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UNIVERSITY OF GHANA

COVID-19 VACCINE-RELATED MISINFORMATION SHARED ON SOCIAL MEDIA IN GHANA

BY

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DECLARATION

I, MUNIRA YAHYA SIBA hereby declare that apart from references to other people's work which have been duly acknowledged, this dissertation is a product of my own independent work undertaken under the supervision of Dr. Philip Teg-Nefaah Tabong. I also declare that no part of this dissertation has been submitted for the award of any degree in this University or any University elsewhere.

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(STUDENT) 22nd August, 2022

22/08/2022

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DEDICATION

I dedicate this work to myself for the hard work, especially in these uncertain times.

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TABLE OF CONTENT

Table of Contents

University of Ghana http://ugspace.ug.edu.gh

University of Ghana http://ugspace.ug.edu.gh

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

LIST OF FIGURES

INTEGRI PROCEDAMUS

University of Ghana http://ugspace.ug.edu.gh

LIST OF TABLES

University of Ghana http://ugspace.ug.edu.gh

LIST OF ABBREVIATIONS

Abbreviation	Meaning
CDC	Centre for Disease Control
COVID-19	Coronavirus Disease 2019
EPRP	Emergency Preparedness and Response Plan
FDA	Food and Drug Authority
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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DEFINITIONS TO TERMS

Disinformation: is deliberately engineered and disseminated false information with malicious intent or to serve agendas.

Misinformation: is false information that's shared by people who don't realize it is false and don't mean any harm, including vaccine proponents.

Misconception: a view or opinion that is incorrect and it is based on faulty thinking or understanding.

Rumors: Unverified information: stories/reports that spread rapidly through a group or population – can be true or false.

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ABSTRACT

The approval of COVID-19 vaccine came as a relieve to the world. However, the roll out of the vaccines have been characterized by misinformation and misconceptions which has the potential to negatively affect uptake and coverage of the vaccination exercise. Many of these misinformation and misconceptions are circulated in various social media in Ghana. This study used social media content to determine the types, and forms of misinformation about COVID-19 vaccine on social media in Ghana. The study used netnography, a form of ethnography that is conducted online. The study was conducted between 1st March 2021 to 30th September, 2021 (a period of seven months). A number of syntaxes were developed in relation to COVID-19 vaccine-related misinformation and searched on WhatsApp, Facebook and Twitter. All posts containing the keywords were retrieved and saved for coding, categorization and thematic analysis using NVivo 12 software. The study included all COVID-19 vaccine related posts shared in English. The study results indicated that misinformation does not begin and stay on only one social media platform. Facebook and WhatsApp were found to have the most vaccine rumor content. The nature of misinformation was dependent on the stage of the COVID-19 pandemic. Rumors and misconceptions including conspiracy theories were found to be the major forms of misinformation circulating in social media in Ghana. The strategies developed by the government to control misinformation and vaccine hesitancy in Ghana were to debunk misinformation, educate the online public and implement a vaccine mandate. In conclusion, misinformation can mar the efforts of researchers and scientist who are dedicated to fighting and providing solutions to curtail the effects of pandemics. Social media fueled vaccine hesitancy is a threat to public health and medical advancement.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The Coronavirus Disease 2019 pandemic is caused by Severely Acute Respiratory Syndrome Coronavirus-2 (SARS-Cov-2), a virus causing respiratory diseases like common cold in humans and it was first discovered in Wuhan, China in December 2019 (Burki, 2020), with a current global death toll of approximately 2.6 million (World Health Organization (WHO), 2020). On 11th March 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic due to the deep concern both by the alarming levels of COVID-19's spread and severity (Hageman, 2020).

Ghana confirmed the first two cases of COVID-19 on 12th March 2020. Since then, the case incidence has risen dramatically with at least, a case has been confirmed in all the sixteen regions in the country. In response to COVID-19 pandemic, government rolled out Ghana's Emergency Preparedness and Response Plan (EPRP) with the objective to "enhance surveillance system and build response capacity to detect, contain, delay and respond to a COVID-19 outbreak in Ghana." A key strategy in the EPRP is to mobilize national resources and put in place strategies for improved risk and behavioral change communication using local and internet-based media.

One concern that has been raised globally about the containment of COVID-19 has been management of misinformation. Misinformation is an essential and unavoidable part of information that spread during public health emergencies and have the tendency to distract and undermine response. Misinformation broadly covers misconceptions and rumors about COVID-19 and the vaccine.

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The approval of the COVID-19 vaccines came as relief to the world. Some of the vaccines available are: Pfizer-BioNTech COVID-19 vaccine, Moderna's COVID-19 vaccine, AstraZeneca's COVID-19 vaccine, whilst Janssen's COVID-19 vaccine and Novavax's COVID-19 vaccine (CDC, 2020). The Oxford-AstraZeneca vaccine is approved for people 16 years of age and older (PFIZER-BIONTECH, 2019) whilst the Moderna's has been approved for 18 years of age and older (ModernaTX, 2019). Two doses of the vaccines are required to confer immunity. Common side effects of the vaccines include pain, redness and swelling at the site of inoculation. The individual may also experience tiredness, headache, muscle pain, chills, fever and nausea (CDC, 2021).

