

Review Article

AN OVERVIEW OF COVID-19 AND ITS PROGRESSION IN GHANA

Abstract

The current SARSCoV2 (coronavirus illness 2019) outbreak, which began in the People's Republic of China's Hubei Province, has spread to many other nations leading to the early declaration by World Health Organization as a pandemic on March 12, 2020.

This research focuses on the progression of the coronavirus pandemic in Ghana, measures put in place to fight the pandemic and evaluation of Ghana's response in terms of both containing the pandemic and mitigating the social and economic effects of the COVID 19 pandemic. This review highlights on and analyzes the quarterly pattern of the infection rate, critical cases, active cases and mortality rates of the pandemic in Ghana. The research points out how the Ghanaian government implemented and enforced measures such as; hand and respiratory cleanliness, social distancing, quarantining travelers, and isolating symptomatic cases in the quest to mitigate the spread of the infection. Ghana's mortality rates were found to be lower than some other African countries. The study concludes that the actions adopted by the Ghanaian government so far in handling the pandemic have generated significant achievements, despite some challenges encountered due to the non-adherence to protocols by some fractions in the Ghanaian population. It is however recommended that more control measures such as mass vaccination, mass testing and contact tracing will help track the infection and further reduce the rate of infection.

Keywords ????

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1. INTRODUCTION

Globally, over one hundred and seventy-two million cases of COVID-19 have been confirmed with not less than three million deaths as at June 21st 2021. The virus has affected 220 countries and territories so far with the United States of America being its worse victim (over 34 million cases and 600,000 deaths). As at June 2021, 47 countries in Africa have been affected by the pandemic with more than 4.8 million confirmed cases and 130,000 mortalities. South Africa has recorded the highest number of cases with over 1.6 million cases and over 56,000 deaths [1].

Coronavirus are-is large family of viruses which can inflict several mild and severe diseases in humans. There are several endemic human coronaviruses globally; HCoV-229E, HCoV-NL63, HCoV-HKU1 and HCoV-OC43 including the zoonotic Middle East Respiratory Syndrome coronavirus (MERS-CoV) and Severe Acute Respiratory Syndrome coronavirus (SARS-CoV), which have higher case fatality rates [2]. The history of this family of viruses dates as back as the years between 2002 and 2003 there when there was an outbreak of severe acute respiratory syndrome (SARS) [3]. SARS-CoV-2, another coronavirus that causes coronavirus disease 2019 (COVID-19), was first discovered in Wuhan, China, in December 2019 [4]. The World Health Organization (WHO) declared the COVID-19 outbreak a public health emergency of international concern on January 30, 2020. By March 2020, the outbreak was referred to as pandemic and countries were cautioned on the effect hence actions to detect and stop the spread must be ensured globally [5].

Since the first case was detected in Wuhan, China in 2019, human life has been impacted by the pandemic, including religious activities, funerals, business, education, public healthcare systems, and sociocultural soeio-cultural events. According to the United Nations (2020) [6], the COVID-19 pandemic has been recognized as one of the world's most serious pandemics, resulting in

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crisis around the world, plunging the world's economy into a recess with historical levels of unemployment, restrictions on free movement of people, and increased levels of deprivation.

This study examine how various policies and measures implemented by the Ministry of Health and government, such as social distancing, frequent ~~hand washing~~handwashing, travel bans, and lockdowns, affected the disease progression in Ghana. Findings from the study seek to provide stakeholders of the health departments such as the Ghana health service and the ministry of health with information on the measures put in place in response to the ~~eovid-19~~COVID-19 pandemic and how these measures have impacted Ghanaians in various aspects of their livelihood, in order to help them in decision-making and policy formulations.

~~1.0~~ **2. METHODS**

This review drew and assessed data from reputable sources; Ministry of Health, ~~Goggle~~Google scholar, Ghana Health Service, Center for Disease Control (CDC), World Health Organization (WHO), World Travel Tourism Council (WTTC) and online news articles. Impact reports on COVID-19 from several agencies including Association of Ghana Industries (AGI), and the Institute of Statistical Social and Economic Research (ISSER) were examined. The studies were conducted with reference to recent published article on COVID-19. The study mainly assessed the COVID-19 situation in Ghana within the period of March 2020 to MAY 2021. The literature search was conducted using the main online databases (PubMed, Google Scholar, MEDLINE, Embase and Web of Science) with the following keywords: “COVID-19 pandemic”, “Ghana’s response strategy”, “Impact”, “Africa”, “Ghana’s economy”, “Socio Economic impact”, “Government policy”, “COVID19 vaccines”, “Measures Taken”, “Vaccination Process”.

2.1 Data Collection and Analysis

The data retrieved was analyzed on a quarterly basis from the onset of the pandemic in Ghana,

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March 2020 to May 2021. The quarterly basis for the analysis is summarized below;

1st Quarter (March to May 2020),

2nd Quarter (June to August 2020),

3rd Quarter (September to November 2020)

4th Quarter (December 2020 to February 2021)

1st Quarter of the second Year (March to May 2021)

2.2 Infection Rate

This was calculated using the formula:

$$\frac{\text{Total number of infections}}{\text{Total number of people tested}} \times 100\%$$

The results of the data retrieved were further tabulated and graphically represented using Microsoft Excel application.

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3.0 RESULTS

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3.1 Results

A total of 15 months from the onset of the pandemic in Ghana were considered. The data for the first year was considered on a quarterly basis as well as the first quarter of the second year of the pandemic in Ghana.

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3.2 Table of Results

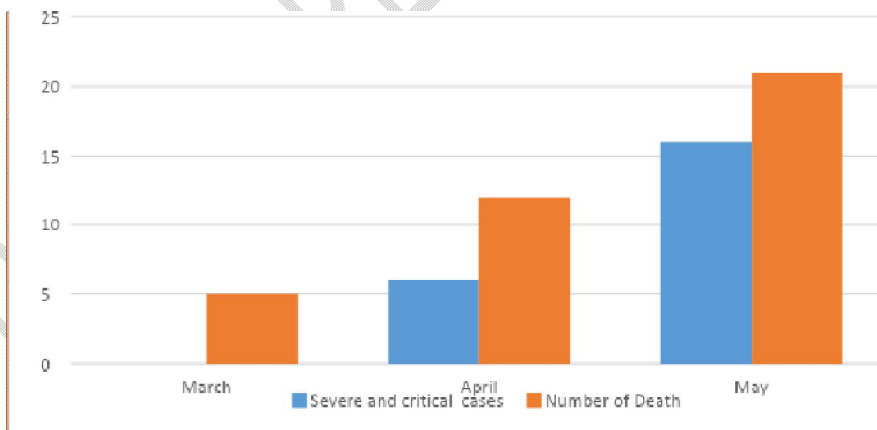
Table 1,3,5,7, and 9 show confirmed cases of COVID-19 for 1st Quarter (March to May 2020), 2nd Quarter (June to August 2020), 3rd Quarter (September to November 2020) 4th Quarter (December 2020 to February 2021) and 1st Quarter of the second Year (March to May 2021) respectively. ~~These Table~~ These tables further showed the total recovery, severe cases, number of deaths, active cases and the total number of confirmed cases for each of the months with this period in their respective quarter. The mortality rate for each quarter is shown in Table 2,4,6,8 and 10 for the respective quarter below.

