and food insecurity by gender dynamics, we find that the food insecurity of female-headed households rose by 12.1 percentage points extra compared to male-headed households. This finding implies that although COVID-19 is affecting both sexes, its impacts on females are more intense. More females (23.54%) lost their jobs compared to their male (21.81%) counteparts. As noted by Alon et al. (2020) and Wenham et al. (2020), given the severe deprivation of females in the labour markets and female's family responsibilities, the COVID-19 pandemic is exacerbating the existing gender inequality gap.

4.4 Sensitivity to Endogeneity

Next, we offer results from various empirical exercises that examine the sensitivity of our results to endogeneity. In Table 4, we report three set of results: (1) OLS estimates, (2) standard IV results in which we instrument for COVID-19 using distance to affected communities, and (3) Lewbel (2012) 2SLS results which combine external instruments with internally generated instruments.

Consistent with our prior expectations, based on the first stage results, we find that distance to affected communities is negatively associated with the COVID-19 and, thus, an increase in distance to the affected communities are associated with a decrease in

Table 4 COVID-19, poverty and food insecurity (IV results)

Variable	Poverty			Food insecurity		
	OLS	2SLS	Lewbel 2SLS	OLS	2SLS	Lewbel 2SLS
COVID-19	0.557***	2.254***	0.403***	0.289***	1.311***	0.213***
	(0.048)	(0.036) [0.140]	(0.032) [0.232]	(0.037)	(0.061) [0.085]	(0.030) [0.165]
Controls?	Yes	Yes	Yes	Yes	Yes	Yes
first stage						
Distance		−0.141**	−0.202***		−0.176***	−0.209***
		(0.044)	(0.053)		(0.053)	(0.126)
N	3905	3905	3905	3905	3905	3905
Durbin-Wu-Hausman test		34.87***			51.91***	
Sargan p-value		0.162			0.101	
F-statistics		201.48****	141.61****		311.01****	277.16****
J P-value			0.152			0.180
Bressuch-Pagan test			304.01**			601.39***
Pagan-Hall test			538.47***			501.98***

Columns 3 and 6 represent 2SLS (Standard IV) estimates with distance to affected communities of COVID-19 as instrument. Columns 4 and 7 represent Lewbel 2SLS results that combine internal and external instruments

Robust standard errors adjusted for heteroskedasticity in parentheses, standard coefficients in brackets

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

COVID-19 (i.e., decrease in job losses or unemployment due to the pandemic). Consistent with our baseline result, we also find that COVID-19 is positively associated with poverty and food insecurity. Here, we find that endogeneity generates a considerable upward bias in the OLS estimates given that the Lewbel 2SLS results are relatively smaller in magnitude compared to the baseline estimates. In more specific terms, ceteris paribus, a standard deviation increase in COVID-19 is associated with an increase of 0.232 and 0.289 standard deviations in poverty and food insecurity, respectively. We interpreted only the Lewbel (2012) 2SLS results and our motivation stems from the fact that the magnitude of the coefficients from 2SLS results with external instruments only is much higher than both the OLS and the Lewbel (2012) with both internal and external instruments, making them unconvincing. In our view, this could probably reflect the lack of instrument exogeneity. Besides, the tests suggest that we have a good instrument. Therefore, we report Lewbel (2012) 2SLS estimates which combine our external instrument with internally generated instruments. Convincingly, the Lewbel (2012) estimates suggest that COVID-19 has a deleterious effect on poverty and food insecurity with coefficient magnitudes that lie between those of our OLS estimates and the standard IV estimates. More reasonably, the estimates using the Lewbel (2012) 2SLS which lie between the OLS and the standard IV are consistent with findings in other settings (Barrett, 2020; Bui, 2020; Gundersen et al., 2020; HLPE, 2020; Mishra & Rampal, 2020; Mouloudj et al., 2020; Pereira & Oliveira, 2020).

In Table 5, we present results from various empirical exercises that examine the sensitivity of our results to endogeneity for the male–female and rural–urban subsamples. Generally, in Table 5, we find that gender and location heterogeneities exist regarding the impact of COVID-19 on poverty and food insecurity. Precisely, consistent with our baseline results, in terms of poverty, female-headed households are particularly worse off with a differential magnitude of 4.6 percentage points. On the side of food insecurity, the effect of COVID-19 is more pronounced in urban households compared to rural households with a significant differential magnitude of 5.8 percentage points. These findings are consistent with findings in other contexts (Alon et al., 2020; Wenham et al., 2020).