The roll out of the vaccines has been characterized by misinformation, raising concerns about uptake and coverage of the vaccination exercise. There currently exists a worldwide mistrust of the vaccines' safety and efficacy and this may be a result of disseminating misconceptions and misinformation on various social media platforms (Li et al., 2020; Vosoughi et al., 2018). In the most recent past, there have been reports of people not participating in public health programs such as polio vaccination campaigns due to rumors that the vaccines contained infertility agents, or were used as a conduit to spread the human immunodeficiency virus (Okonta, 2007; Petryna, 2005). More recently in the Democratic Republic of Congo and Guinea, rumors that health workers were deliberately spreading the Ebola virus resulted in violence, civil unrest and targeted attacks on healthcare facilities, and the killing of healthcare workers (Samb, 2014). In recent past, misinformation about Ebola vaccine trial in Ghana led to abortive exercise, with social media reported as carrying more of such misconceived information (Kummervold et al., 2017).

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As of December 10, 2021, only 2.7% of the Ghanaian population were fully vaccinated against the Coronavirus, making a total of 3.49 million doses administered to 842,000 people (Mathieu et al., 2021). This study therefore aims to identify the COVID-19 related misinformation, the social media channels used to disseminate such information and the governments strategies employed to tackle misinformation.

1.2 Problem Statement

The approval of COVID-19 vaccines for mass immunization came as relief to world. Ghana becomes the first to receive the first free 600,000 doses of the Oxford University and AstraZeneca vaccine from the COVAX facility on 24th February, 2021. A time table was developed for the rollout starting with health workers, people 60 years and above and people with chronic conditions. Sanche et. al (2020) reported that about 55% to 82% of the population need to be vaccinated against the virus for community protection. However, the spreading of misinformation have widely been reported as the reason for low uptake of immunization exercises for diseases such polio (Ghinai et al., 2013), Ebola (Dada et al., 2019) and malaria in Ghana (Febir et al., 2013). These misinformation can be spread online, offline and on-ground (UNICEF, 2020).

Even before the roll out of vaccination in Ghana, COVID-19 vaccine related misinformation were already spreading across the world mostly in developed countries who first started the mass immunization exercise. Majority of these misinformation are spreading on social media (Fern et al., 2020). People use social media as an alternative source for evidence-based information on health (Kass-Hout & Alhinnawi, 2013). The same social media could also be used to spread

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misinformation such as misconceptions and rumors (Moorhead et al., 2013). Recently, social media has been identified as a possible place to conduct rumor surveillance in public health which can hinder the uptake and impact of health interventions (Fung et al., 2015; Joshi et al., 2020). Social media platforms provide an incredible opportunity to share information quickly across the globe but lack the proper safety measures that make sure the information being spread are accurate.

Social media has aided the spread globally and Ghana is not an exception. With the advent of smartphones, social media has become an important source of information and news in Ghana (CDD, 2020). Social media has redefined how Ghanaians access information, and doors have been opened for a better distribution of content and a wider reach of audience. As of January 2020, Ghana registered approximately six million active social media users, and 5.8 million in 2019 with WhatsApp, Facebook and Twitter being the most commonly used (Sasu, 2020). This high penetration and use of social media make these platforms very suitable for distribution of COVID-19 vaccine-related misinformation. As part of their research, social media has been identified as a possible place to conduct rumor surveillance in public health which can hinder the uptake and impact of health intervention (Fung et al., 2015; Joshiid et al., 2020). Misinformation and misconception about the vaccines lead to hesitancy, low uptake and expiring of vaccines. In the Volta region for instance, about 10% of COVID-19 vaccines expired because of vaccine hesitancy (Djokoto, 2021) which was largely due to misinformation. Identifying these misinformation and misconceptions is relevant to providing timely response to reduce their negative effects. As of 15th December, (8.5%) of Ghanaian adults eligible to be vaccinated had received the vaccines with high level of vaccine hesitancy reported. In March 2021 when the COVID-19 vaccines were being rolled out, only 0.7% of the Ghanaian population received at least one dose of the vaccine (Mathieu

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et al., 2021). Vaccine hesitancy, driven by online misinformation, has played a role in the recurrence of preventable diseases, notably measles (Phadke et al., 2016; Salmon et al., 2015). This study therefore uses social media content to determine the types, and forms of misinformation about the COVID-19 vaccine on social media. This is important in order to design evidence-based interventions to better handle the communication aspect of COVID-19 vaccine rollout and containment in the country.

1.3 Justification of the Study

A number of studies have been conducted to assess the causes and effects of COVID-19 related misinformation however, there is a gap in research that fails to address the root source of said misinformation, especially on social media platforms with the highest number of users and how public health intervention should focus on strategies to minimize the spread of misinformation related to the COVID-19 vaccine in low-income countries like Ghana. Very limited work has been done in the area of COVID-19 vaccine-related misinformation and the possible effect on vaccine uptake.

1.4 Research Questions

This study seeks to address the following research questions:

1. What are the types of COVID-19 vaccines-related misconceptions and rumors circulating in social media in Ghana?
2. Which aspects of COVID-19 vaccines are these misconceptions and rumors targeting?
3. What vaccine-related misinformation management strategies have been adopted in Ghana's COVID-19 response?

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1.5 Objectives of the study

The objectives of the study are divided into general and specific objectives

1.5.1 General objective

The general objective of the study is to identify COVID-19 vaccines misinformation in social media in Ghana and strategies adopted to contain the circulation of misconceived information.