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The Critical Cases and the Number of Death in Ghana for 1st Quarter (March to May 2020), 2nd Quarter (June to August 2020), 3rd Quarter (September to November 2020) 4th Quarter (December 2020 to February 2021) and 1st Quarter of the second Year (March to May 2021) are represented on figures 1,2,3,4, and 5 respectively.

Table 1: Number of Repported cases by the first quarter from March to May 2020

Months	New Confirmed cases	Total Recovery/Discharged	Severe & critical cases	Number of Death Cases	Active Cases	Total number of confirmed cases
March	152	22	5	5	125	152
April	1922	190	6	12	1839	2074
May	6223	8085	16	21	5257	8297



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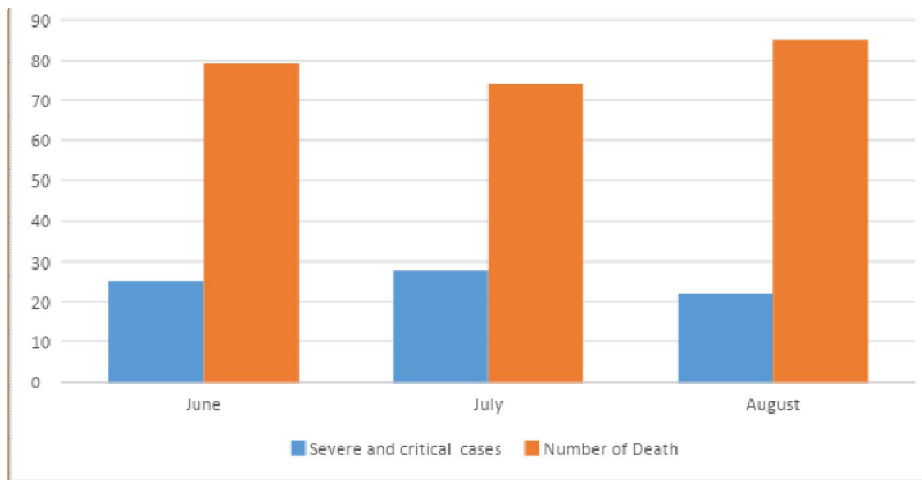
Figure 1: Critical Cases and the Number of Deaths in Ghana from March to May 2020

Table 2: Covid-19 mortality rate and infection rate by the first quarter, Ghana

First Quarter	Total number Tested	Total number of Infection	Total no. of Death cases	Mortality Rate	Infection Rate
March-May 2020	219,825	8,297	38	0.46%	3.77

Table 3: Reported cases within the second quarter from June to August 2020

Months	New Confirmed cases	Total Recovery/Discharged	Severe & critical cases	Number of Death cases	Active Cases	Total number of confirmed cases
June	9837	13550	25	79	4467	18134
July	19678	34313	28	74	3308	37,812
August	6846	43478	22	85	904	44658



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Figure 2: Critical Cases of COVID-19 and the Number of Deaths in Ghana within the second Quarter (June to August 2020)

Table 4: Covid-19 mortality rate and infection rate by the second quarter, Ghana

Second Quarter	Total number Tested	Total number of Infection	Total no. of Death cases	Mortality Rate	Infection Rate
June-August 2020	225828	36361	238	0.66	16.10

Table 5: Covid-19 reported cases for the third quarter from September to November 2020

Months	New Confirmed cases	Total Recovery/ Discharged	Severe & critical cases	Number of Death cases	Active Cases	Total number of confirmed cases
September	2145	46006	22	27	494	46803
October	1708	47372	13	17	819	48511
November	3585	50924	19	5	847	52096

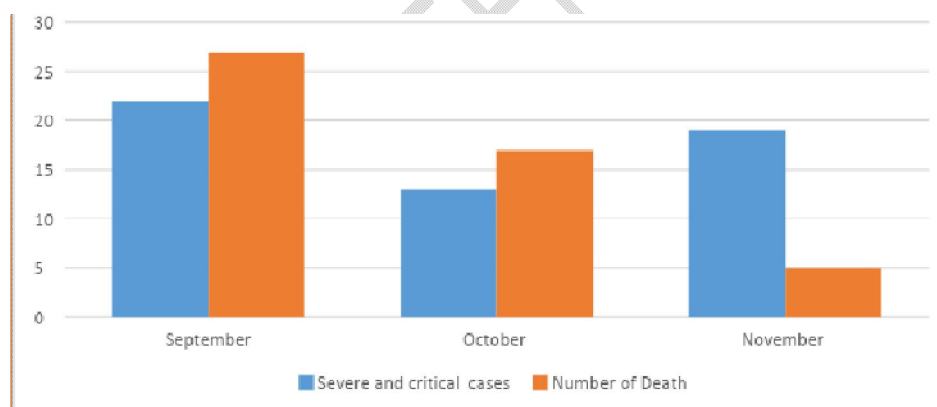


Figure 3: Critical cases of covid-19 and the number of deaths in Ghana within the third quarter (September to November 2020)

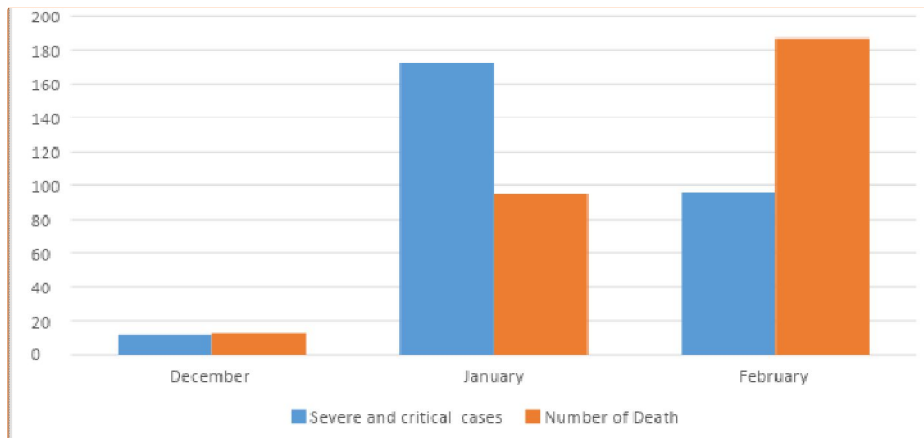
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Table 6: Covid-19 mortality rate and infection rate by the third quarter, Ghana

Third Quarter	Total number Tests	Total number of Infection	Total no. of Death cases	Mortality Rate	Infection Rate
Sept.-Nov. 2020	155,354	7,438	49	0.66	4.79