4.5 Robustness Checks

To further ensure the robustness of our results, we implemented simultaneous quantile regression (SQR) and an ordered probit estimator largely on two grounds. First, it is possible that the effect in the use of basic services by households may likely vary along with the distribution of household welfare. Thus, we implemented SQR to examine the effect of the COVID-19 beyond mean household consumption expenditures. Similarly, there are potential tendencies that the effect of COVID-19 may vary for different categories of food insecurity status (mild, moderate and severe). Thus, we apply the maximum-likelihood ordered probit estimator, which ranked household food insecurity into three groups (mild, moderate and severe). The results for these additional robustness checks are presented in Table 6. The robustness estimations show that COVID-19 affected the whole poverty spectrum: overall, its effects on persons within the middle class and the upper class (highest) were more significant compared to those in the lowest class. For instance, while the overall consumption of COVID-19 households per adults equivalence decreased by 18 percentage points for those in the lowest quantile, it decreased more (18.5%) for their counterparts in the highest quantile. A possible explanation for this finding is that COVID-19 in Ghana is so much concentrated in the major cities compared to the rural areas of the country. Secondly, albeit, COVID-19 impact on all persons along the whole food insecurity spectrum,

Table 5 Gender and location dimensions to the effect of COVID-19 on poverty and food insecurity

Variables	Poverty				Food insecurity			
	Gender		Location		Gender		Location	
	Male	Female	Urban	Rural	Male	Female	Urban	Rural
Panel A: 2SLS with external instrument								
COVID-19	0.510***	0.556***	0.600***	0.412***	0.211***	0.297***	0.258***	0.200***
	(0.124) [0.136]	(0.031) [0.271]	(0.232) [0.282]	(0.021) [0.210]	(0.011) [0.105]	(0.106) [0.198]	(0.094) [0.287]	(0.110) [0.087]
Controls? first stage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance	−0.014**	−0.012**	−0.011**	−0.023**	−0.101**	−0.019**	−0.21**	−0.101**
	(0.0136)	(0.011)	(0.010)	(0.001)	(0.005)	(0.004)	(0.005)	(0.021)
Durbin-Wu-Hausman test	64.19	63.40	36.31	29.52	55.30	47.85	50.31	81.89
Sargan *p*-value	0.101	0.067	0.194	0.138	0.068	0.129	0.191	0.102
F-statistics	234.06**	143.12**	189.40**	126.52**	196.72**	223.41**	102.89**	162.34**
Panel A: 2SLS with internal and external instruments								
COVID-19	0.524***	0.561***	0.598***	0.379***	0.178***	0.312***	0.291***	0.286***
	(0.099) [0.138]	(0.215) [0.289]	(0.073) [0.291]	(0.120) [0.230]	(0.027) [0.121]	(0.034) [0.201]	(0.180) [0.288]	(0.031) [0.198]
Controls? first stage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance	−0.018***	−0.159**	−0.104***	−0.021**	−0.102**	−0.325**	−0.018**	−0.152**
	(0.002)	(0.012)	(0.003)	(0.001)	(0.002)	(0.001)	(0.011)	(0.030)
F-statistics	234.06**	143.12**	189.40**	126.52**	196.72**	223.41**	102.89**	162.34**
J P-value	0.102	0.030	0.010	0.123	0.038	0.056	0.025	0.161
Bressuch-Pagan test	256.27**	621.33**	557.42**	681.01**	164.26**	243.89**	245.20**	233.80**
Pagan-Hall test	603.01**	627.50**	689.21**	670.22**	664.26**	611.76**	681.05**	654.11**

Robust standard errors adjusted for heteroskedasticity in parentheses, standard coefficients in brackets

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 6 SQR and Ordered Probit estimates on the effect of COVID-19 on poverty and food insecurity

Variables	Poverty					Food insecurity (Ref = mild)	
	Simultaneous Quintile Regression (SQR)					Ordered Probit	
						Moderate	Severe
	Lowest	Second	Third	Fourth	Highest	ME	ME
COVID-19	− 0.180**	− 0.203**	− 0.199**	− 0.226**	− 0.185**	0.358***	0.480***
	(0.059)	(0.052)	(0.041)	(0.024)	(0.041)	(0.020)	(0.005)
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3905	3905	3905	3905	3905	2027	2027

ME is marginal effect. Standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

its effect was most significant for households experiencing severe food insecurity compared to those experiencing mild food insecurity. In specific terms, compared to households that experienced mild food insecurity, the food insecurity for households experiencing moderate and severe food insecurity increases by 35.8 percentage points and 48.0 percentage points, respectively. The differential magnitude of 15.5 percentage points against severe food-insecure households is significant at one percent. This finding implies that COVID-19's effect is more intense in severe food-insecure households.