1.5.2 Specific objectives

The specific objective of this study includes:

1. To identify the types of misconception and rumor about the COVID-19 vaccines circulating in Ghana;
2. To assess the aspects of the COVID-19 vaccines that these misconceptions and rumor target; and
3. To identify the government's strategies in minimizing the spread and effects of misconceived information in social media.

1.6 Significance of the Study

The study will provide a descriptive analysis of how misinformation and misconceptions can influence behavior of consumers on social media with regards to acceptance and adherence to public health interventions. The results of this study will provide a comprehensive approach to effective risk communication and community engagement to mitigate the effects of misinformation the current and future public health emergencies.

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1.7 Theoretical and conceptual framework

Theories are very important in the study of social phenomena (Venable, 2006) such as how misinformation are conceived and spread among a given population. Although there are several theories, this study relies on the foundations of the social amplification and attenuation of risk theory (Kasperson, 2008). The concept of social amplification and attenuation of risk is based on the proposition that events pertaining to threats interact with psychosocial, institutional, and cultural processes in ways that can either heighten or attenuate individual and social perceptions of risk as well as shaping of human behavior. Behavioral patterns in turn, generate secondary social or economic consequences. These consequences may directly affect humans or their environment. There could also be indirect impacts such as loss of trust in institutions or alienation from community affairs (Kasperson et al., 1988). Such secondary effects often trigger demands for additional institutional responses and protective actions or conversely (in the case of risk attenuation), place impediments in the path of needed protective actions.

In adopting this theoretical approach, the study recognized that COVID-19 vaccine-related misinformation such as rumors and misconceptions are socially constructed and communicated to others through various platforms including social media such as Twitter, Facebook and WhatsApp as recognized in the specific objective two of the study. The consequences of these communication efforts may lead to individual perceptions about the information and inform behavioral changes. The Kaspersons' social amplification of risk framework therefore highlights factors that influence risk of COVID-19 and perception about the vaccine, which include examining the characteristics of the risk event and how it is interpreted and communicated by social actors and government's risk management organizations such as the Ministry of Health and Ghana Health Service structures. According to the theory, information is communicated through social amplification

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stations. The social amplification stations produce and transmit information through communication networks such as social media platforms that include Twitter, Facebook and WhatsApp. Each recipient then engages in amplification processes, thereby acting as an amplification station for vaccine-related misinformation. For example, these amplification stations on Twitter can be seen as retweets, Facebook as number of read and shared in groups. These socially built misinformation messages are consequently interpreted and acted on by individuals based upon one's attention, personal characteristics and attitudes (Kasperson et al., 1988). It has indeed been demonstrated that a combination of trust, perception and emotions play a significant role in shaping risk perceptions during conditions of uncertainty such as COVID-19 pandemic.

Based on the theory adopted for this study and the specific objectives of the study, a conceptual framework has been developed for the study (Figure 1).

The channels for circulation of misinformation does not take a linear form. It can be observed from the conceptual framework (Figure 1) that attempts to mitigate misinformation can lead to creating more rumors and subsequently accepting misinformed positions on the Covid-19 vaccine. There is a misinformation loop oscillating between the various social media channels used to spread the rumors and misconceptions, the theories behind the rumors such as the vaccine development process and timeline, the immediate and prolonged side effects and its efficacy. The position of the public on the Covid-19 vaccine-related misinformation may inform the government on mitigation strategies such as debunking rumors, raising trusted voices and using social media channels to educate the public on how vaccines work, can be adapted. There is however a link between efforts to mitigate vaccine related misinformation and creating more doubts and

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misconceptions. This loop then affects the rate of vaccine uptake and can be observed in the form of hesitancy, lack of trust and low uptake.