Table 7: Reported cases for the fourth quarter from December to February 2020

Months	New Confirmed cases	Total Recovery/ Discharged	Severe & critical cases	Number of Death cases	Active Cases	Total number of confirmed cases
December	3,072	53,928	12	13	905	55,168
January	13,391	62,340	172	95	5786	68,559
February	16,191	78,924	96	187	5,206	84,750



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Figure 4: Critical Cases of Covid-19 And The Number of Death in Ghana Within the Fourth Quarter (December to January 2021)

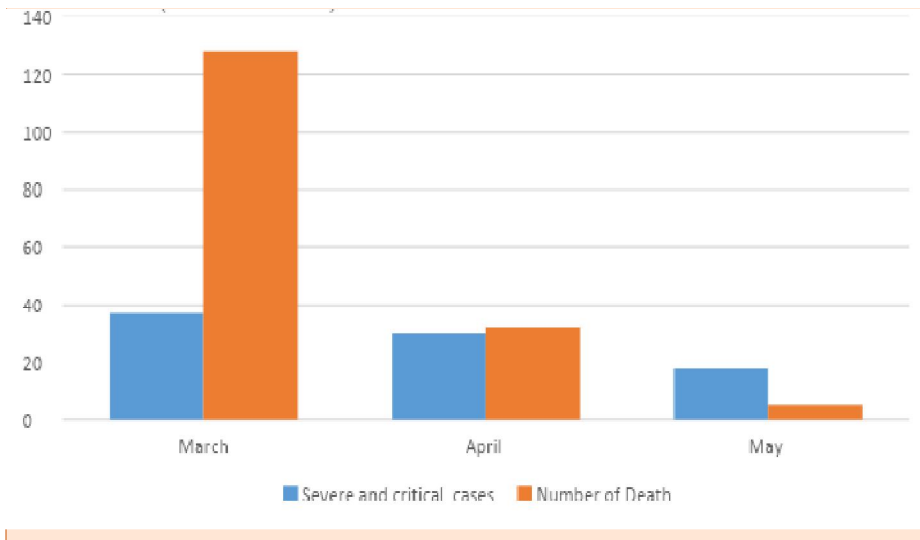
Table 8: Covid-19 mortality rate and infection rate by the third quarter in Ghana

Fourth Quarter	Total number of Tests	Total number of Infection	Total no. of Death cases	Mortality Rate	Infection Rate
December- Feb.2021	309666	32654	295	0.90	10.55

Table 9: Reported cases for the first quarter of the second year from March 2021 to May 2021

Months	New Confirmed cases	Total Recovery/Discharged	Severe & critical cases	Number of Death cases	Active Cases	Total number of confirmed cases
March	6032	88585	37	128	1449	90782
April	1958	90376	30	32	1584	92740
May	1271	13133	18	5	1169	94011

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Figure 5: Critical cases of covid-19 and the number of deaths in Ghana from March 2021 to May 2021

Table 10: Covid-19 mortality rate and infection rate by the first quarterly of the second year, Ghana.

1 st Quarter (2 nd Year)	Total number Tests	Total number of Infection	Total no. of Death cases	Mortality Rate	Infection Rate
March-May 2021	260,182	9,261	165	1.78	3.60

Table 11: Covid-19 Total number of Confirmed cases, Ghana, March 2020-May 2021(Quarterly) from March 2021 to May 2021

	NUMBER OF CONFIRMED CASES
QUARTERS	
MARCH- MAY 2020	8297
JUNE-AUGUST 2020	44658
SEPTEMBER-NOVEMBER 2020	52096
DECEMBE-FEBRUARY 2021	84750
MARCH-MAY 2021	94011

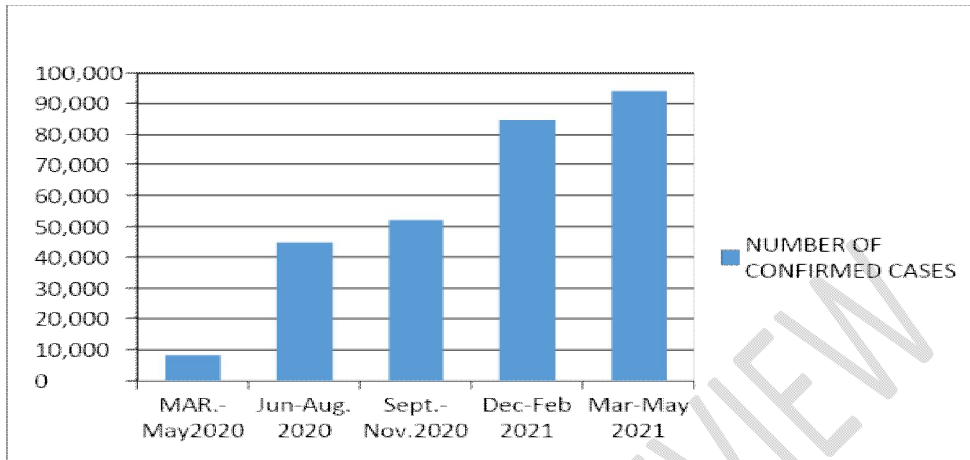


Figure 6 COVID-19 Total number of Confirmed cases, Ghana, March 2020-May 2021(Quarterly)

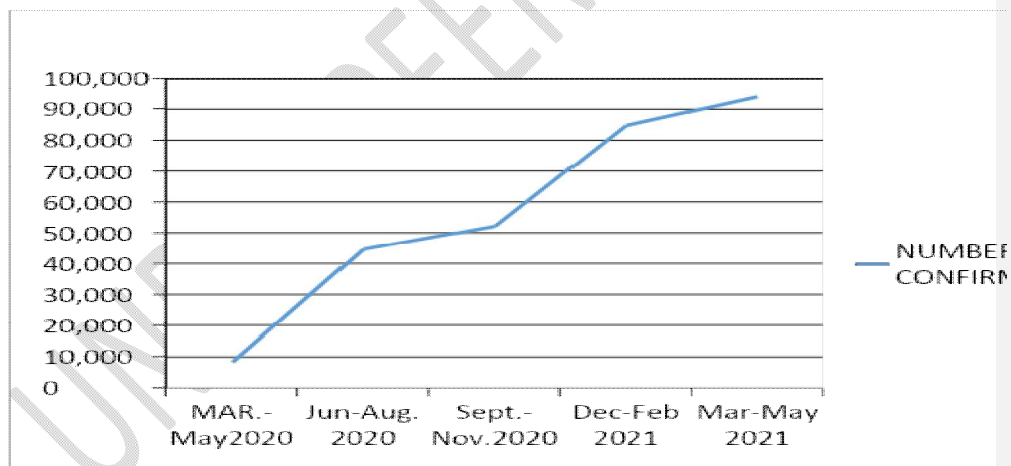


Figure 7: COVID-19 Total number of Confirmed cases, Ghana, March 2020-May 2021(Quarterly)

Table 12: Covid-19 infection rate and mortality rate in Ghana on quarterly basis from March 2021 to May 2021