5 Conclusions and Policy Implications

This study sought to examine the impact of the COVID-19 on poverty and food insecurity in Ghana. Using national-level data that were collected from households in Ghana, the study showed that COVID-19 has adversely affected the welfare of households. More importantly, the pandemic has subtantaily increased poverty and exacerbated food insecurity situation in Ghana. It heightened the food insecurity status of many and pushed several people who were non-poor before the pandemic into poverty. The findings of the present study further revealed that socio-economic characteristics significantly influence the extent to which the pandemic affected the livelihood of households. For instance, the unemployed and least educated, experienced the greatest adverse effects, while the economically sound households were able to escape the severe impact of pandemic-induced shocks. We conclude that COVID-19 has created layered vulnerabilities to poverty and hunger and this is likely to render current policy efforts ineffective or simply counterproductive. The findings of the study offer several policy implications. Of utmost importance is the need to improve the economic status of households through income generation activities that provide reliable sources of income to households to empower them to withstand threats posed by a pandemic of this nature. Also, securing jobs of households should be prioritized by the government, as this study showed that poverty increased for people who are unemployed or

lost their jobs due to the pandemic compared to others. A plausible way to secure the jobs of households is for businesses to be given income support and other incentives to retain employees. Furthermore, there is the need to expand social protection programs such as direct cash disbursement to low-income households and other vulnerable groups in society to facilitate access to food and other basic needs.

The study has some limitations which should be considered, although their combined effects could not invalidate the importance of the findings of the study. The survey was implemented for a short period and hence did not collect data that could permit trend analysis of the impact of the pandemic on poverty and food insecurity. A trend analysis could have revealed more insights into the dynamics of the link between COVID-19 and poverty and food insecurity. Again, those who lost their jobs or being unemployed due to COVID 19 was the primary measure used to represent the effect of COVID-19. Likely, this was not detailed enough. It is recommended that additional measures are included in future studies to evaluate the impact of COVID-19 on households.

Appendix

See Tables 7 and 8

Table 7 sample distribution of the respondents (*N* = 3905)

Variable	Definition	Mean	SD
COVID-19	Captures whether the respondent is affected by COVID-19 (1 = unemployed/lost job due to COVID-19, 0 = otherwise)	.66	.81
Male	Gender of the respondent (0 = male, 1 = female)	.48	.50
Female			
Urban	Respondent's place of residence (0 = urban, 1 = rural)	.47	.50
Rural			
No edu	Educational attainments of the respondents (0 = no formal education, 1 = primary, 2 = secondary, 3 = tertiary)	2.67	1.49
Primary			
Secondary			
Tertiary			
Dependents			
Yes	Whether persons under 16 years are living in the household (0 = No, 1 = Yes)	.69	.462
No			
Greater Accra Region	Region of the respondent (0 = Greater Accra, 1 = Western, 2 = Central, 3 = Oti, 4 = Eastern, 5 = Ashanti, 6 = Bono, 7 = Northern, 8 = Upper East, 9 = Upper West)	3.61	2.82
Western Region			
Central Region			
Oti Region			
Eastern Region			
Ashanti Region			
Bono Region			
Northern Region			
Upper East Region			
Upper West Region			
Household size	Household size	4.41	2.99
Income	Household total monthly income	1145.56	1095.16
Age	Age of the respondent	36.6	14.06

Table 8 Sample description

Variable	%
Employed	55.62
Lost job/unemployed due to COVID-19	33.64
Unemployed due to other factors	10.74
Male	51.91
Female	48.09
Urban	52.86
Rural	47.14
No formal education	19.59
Primary education	15.31
Secondary education	24.02
Tertiary education	41.08
Dependents	
Yes	69.07
No	30.93
Greater Accra Region	19.62
Western Region	13.11
Central Region	8.22
Oti Region	8.40
Eastern Region	8.83
Ashanti Region	15.01
Bono Region	7.27
Northern Region	8.50
Upper East Region	6.35
Upper West Region	4.69
Household size	
Income	1145.56
Age	36.6
Below lower poverty line of Ghc 792.00	35.09
Below upper poverty line of Ghc 1, 314.00	56.02

our calculation of the two poverty lines using household's total consumption expenditure

Data Availability The data is readily available upon Editor's request.

Declarations

Conflict of Interest There are no conflict of interest.

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