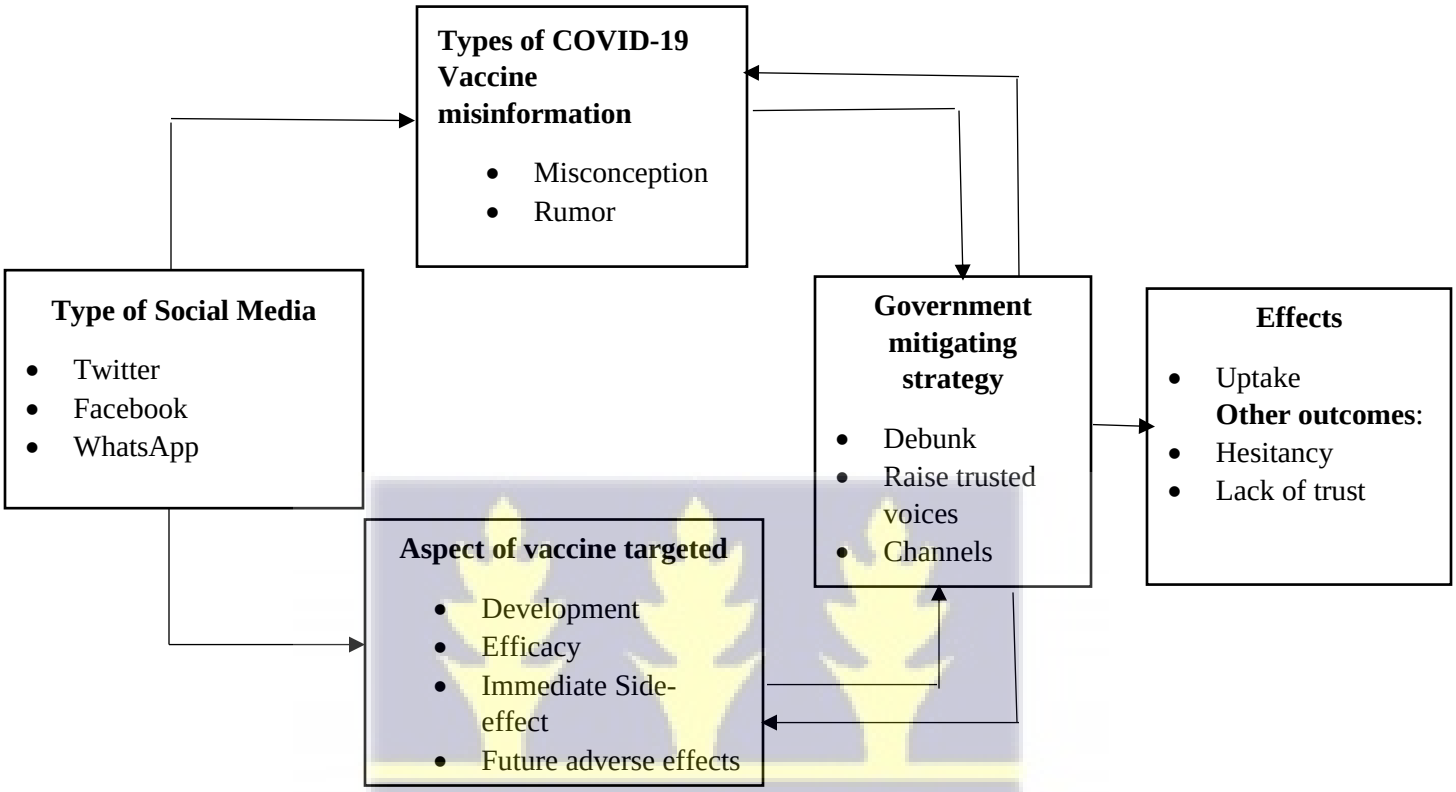

Figure 1: Conceptual Framework for COVID-19 vaccine-related misinformation, the medium of circulation and outcomes.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Epidemiology of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV 2)

Coronaviruses are pathogens that target the respiratory system of humans (Rothan & Byrareddy, 2020). There have been previous outbreaks of coronaviruses such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) which have been identified as great public health threats (Rothan & Byrareddy, 2020). In December 2019, the first cases of the new coronavirus were reported in Wuhan, China (Burki, 2020). It continued to spread to other provinces and other parts of Asia, Europe and the Americas (Rothan & Byrareddy, 2020). The case fatality rate was then recorded to be 2.2% (Bassetti et al., 2020). The risk of a disease is estimated by determining the case fatality rates and it is the proportion of deaths out of the total cases, when an epidemiological disease is prevalent (Kim et al., 2021). According to Kim et al. (2021), the case fatality rate is an important epidemiological measure of disease severity. COVID-19 has claimed many lives since the start of the pandemic. The morbidity rates differ in different parts of the world with South Asia, Europe and America recording about 87% of Covid-19 cases and Africa and West Pacific recording about 4.3% of the total cases globally as of March, 2021 (Njoga et al., 2021). Dhar Chowdhury and Oommen (2020) reported that until we achieve herd immunity either by vaccination or infection, the entire global population will continue to be at risk. The study stated that the disease can affect any age group, however elderly people and those with comorbidities such as cancer, hypertension and chronic respiratory diseases are at high risk of infection (Dhar Chowdhury & Oommen, 2020).

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2.1.1 Global Perspective of SARS-CoV 2

In late January, 2020, after the first few cases of COVID-19 were recorded, 7734 and 90 cases were confirmed in China and other countries globally including Taiwan, Thailand, Vietnam, Malaysia, Nepal, Sri Lanka, Cambodia, Japan, Singapore, Republic of Korea, United Arab Emirates, United States, The Philippines, India, Australia, Canada, Finland, France, and Germany (Rothan & Byrareddy, 2020). Since then, the number of confirmed cases and deaths in North and South America, Italy and other European countries had multiplied exponentially. According to the WHO, there have been more than 290,860,000 confirmed cases of COVID-19 and 5,443,056 deaths reported as of Jan 2nd, 2022, and more than 8.81 billion vaccine doses have been administered. It is evident that the COVID-19 disease without the use of a vaccine, coupled with the implementation of personal hygiene guidelines proposed by the WHO to mitigate the effects on human lives places a serious burden on countries. There have been lockdowns in some countries like the United Kingdom due to a new potent strain found in the region. Health workers worldwide are at the risk of infections caused by the overwhelming amount of COVID-19 cases reported in countries recording high cases (Bong et al., 2020). In the last week of April 2021, new COVID-19 cases increased with nearly 5.9 million weekly cases with over 87,000 new deaths and India alone was responsible for 38% of the increase (World Health Organization, 2021).

2.1.2 The Burden of SARS-CoV 2 in Low- and Middle-income Countries

The high number of cases recorded in Low- and Middle-income countries directly tests the capacity of health facilities. There are already high volumes of patients visiting health facilities with pneumonia, malaria, tuberculosis and other infectious diseases, hence a shortage of hospital beds and frontline health workers to accommodate and treat COVID-19 patients has been a wake-

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up call (Bong et al., 2020; Kempthorne et al., 2017). While the COVID-19 vaccine is a long term solution to reducing the spread of the disease, the vaccine-related myths circulating on social media still poses as a threat to realizing herd-immunity (Loomba et al., 2020), meanwhile, COVID-19 is still spreading rapidly with unpleasant effects on health care workers, the health system, economies and the general public (Bong et al., 2020).