Yearly Quarters	Infection Rate (%)	Mortality Rate (%)
March-May2020	3.77	0.46
June-August 2020	16.10	0.66
Sept.-November 2020	4.79	0.66
Dec-Feb 2021	10.55	0.90
March-May 2021	3.60	1.78

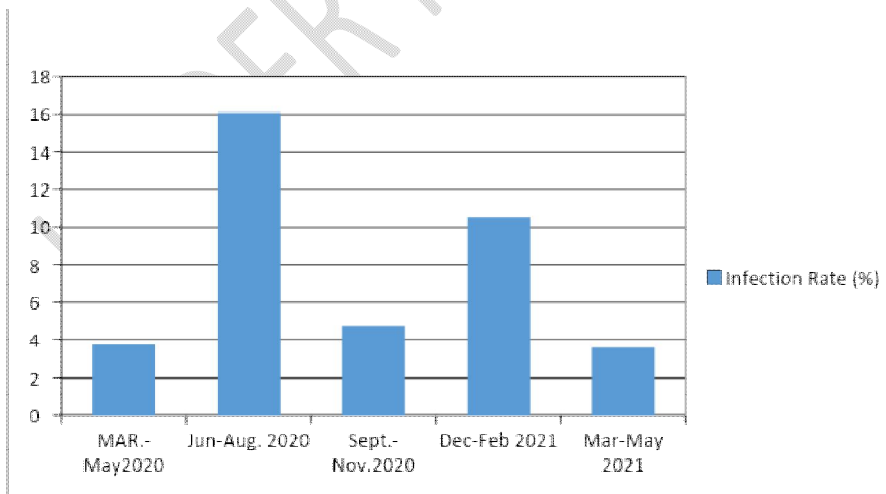


Figure 8: Covid-19 infection rate and mortality rate, Ghana, March 2020-May 2021(quarterly)

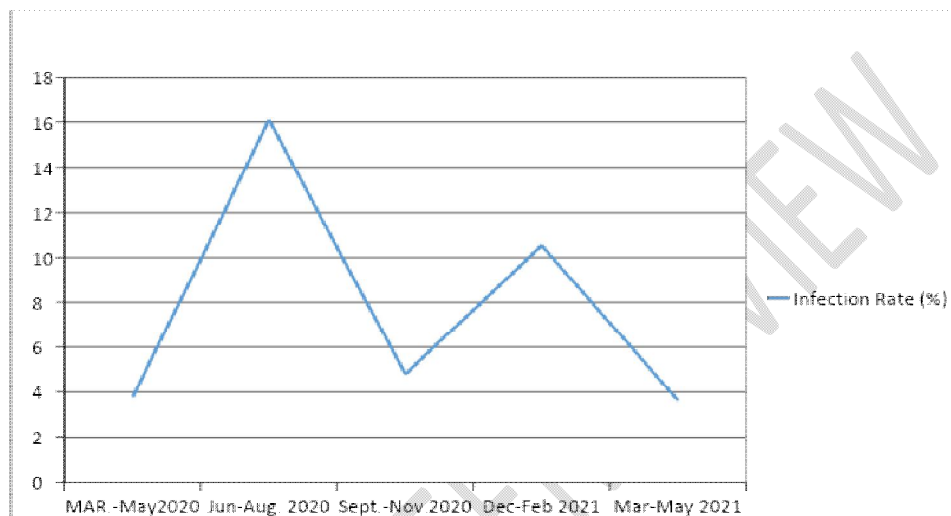


Figure 9: COVID-19 Infection rate (%), Ghana, March 2020-May 2021(Quarterly)

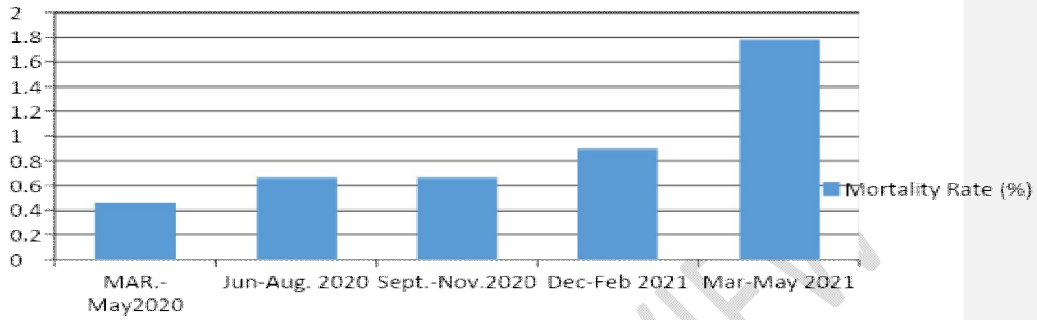


Figure 10: Covid-19 Mortality Rate, Ghana, March 2020-May 2021(Quarterly)

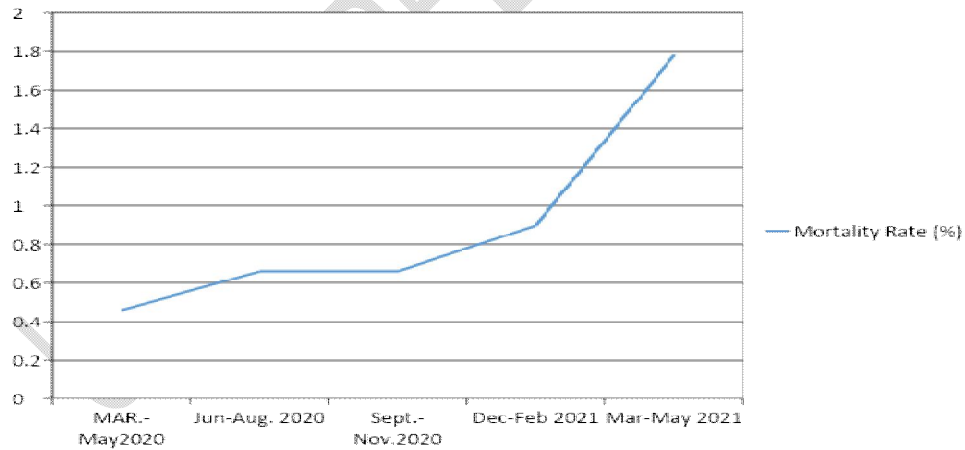


Figure 11: Covid-19 Mortality Rate, Ghana, March 2020-May 2021(Quarterly)

Table 13: Severity of the Covid-19 pandemic On Quarterly Basis

Quarters	No. Critical Cases	No. Death	No. Active Cases
MARCH -MAY 2020	22	38	7221
JUNE-AUGUST 2020	75	238	8677
SEPTEMBER- NOVEMBER 2020	54	49	2160
DECEMBER 2020- FEBRUARY2021	280	295	11897
MARCH-MAY 2021	85	165	4202

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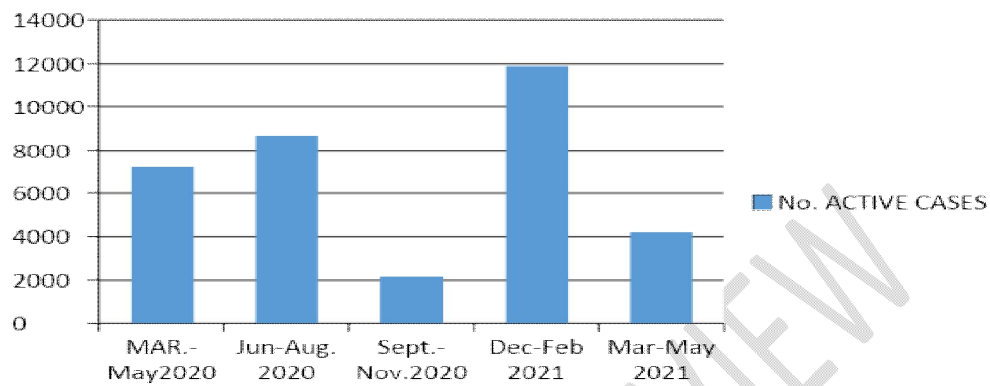


Figure 12: Active COVID-19 cases, Ghana, March 2020-May 2021(Quarterly)

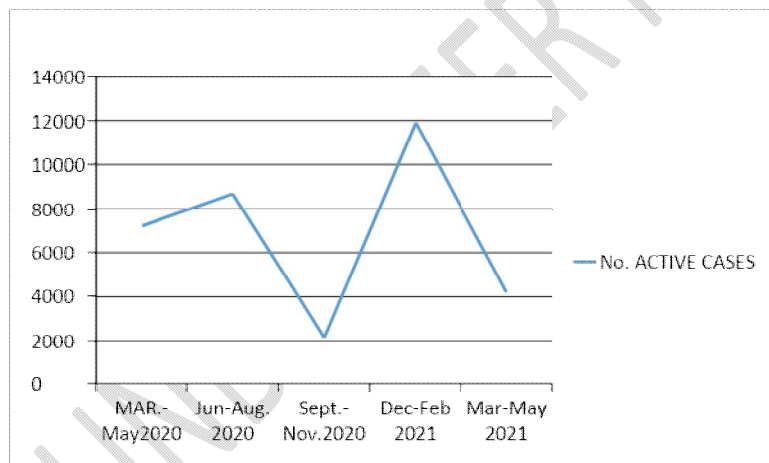


Figure 13: Active covid-19 cases, Ghana, March 2020-May 2021(quarterly)

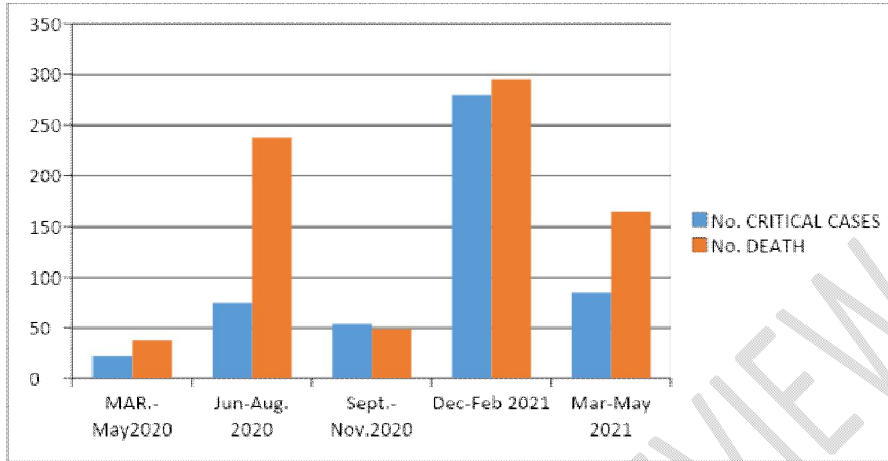


Figure 14: COVID-19 Critical cases and number of deaths, Ghana, March 2020-May 2021(Quarterly)

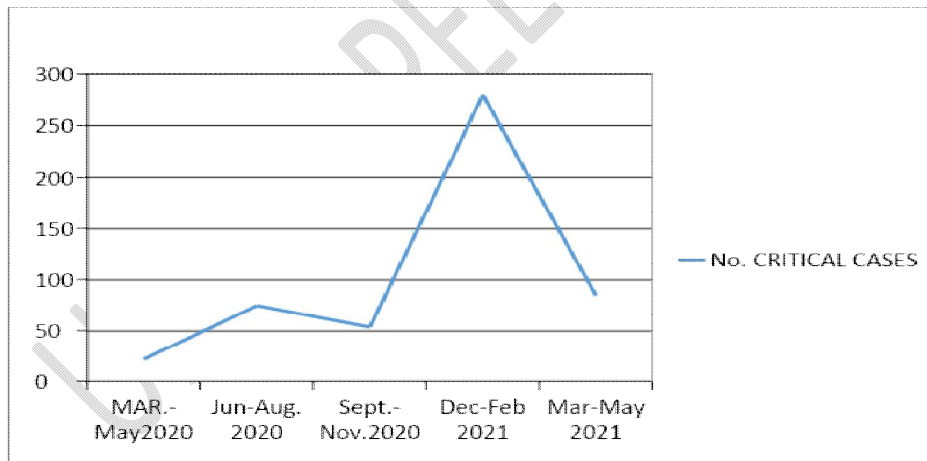


Figure 15: Covid-19 Critical cases and Number of Death, Ghana, March 2020-May 2021(Quarterly)

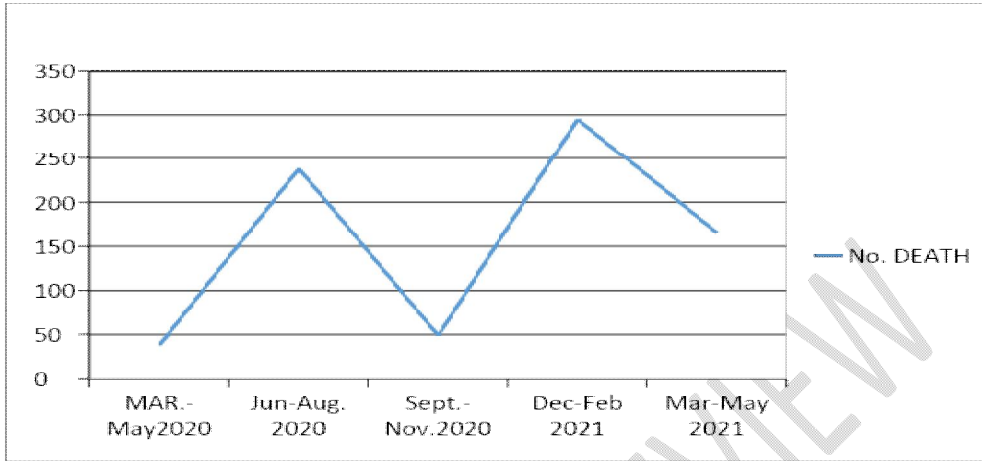


Figure 16: Number of Deaths, Covid-19 Cases, Ghana, March 2020-May 2021(Quarterly)

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4.0—DISCUSSION

4.1 Total Number ~~Of~~ Confirmed Cases ~~In~~ Ghana

The first two COVID-19 cases were detected in Ghana on March 12, 2020. Fourteen months later in May 2021, the country had 94,011 COVID-19 confirmed cases.