2.1.3 The Burden of SARS-CoV-2 in Africa

In the African region, 47 countries have been affected by COVID-19 since January 2020, recording about 7,275,913 cumulative incidences and 156,009 as of 3rd January, 2022 (*Coronavirus (COVID-19) | WHO | Regional Office for Africa*, 2021). The most affected African countries in the beginning of the pandemic were Egypt, South Africa, Nigeria and Ghana (Lukman et al., 2020). Aside the health implications of the disease, COVID-19 threatens the economic state of many affecting countries. Families may bear the cost of treatment and out-of-pocket costs for accessing healthcare which are not covered by health insurance (Ataguba, 2020). The lockdown restrictions prevented informal workers who are mostly women from working, putting a strain on their families (Ataguba, 2020).

2.1.4 The Burden of SAR-CoV 2 in Ghana

The COVID-19 pandemic has resulted in the death of many Ghanaians. The number of infections spiked with the highest number of deaths recorded in February, 2021. As of January 2nd, 2022, the number of confirmed cases and deaths were 145,000 and 1,303 respectively as reported by the Ghana Health Service. A total number of 5,774,413 vaccine doses had been administered throughout the country as of Dec 9, 2021.

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2.1.5 Public Health Approaches to Contain SARS-CoV-2

The protocols to minimize the spread of COVID-19 had been somewhat strictly adhered to in the beginning of the first wave of the pandemic. Ghana had ensured a partial lockdown in March, 2020 to restrict movement of non-essential workers in order to manage community spread for two weeks, banned social gatherings, including conferences, funerals, festivals and religious activities (Sibiri et al., 2021). Many other countries followed and observed the WHO guidelines on social distancing, restricting international travels and quarantine or stay-at-home orders. The effects of social distancing have been reported to have certain psychosocial constraints on individuals (Dubey et al., 2020; Hamadani et al., 2020; Semo & Frissa, 2020). Some of the other protocols deployed to minimize community spread were hand washing, wearing of facemasks and the use of alcohol-based sanitizers. These are personal hygiene acts that most people were not used to and the cost of including these supplies in daily, weekly or monthly spending placed a burden on low-income families (Ataguba, 2020; Hamadani et al., 2020). After the announcement of the lockdown restriction in Ghana, facemasks, sanitizers, tissues and hand washing soaps were in short supply in pharmacies and retail centers. The effects of COVID-19 in many low-and middle-income countries like Ghana were reported to be socio-economical (UNFPA, 2020) and psychosocial (Dubey et al., 2020; Semo & Frissa, 2020). The pandemic denied families with low income their livelihood. Reduction in employment during lockdown had increased food insecurity and extreme poverty in countries like Bangladesh (Hamadani et al., 2020). The Ghanaian government passed a Coronavirus Alleviation Program bill as a plan to stimulate households and business which included a free three-month water bill plan, 50% electricity bill and a 2% reduction in bank rates (Sibiri et al., 2021). These steps to ensure the reduction in economic stress on citizens by the government, during the lockdown period proves the burden of stay-at-home orders on Ghanaians.

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Stay-at-home orders affect family welfare and women's mental health and safety, hence a comprehensive public health response approach is required for future lockdowns and pandemics (Hamadani et al., 2020)

One of the most important long term public health strategies to minimize the spread of the COVID-19 is the introduction of a vaccine which poses as a long term solution to the pandemic (Hursh et al., 2020).

2.1.6 COVID-19 Vaccine

A number of vaccines were approved by the American Food and Drugs Administration (FDA) and granted emergency use due to the escalating number of deaths recorded worldwide caused by SARS-CoV-2. In the United States of America, three vaccines (Moderna, Pfizer-BioNTech and Janssen/Johnson & Johnson) have been approved for use (CDC, 2020). Sputnik V, AstraZeneca, Pfizer/BionTech, Moderna, COVAXIN, Johnson and Johnson, Sinovac, Sinopharm, were declared safe for COVID-19 vaccination as of November 2021, by WHO. These vaccines are eligible for people 18 years and above, as well as those with any type of pre-existing diseases, including auto-immune disorders such as hypertension, diabetes, asthma, lung, liver, and kidney illness, as well as stable and treated chronic infections.

WHO advised that vaccines are developed to give immunity without the dangers of getting seriously ill from the disease, therefore mild side-effects may be experienced after receiving vaccinations (*Side Effects of COVID-19 Vaccines*, 2021). The known side effects of COVID-19 vaccines are pain, redness and soreness on the arm that received the shot and tiredness, muscle pain, chills, fever, nausea and headache throughout the entire body (CDC, 2021). These side effects typically last 24 to 48 hours (*Gavi, the Vaccine Alliance*, 2021).

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In Ghana and other African countries, the Oxford-AstraZeneca vaccine was the only procured and deployed vaccine as of May, 2021. Only 350,000 more vaccines compared to the original 600,000 received in February,2021 arrived in May, 2021 to carry out the second phase of immunization. The vaccines available to Ghanaians as of December 2021, were the AstraZeneca/Oxford vaccine, Pfizer, Moderna, Johnson and Johnson, Sputnik V which have all received emergency use approval by the Food and Drugs Authority, Ghana. A vaccine mandate was declared at a Ministry of Health press briefing on the 28th of November, 2021 in collaboration with the Ministry of Health and Ministry of information.