In the first quarter (March to May 2020) the total number of confirmed cases were 297 as shown in Table 1 above. The first two recorded cases which were all imported cases led to the initiation of measures to mitigate the importation and the spread of COVID-19 in Ghana by the President and Ministry of Health (MOH). These measures include; the closure of the country's borders, contact tracing process (COVID-19 tracker App, a mobile application designed to raise awareness of novel coronaviruses, assist in the contact tracing of COVID-19 cases, and provide patient information to essential health care providers in the country) and a subsequent partial lockdown in the major cities (Accra and Kumasi) [7] and restriction of social and religious gatherings in Ghana [8]. The measures to control the imported cases, the overall policy was successful as it was able to reduce the infection rate and the mortality rate in the first quarter as shown on the Table 2 above. Entering into the second quarter, the president eased some ~~of the~~ restrictions allowing for meetings of up to 100 persons. As the science of the virus depicts high transmission through physical contacts via interactions, and with the celebration of festivals, funerals, weddings and mass gatherings not ignoring these, it was most prudent to impose a ban [9]. Easing the restrictions exacerbated the spread of COVID-19 as the number of new daily cases increased in the month of June 2020 as shown in Table 3 and Fig. 6 above. From June 15, senior high schools and **tertiaries** final year students started to go back to school, which increased the risk of viral transmission.

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As shown in Fig. 7, there was no great increase in the confirmed cases in the third quarter as the government enforced strict adherence to the COVID-19 protocols, promotion of COVID-19 awareness education due to previous spikes and with the introduction of COVID-19 tracker app on the April 13, 2020.

In the fourth quarter from the onset of the pandemic, December 2020 to February 2021 as shown Fig. 8 a drastic increase in the number of confirmed cases due to the celebration of Christmas coupled with the presidential elections. Additionally, according to CDC(2021) [10], the alpha, beta and gamma variant that were initially detected in the United States in December 2020, South Africa in December 2020 and Brazil, in early January may have been one of the reasons for the drastic increase of confirmed cases in the quarter.

On 24 February, Ghana became the first country to receive COVID-19 vaccines by COVAX, as vaccination had started in the beginning of the second year March 2021. Studies suggest that the current authorized vaccines work on the circulating variants of COVID-19 [11].

In general, it is evident in Fig. 6 and Fig.7, that there was a progressive increase in the number of confirmed cases in Ghana quarterly. Comparing this data to other African countries, the measures and policies put in place by the Government of Ghana had an effect in containing the virus. Ghana was ranked as the best responsive country in Africa on COVID-19 preventive measures as reported by Hadzide (2020) [12].

4.2 Ghana's Covid-19 Active Cases

The data on Fig.13 shows that as demonstrated in other countries, COVID-19 is highly infectious and all 16 administrative regions of Ghana have reported cases within the first 100 days of onset of the outbreak in Ghana. The majority of cases were in the two most populated cities of Accra

and Kumasi as indicated earlier. As discussed in section 5.1, Some Immediate measures were implemented in the first quarter of the year of onset of COVID-19 in Ghana to detect, contain and prevent the spread of the disease. In spite of these measures and policies in the first quarter of the pandemic in Ghana, the country recorded 7,221-active cases of COVID-19 as shown in Table 13 above. From the first quarter, there were about 1,456 increases in active cases in the second quarter. – The Active case count of Covid-19 in Ghana was fast rising. One major contributor to the increase in the active cases was the enhance case and contact tracing strategies during the period of lockdown from March 31st, 2020 to April 27, 2020. The enhanced surveillance and contact tracing strategy helped the country to identify a significant number of cases. This enhanced surveillance and contact tracing strategy is the reason for the drastic increase in Active cases in April and May 2020 as shown in Table 1. Although the lockdown was lifted after three weeks, post lockdown measures were enforced to control the spread of the infection. These included personal hygiene measures, mandatory wearing of masks, ban on social gathering, social distancing, increasing the number of testing sites and humanitarian support for the people of Ghana. Albeit all these measures the rise in new cases were constant from the first quarter through to the second quarter as shown in Fig. 12 and Fig. 13. However, in the third quarter (September to November 2020) the number of active cases begun to nosedive meaning the previous strategies has yielded positive effect. The number of active cases for the third quarter as shown in Table 13 above has reduced by about 6,517.

The increase in the number of active cases in June 2020 led to the government announcing new measures to help curtail the spread of Covid-19. The mandatory wearing of face masks is the latest of such measures. Supported by an Executive Instrument (EI), it was an offence for anyone in Ghana to be in public without a face covering (mask) and the punitive measures attached to

the flouting of this regulation are so severe. An offender risks being imprisoned for a period up to 10 years or fined a sum from GHS 12,000.00 to GHS 60,000.00.

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4.3 Ghana's Covid-19 Infection Rate

In the first quarter, the infection rate recorded was 3.77% as shown in Fig. 8 and 9. As discussed earlier there ~~were relaxation~~ was relaxation of the restriction in the second quarter. These resulted in worsening the situation and led to increased COVID-19 infection rate (16.10%) compared to the first quarter as shown on Table 12 connoting an increased factor of 12.33% infection rate from the first quarter.

However, with reinforcement of the COVID-19 protocol in the third quarter there was a significant decrease in infection rate (4.71%) compared to the previous quarter (Fig.9). In the fourth quarter which was crippled with a lot of activity from presidential elections to Christmas celebration resulted in the increase and the spread of the infection. This resulted in recording of 10.55% infection rate as seen on Fig.9.

Finally, in the first quarter of the second year of the pandemic in Ghana, from March to May, the government reinforced all restrictions and bans to help control the spread of the virus. Personal hygiene and social distancing protocol was seriously put in place again in this period, sanitizing of hands was ensured and also vaccination started in this period. Infection rate for this period was recorded to be 3.60%.

4.4 Ghana's Covid-19 Critical Cases ~~And~~ Mortality Rate.

The ~~number of critical cases recorded within the quarter of first confirmation in Ghana~~ ~~were~~ number of critical cases recorded within the quarter of first confirmation in Ghana was 22 as shown in Table 13 and Fig.15. In the second quarter, the critical cases had shot up to 75 as the number of confirmed cases had increased as well placing a high demand on ventilators and hospital facilities. Majority of infected people with underlying conditions such as asthma, COPD, diabetes, heart failure, hypertension as well as the aged were in critical care. The death toll was 38 as shown on Table 2 above with a mortality rate of 0.46% and in the second quarter, it had risen to 238 with mortality rate of 0.66% (Table.4). The confirmation of death increased the tension, stress level and the anxiety level among Ghanaians. The majority of news websites were swamped with hourly cases. The-number of deaths reported around the world, particularly in many European nations, had sparked concerns that many Ghanaians may also die as a result of the virus.

The government became strict in the reinforcement of restrictions and adherence to COVID-19 protocols. Regarding the contact tracing strategy adopted by the government, the Ghana Health Service enforced the tracing of every person suspected of having come in contact with any confirmed positive person to test, isolate, and treat them if necessary. The success of the approach is evident in (Table 12) This was one of the lowest fatality rates in the world – bested by only ten countries worldwide, including two from Africa; Namibia (0.3%) and Rwanda (0.3%) who only had a confirmed case of 1344 and 1629, respectively as at that time [13]. In the fourth quarter (December 2020-February2021), there was a sharp rise in the number of critical cases as shown in figure 15. This can be attributed to the increased number of cases due to the non-adherence of COVID-19 protocols in the festive season. There was a slight increase in the

mortality rate from the third quarter to the fourth quarter because the critical cases had worsened and cases may have been reported late.

The new variants of COVID-19 were detected around the first quarter of the second year of the pandemic and were determined to be very infectious thus the death toll increased in this quarter (fig. 10&11). Even though vaccination had started, there were conspiracy theories concerning vaccination and so there was reluctance on the part of Ghanaians to get vaccinated.

4.5 An Outline ~~Onon Thethe~~ Policy Steps ~~To~~ Control ~~t~~The Pandemic ~~i~~n Ghana~~A~~.

~~President~~ Akuffo-Addo, the Ghanaian president has been on the front lines of Ghana's COVID-19 outbreak since it began.

~~Akuffo-Addo~~He had given 25 national addresses so far. On the 5th of April, in Ghana's fight against COVID-19, he announced five important objectives:

1. Prevent the infection from being imported.
2. Stop the infection from spreading.
3. Ensure that individuals infected with the virus receive sufficient care.
4. Minimize the virus's social and economic effects.
5. Increase Ghana's local capabilities and self-sufficiency.

[14]

4.6 Measures Taken ~~Troughout~~Throughout ~~t~~The Quarters.

4.6.1 Public Education

Before any COVID-19 cases were identified in Ghana, the Ministry of Information launched a statewide public awareness campaign on COVID-19 prevention steps that all Ghanaians must

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follow in the event that new coronavirus cases come [15]. The Ghana Health Service issued self-quarantine guidelines on March 19. Close contacts of infected people were obliged to stay in their homes for 14 days after their last contact with the confirmed case, without socializing with the public or family members [16]. This happened in the first quarter of the year 2020.

In the fourth quarter from the onset of the pandemic, government launched a series of COVID-19 awareness campaigns to help all Ghanaians adapt to the re-opening of schools. According to the government, this awareness would help to inform the public about all the formalities involved [17].

4.6.2 Tracing, Testing ~~And~~ Treatment (3 T's Approach)

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The President announced in one of his addresses on March 28, 2020, the policy decision to impose movement restrictions in selected District Assemblies and implement the 3T approach. 'Tracing' refers to aggressive contact tracing to identify infected and high-risk people in communities; 'Testing' refers to increasing the country's testing capacity; and 'Treatment' refers to isolating and treating people who have tested positive [18].

4.6.3 Contact Tracing

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Following the confirmation of the first cases on 12 March 2020, the government began contact tracing [19]. The vice president, as well as the Ministry of Communication and Technology launched the COVID-19 Tracker App on 23rd March, a digital tool to assist people in assessing and self-reporting symptoms, tracing those who have had contact with infected people, and assisting infected people in gaining access to health services [20].

4.6.4 Testing

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The Noguchi Memorial Institute for Medical Research was the only facility in Ghana capable of testing for COVID-19 in early March 2020. It also had a very limited supply of test kits. As a result, Ghana adopted Pool testing as a method for COVID-19 testing [21]. Initially, only people who had symptoms and reported to facilities were tested. Beginning on April 9, all contacts of positive cases had to be tested right away, without waiting for symptoms. The pool testing strategy combines and tests samples from multiple people. When a pool tests positive, each individual specimen from that pool is tested. Initially, a pool of fives was tested, and this was later increased to ten. Pooled testing, which is less expensive and takes less time, increased Ghana's testing capacity [2].

4.6.5 Expansion ~~Of~~ Testing

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On July 30, 2020, the GHS announced that COVID-19 testing would be expanded to hospitals throughout Ghana. The government provided 50,000 PCR testing kits as well as other supplies to COVID-19 testing facilities throughout Ghana. This was within the second quarter of the year from the onset of the pandemic. The government delivered laboratory equipment and supplies, increasing the nation's testing capacity [22]. Incas Diagnostics, a medical diagnostic development and manufacturing social enterprise, collaborated with Kwame Nkrumah University of Science and Technology to develop a rapid test that detects COVID-19 antibodies. This rapid test produces results in 15 to 20 minutes, greatly improving Ghana's testing capacity [23]. The COVID-19 National Trust Fund invested over 32 million Ghana cedis to help battle COVID-19 in the country [24].

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4.6.6 Treatment ~~And~~ Health Care,

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In response to Ghana's COVID-19 outbreak, 7,791 health facilities and 18 intensive care units were activated. President Akufo-Addo announced on April 26 a plan to build three infectious disease centers for each of the three ecological zones: coastal, northern, and middle belt zones, with the overall goal of establishing a Ghana ~~Centre~~-Center for Disease Control [25]. President Akufo-Addo announced incentives for all health workers in order to provide relief to frontline health workers in response to COVID-19 on April 5, 2020 [26]. The Isolation and treatment centers were constructed within the second quarter that is June to August 2020, as part of government's efforts to ensure the management of COVID-19 across Ghana [27] [28].

In the fourth quarter, The Ghana Food and Drugs Authority (FDA) and the National Medicine Regulatory Agency (NMRA) authorized an herbal medicine called *Cryptolepis Sanguinolenta* locally known as Nibima for Covid-19 clinical trials [29].

4.7 Social Restrictions

4.7.1 Meetings ~~And~~ Gatherings,

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Three days after the first cases were confirmed in Ghana, President Akufo-Addo banned all public gatherings, including conferences, workshops, funerals, festivals, political rallies, and church activities and closed all schools and universities to reduce the spread of COVID-19 [30] [31]. This was in the first quarter of the year 2020. The restriction, on the other hand, exacerbated the problems of informal businesses such as event planners and decorators, local performers, and food vendors, among others. Other social reactions include social protection measures to assist the disadvantaged in society, such as the giving of free meals to 'kayayei' - a

popular term for the phenomenon of head porters mostly from deprived rural areas of Northern Ghana and working in market-places as a carrier of goods.

4.7.2 Hand Washing, Free Water ~~For~~for All Ghanaians ~~And~~and Subsidized Electricity Water Bills

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~~Hand washing~~Hand washing was recommended by the WHO as one of the most effective ways of preventing the spread of COVID-19. With most families at home, frequent hand-washing under running water has become a necessity, and utility bills, particularly water and electricity (power), will rise. On April 9, the president announced that the government would cover all Ghanaians' water and electricity bills for the months of April, May, and June ~~of~~2020. The policy initiative was intended to cushion citizens and lessen the impact of the imposed lockdown [32].