There are still a significant number of Ghanaians flouting COVID-19 protocols and have not yet received any of the available vaccines which could possibly be due to vaccine hesitancy and misconceptions. Misinformation has targeted the side effects and future adverse effects of the COVID-19 vaccines (Hoffman et al., 2019). The Centre for Disease Control (CDC) urged individuals to accept the first available vaccine and not wait for specific brands. This message is important for rumors surrounding the safety and efficacy of certain brands as opposed to others. The CDC also stated that all vaccines approved are "safe", "efficient" and will "reduce the risk of severe illness" (CDC, 2020).

2.2 Social Media and Misinformation and Misconceptions

In recent years, the subject of fake news and misinformation, as well as its consequences, has gained a lot of attention. Even though misinformation is not a new occurrence, technological advancements have created an ideal atmosphere for it to spread quickly. Platforms like Facebook, Twitter, WhatsApp, Telegram and YouTube provide fertile grounds for the creation and dissemination of misinformation and disinformation. Because social media is a public forum,

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anybody may post whatever they want, including news organizations, without fear of being held accountable for fact-checking (Pennycook & Rand, 2019). According to the Pew Research Center, as of 2019, 72 percent of Americans had at least one social media account and about two-thirds of Americans occasionally get their news from social media platforms; social media usage has only skyrocketed since the COVID-19 pandemic (PRC, 2021).

More individuals are getting involved with social media as a result of the growing popularity of a wide range of internet-enabled gadgets and enhanced mobile internet speeds. Indeed, Facebook is used by most people globally, and many of us obtain our news from social media posts (Erdoğmuş & Cicek, 2012; Stephen, 2016). Twitter is another social media that is widely used by the online population across the world. A single tweet contains more than 150 data variables including the time the tweet was posted, the tweet text, the Twitter handle, locations, and more (Koohikamali & Sidorova, 2017). The information shared on twitter is often shared through retweets.

WhatsApp is another widely used social media platform across the world. The number registered WhatsApp users vary across countries. In the US for example, it has been reported that there are about 78 million users (PRC, 2021). This social media platform is one of the super spreaders of misinformation and misconceptions (Tabong & Segtub, 2021). WhatsApp now attempts to curb a viral message from spreading by limiting forwarding messages to only five chats at a time, which the company said reduced forwarded messages on WhatsApp by a quarter (PRC, 2021).

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These platforms were identified as media used to spread misinformation and misconception about COVID-19 infection and disease in an earlier study conducted in Ghana (Tabong & Segtub, 2021). Unfortunately, according to studies, most social media users share stories based on the title without actually reading the text. If the title does not correctly reflect the reality, it may have the same impact as misinformation or misconception. Many readers and social media users share these misconceived, badly researched and written content with their social connections, spreading incorrect information to an increasing number of people (Hilary & Dumebi, 2021). For Indian Americans whose native country has the highest number of WhatsApp users, a recent survey found that around 30 percent of Indians surveyed used WhatsApp for COVID-19 information, and just about as many fact-checked less than 50 percent of messages before forwarding (PRC, 2021).

2.3 Types of misinformation and Misconceptions

Misinformation according to Baines and Elliott (2020) is a representative data that unintentionally misleads. The types of misinformation identified usually take the form of rumors and misconceptions. About 73% of 260 health professions in the forefront of immunization in 83 countries reported in a survey that there had been a disruption of immunization during the COVID-19 pandemic which was caused by the increased spread of rumors and misconceptions especially in a growing digital world (*Gavi, the Vaccine Alliance*, 2021).

The research by Islam et al., (2020) identified rumors as the most prevalent form of misinformation online with regards to the COVID-19 pandemic. A number of studies have found that rumors on social media are from anti-vaccinators spreading fake news (Ateghang-awankem et al., 2021; Germani & Biller-Andorno, 2021) and anti-vaccination posts online may be influencing anti-vaccination behavior (Hoffman et al., 2019). Strong believe in conspiracy theories determines

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whether an individual is an anti- or pro-vaccinator with certain views on individualism and social hierarchies (Germani & Biller-Andorno, 2021).

Conspiracy theories around the virus' origins have also spread, some as outlandish as the vaccine being a cover for Microsoft co-founder and billionaire Bill Gates' attempt to create microchips and track people (PRC, 2021). WhatsApp features people claiming to be doctors spouting false information about the vaccine, to memes in WhatsApp groups saying things like "the only cure I need is God (Tabong & Segtub, 2021).

2.4 Aspect of the vaccines targeted

The introduction of vaccines as a pharmaceutical intervention to combat COVID-19 had been of major concern worldwide with many Ghanaians at the mercy of COVID-19 vaccine-related misinformation from traditional and social media. The aspect of vaccines being targeted often are development, efficacy, immediate side effects and future adverse effects. Ditekemena et al., (2021) in their study reported that about 60% of participants did not trust the Covid-19 vaccine, hence the need for strong evidence about its safety and efficacy to increase community confidence and acceptance. Knowledge about the rapid development of vaccines contributed to the increase in decline rate of vaccine acceptance according to Hursh et al., (2020). The study reported a reduced vaccine demand with decrease in expected efficacy and that, multiple news sources reported that an accelerated vaccine might have health concerns (Hursh et al., 2020).