Following the outbreak of the novel coronavirus, the use of Veronica buckets became very popular in Ghana as it was used for hand washing to prevent the virus's spread [33]. Richard Kwarteng and his team in Kumasi invented the SolaWash, an automated and mobile hand washing machine powered by solar panels, to combat the novel coronavirus pandemic. The Ghana Standards Authority (GSA) certified the technology in four days rather than the usual twenty-one days. This was quickly commercialized in order to combat COVID-19 [34].

4.7.3 Wearing ~~Of~~of Nose Mask ~~And~~and Local Production ~~Of~~of Personal Protective Equipment (PPE)

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On April 11, within the first quarter of the onset of the pandemic, the government made a US\$10 million loan to some local companies through the Ghana Exim Bank to help them manufacture face masks, scrubs, and protective gowns. This loan was intended to ensure that

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adequate PPE was available [35]. In the second Quarter, On June 15, President Akufo-Addo signed E.I.164, a new Executive Instrument that says that anyone who do not wear face masks in public face a four- to ten-year prison sentence, a fine of between GHS12,000 and GHS60,000 [36]. The Ghana Police Service ~~were~~was issued instructions on how to implement the mandatory wearing of face masks, according to the government [37].

4.7.4 Lockdown ~~a~~And Restrictions.

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On March 27, President Akufo-Addo imposed a partial lockdown of Accra, Tema, Kasoa, and Kumasi, identified by Ghana Health Service as the “hotspots” of infections. This lockdown was effective starting 1am on Monday, March 30 [7]. On April 19, this partial lockdown was lifted. This partial lockdown was l-lifted but public gatherings were still banned [38]. Twenty-five percent (25%) attendance, with a maximum number of one hundred (100) congregants, could worship at a time in church or at the mosque, with a mandatory one-meter rule of social distancing between congregants” [9].

In the second quarter of the year, the limit on the number of worshippers, which had been set at 100, was lifted. With impact on August 1, 2020, The President extended the length from one hour to two hours [39].

In the third and fourth quarter of the year, the recreation centers were further suspended, despite the fact that certain prohibitions on social activities had been lifted [9].

During the Easter celebrations in March 2021 (first quarter in 2021), President Nana Akufo-Addo restricted church activities to smaller crowds and beaches were remained closed.

Travelers from Ghana were to halt or postpone journeys to high-risk COVID-19 countries, according to Nana Akufo-Addo.

4.7.5 *The Resumption of Schools*

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Starting June 15, schools and universities reopened to final year students [40]. In order to control the risk from reopening of schools, the government had deployed over 200 staff members from the Ghana Education Service and the Ghana Health Service to monitor the COVID-19 situation in senior high schools [41].

4.7.6 *Disinfection and Fumigation*

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The Ghanaian government responded to the virus by launching a nationwide disinfection and fumigation campaign in April 2020, within the first quarter from the onset of the pandemic. Over 464 markets were disinfected across the country beginning on April 3 [42]. In July, the second phase of nationwide fumigation began. On September 23, the MoE and GES collaborated with Zoom lion to disinfect and fumigate all SHS across Ghana in preparation for school reopening. Over 3700 schools in the Greater Accra alone, were fumigated. The third phase of the ongoing national disinfection exercise continued in the Upper West Region's markets and lorry stations [9]

In the fourth quarter from the onset of the pandemic, Senior High Schools and Basic Schools in the Upper East Region witnessed a major disinfection exercise on Friday, 8 January 2021, before the re-opening of schools on 15th January 2021 [43]. The police stations and facilities such as police cells, office rooms, barracks, offices were disinfected [44].

In the last quarter, March to May 2021, Meridian Port Services' Terminal 3 was disinfected. Zoom lion also disinfected Kumasi airport. Some departments at the Police Hospital were closed for disinfection and some football match centers were disinfected [45]. The government declared

that it would construct 14 medical waste treatment units and collect a COVID-19 surcharge [46].

The government had set aside €90 million for the development of 33 health facilities [47].

4.7.7 Evacuation

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According to the Deputy Minister of Foreign Affairs, 2,262 Ghanaians were evacuated from Lebanon during the COVID-19 lockdown, and a total of \$1,062,600 was spent [48]. On September 13, the Ministry of Foreign Affairs announced that it had completed the evacuation of Ghanaians who had become stranded abroad as a result of the COVID-19 restrictions. Over 9,000 Ghanaians and resident permit holders from countries such as South Africa, The Gambia, Ukraine, United Arab Emirates, United Kingdom, United States of America, China, Benin, Burkina Faso, and Togo returned home following the closure of borders in an effort to contain the spread of COVID-19 [49].

4.8 Government Response ~~To~~ Vaccines.

In the last quarter, ~~march~~March 2021, President Akufo-Addo had announced that the country would purchase 42 million COVID-19 vaccines [50]. The government arranged for the supply of 3.4 million doses of Sputnik V through the Private Office of Sheikh Ahmed Dalmook Al Maktoum [51]. President Nana Akufo-Addo claimed the country would receive 350,000 doses of the AstraZeneca vaccine [52]. Ghana was the first recipient of COVID-19 vaccine doses distributed by COVAX, a national vaccine sharing project. Ghana had received 600,000 doses of AstraZeneca COVID-19 vaccine from India's Serum Institute. The vaccines were delivered to the Kotoka International Airport by senior government and health officials, as well as diplomats. A plane loaded with 600,000 boxes of AstraZeneca on 24th February [53].

4.8.1 Vaccination Report

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In Ghana, 1.27M doses of vaccines have been administered and 400k people have been fully vaccinated. The percentage of the population fully vaccinated is 1.3% as at 15th July, 2021. According to O. World (2021) [54], 12.8% of the world population has been fully vaccinated. 3.61 billion Doses have been administered globally, and 30.46 million are now administered each day. Only 1% of people in low-income countries have received at least one dose. At least 70% of the world's population must be immune to keep the rate of infection down (“achieve herd immunity”) without restrictions on activities.

5.0-CONCLUSION:

Ghana's COVID-19 response strategy has been successful in reducing the pandemic's impact. The study concludes that the actions adopted by the Ghanaian government have generated significant achievements, despite some challenges encountered due to the non-adherence of protocols. The policy responses of the Ghanaian government have so far been positive and continue to contribute greatly to mitigating the impact of COVID-19 on the citizens. The Ghanaian situation serves as an excellent model for other African countries and the rest of the world. Future studies can continue to analyze measures by various governments throughout the world even as limitations are eased as the crisis continues and governments continue to make policies to reduce the impact of the pandemic.

DATA AVAILABILITY

The data used to support the findings of this study are included in the article and also available from the corresponding author upon request.

CONSENT AND ETHICAL APPROVAL ?

FUNDING ????

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COMPETING INTERESTS?????

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