In Democratic Republic of Congo, only about 56% of participants in the study were willing to accept the vaccine which is far below the percentage required to achieve herd immunity

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(Ditekemena et al., 2021). In the United States, a series of studies conducted by Hoffman et al. (2019) on polio and measles vaccine hesitancy found that social media users targeted vaccine safety e.g. “vaccines cause autism, seizures, cancer and death”, “kids who are not vaccinated rarely fall ill’.

2.5 Strategies to minimize spread of misconceived information on social media

To understand public attitudes, governments typically use surveys, however, these have limitations such as small samples sizes so in order to overcome such limitations, social media platforms can be used to obtain data on public perceptions and attitudes on public health emergencies within a given space and time (Hussain et al., 2021). A large proportion of social media content about vaccination are anti-vaccination messages (Wilson & Wiysonge, 2020). Hussain et al., (2021) suggest that obtaining social media data by using artificial intelligence and deep learning can help the tracking of vaccine perceptions among users which could better inform strategies to debunk rumors and clarify misinformation. UNICEF misinformation management guide identifies the reasons for creating misinformation; to polarize, politicize and/or monetize (UNICEF, 2020). WHO recommends social listening as an effective method of detecting changes in community concerns and narratives. Using social media data to develop strategies to address concerns can help reach individuals who are undecided about observing Covid-19 public health measures including vaccinations (*WHO,* 2021).

Another effective intervention strategy is education on clinical trials and research literacy targeting health care professionals and other local populations (Ateghang-awankem et al., 2021). A significant number of stakeholders such as media, ministries, religious leaders, local government

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and pharmaceutical companies must be engaged and included during the fight against Covid-19 vaccine-related "infodemic" (Tabong et al., 2021).

Public health programs must have a proactive presence in these information-sharing spaces to provide access to trusted and accurate information. Amid the pandemic, the World Health Organization launched a WHO alert on WhatsApp. If you texted "hi" to a certain number, you'd receive factual information on the coronavirus infection — its rates around the world, travel advisories, debunked (Loomba et al., 2020). An alternative approach to debunking misinformation emphasizes providing correct information rather than directly countering misinformation, to avoid spreading the narrative further to people who would otherwise not have come in contact with it and thus increasing their familiarity with the misinformation (Schwarz et al., 2007, 2016)

Another strategy for handling misinformation in social media is providing information from trusted sources. In Zimbabwe, trusted sources of information was discovered to be effective in leveraging the ubiquity of social media to combat misinformation and related potentially harmful behavior on COVID-19 pandemic (Bowles et al., 2020). Meta-analyses studying different strategies for countering misinformation found that detailed counterarguments could be effective, especially when they are delivered by a trusted source and in line with recipients' worldviews and social norms (Chan et al., 2017).

Providing health education has also been identified as one of the strategies in dealing with misinformation. Studies performed in low-income settings have looked at various forms of health

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education to increase knowledge and uptake of protective behaviors an has been recommended as an effective strategies to target health misinformation (Ecker et al., 2001; Sarrassat et al., 2018) including Ghana (Fink et al., 2018).

2.6 Summary

Covid-19 vaccine-related misinformation transcends the social media demographic (Ateghang-awankem et al., 2021); the population offline are also at risk of consuming misinformation shared online in newspapers and traditional media . Therefore, design and implementation of research that addresses the misinformation and misconceptions are important to increase vaccine uptake in order to achieve herd immunity. Misinformation concerning the COVID-19 has been documented in earlier research in Ghana. However, misinformation related to the vaccines is yet to be formally researched even though it would play an important role in vaccine roll out (Folayan & Haire, 2016). This is required to develop appropriate strategies to increase trust, uptake and coverage.

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CHAPTER THREE

METHODOLOGY

3.1 Background of the Study Area

This study was conducted in Ghana. Ghana practices a democratic governance system with the 1992 constitution being the supreme law of the country. The country's constitution and democratic mechanisms dictate the transparency of decision-making processes and thereby determine the degree to which politicians are held accountable. The 1992 Constitution is based on the principle of separation of powers, as well as a system of overlapping personnel, functions, and powers, resulting in a hybrid of the Presidential and Parliamentary systems of government. Three arms of government are recognized by the 1992 constitution of the Republic: Executive headed by the President, Parliament headed by Speaker (who is nominated by the majority in Parliament) and Judiciary headed by the chief Justice (nominated by the President and approved by Parliament). Parliament is mandated to make laws and approve international agreements whilst the Judiciary is mandated to interpret the laws and protect the right of all citizenry.

In terms of health service delivery, the country operates a five-tiered service system, including: National, Regional, District, Sub-district and the Community (MOH, 2011). The regional, district and community levels, health facilities are established to provide primary and secondary health care services.

In Ghana, the media has been documented to play an important role in crisis management (Ghassabi & Zare-Farashbandi, 2015). Ghanaians have increasingly used social media during crises and health emergencies such as the COVID-19 pandemic. With the advent of smart phone,

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social media has become an important source of information and news in Ghana (CDD, 2020). Social media has redefined how Ghanaians access information, and doors have been opened for a better distribution of content and a wider reach of audience. Social networking sites including Facebook, Twitter, YouTube, WhatsApp, Telegram, smart phone applications, as well as news delivery sites and other online platforms are widely used in Ghana. As of January 2020, Ghana registered approximately six million active social media users, up from 5.8 million in 2019 with WhatsApp as the most popular platform in use (Sasu, 2020).

3.2 Study Design and Type

The study design is a "Netnography", an online ethnography (Kozinets, 2015). Netnography engages qualitative research methodology. In 2002, Kozinets described netnography as a new qualitative research methodology that adapts ethnographic research techniques to the study of cultures and communities emerging through electronic networks (Kozinets, 2002). It is an innovative strategy for performing ethical and extensive ethnographic research that integrates archived and online communications activity, participation, and observation with new types of digital and network data collecting, analysis, and research representation is presented using social science approaches (Kozinets, 2015). Netnography offers a specific set of analytic approaches and processes applicable across a spectrum of online involvement, while the focus is on gaining access to an online community. In this study, a system was designed to collect information on COVID-19 vaccine shared in key social media platforms in Ghana using an online strategy as required in netnography for a period of seven months. related misinformation and misconceptions were This study design has in the past to study misinformation on social media in Ghana (Islam et al., 2020; Tabong & Segtub, 2021).

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3.3 Study Population

The study population is people resident in Ghana who use these social media platforms: WhatsApp, Facebook and Twitter. Netnography uses online population that is, people resident in a particular geography location and uses an online device to access information on a particular issue of health event. Although the social media platform requires users to be adults, some allow the minor but with a parental and guardian required to complete the process. The vaccines that have been registered for use in Ghana are given to people from 15 years or 18 years. As such these categories of people are the focus as the effects of the misinformation is vaccine hesitancy.

3.4 Inclusion and Exclusion Criteria

The post should have been shared on WhatsApp, Facebook and Twitter platforms in Ghana. The misinformation was related to COVID-19 and covered the production, side effects and the licensing of the vaccines in English. The study excluded content shared in languages other than English.

3.5 Sample Size Determination

For a netnography research, a sample size is not determined. However, the search is often confined to a particular period, and in this case, between 1st March 2021 to 30th September, 2021 (a period of seven months). In doing the search and analysis of the data, the aim was to end the study at the point of theoretical saturation as required in qualitative research (Bowling, 2014). Theoretical saturation is a stage in qualitative research where further recruitment of individuals of review of documents in the context of this study does not yield new insights (Creswell, 2009).

3.6 Sampling Technique

Sampling was done purposively by searching key words related to COVID-19 vaccine-related misinformation in search engines across the three social media platforms. All information that

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were shared on social media in Ghana and related to any of the COVID-19 vaccines were included in the analysis.

3.7 Data Collection Tool

A data extraction sheet matrix was developed. This tool was developed based on experiences with other vaccines and the recommendations and guidelines of UNICEF. The key items in the data extraction matrix included; type of misinformation, the type of social media, whether this misinformation is active (trending on daily basis), which aspect of the vaccine is targeted, reach (measured as Retweets, Likes, sharing etc), likelihood of affecting community trust, and response from public health authorities (see appendix 2).

3.8 Data Collection Technique

Secondary data was collected by searching key words related to COVID-19 vaccine-related misinformation in search engines of Facebook Instagram and Twitter. Keywords and variations of vaccination: "vaxx", "vaxxer", "vax", "vaccine", "COVID-19 vaccine", "vaccination", "immunization", "vaccinated", "vaxxed", "vaccine side effects", "anti-vaxx", "vaccine mandate", "coronavirus vaccine" were searched in all three social media platforms. WhatsApp search bar is limited to messages sent and received on the user's application therefore, very limited data can be gathered on the application. On Facebook, the comments sections contain thoughts of users exposed to content shared. The Facebook search engine collects posts in the Facebook database containing keywords searched, which is not limited to the number of followers the account user has. On twitter, retweets, quotes and replies can expose users' perceptions and thoughts. Six research assistants were trained to monitor and collate all social media content related to COVID-19 using the same set of keywords in all searches across Twitter, Facebook and WhatsApp. Monitoring of the Twitter handle of the minister of communication who provided responses to

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misinformation that were circulating in social media was also done. In addition, the use keyword searches on Twitter (Pulsar search tool) and Facebook for the specific period of the study and location (Ghana) was adopted. We used the Instagram business tool which is linked to Facebook to collect all post on Instagram timelines and other social media platforms. Furthermore, the NCapture on NVivo program for the extraction and segmentation of Twitter data from a web browser was done, following the recommendations of Edward and colleagues (Edwards et al., 2013).

For media releases from government officials which were shared, the entire document was retrieved and added to the data set. Daily monitoring was done throughout the seven months' study period. The monitoring was done by the principal investigator and trained research assistants. Daily Zoom meetings were held to discuss new misinformation and characterize their content to determine theoretical saturation. The PRISMA flowchart for scoping and systematic review was adopted for screening of the messages that were retrieved from various social media.

3.9 Data Analysis

All data extracted from social media (Twitter, Facebook, WhatsApp) were imported into NVivo 12. Content thematic analysis was employed in this study. A review of the content of the data that was extracted from the various sources was done. Based on that, a codebook was developed. Conceptual dimensions of the Kasperson and Kasperson social risk amplification and attenuation theory, conceptual framework and social media content guided the preliminary development of the codebook and nodes in NVivo. The key constructs of the theory are: sources of information, contents, media that is used to communicate the information, and how these interact to either amplify or attenuate the individual perception of risk and subsequent behavior. This was then

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revised to include the emerging themes from the data. The codebook was imported into NVivo 12 and used in coding the data. Each data was opened in NVivo and coded into the appropriate node. After coding the nodes, browser was reviewed and similar node merged into various themes. Using word frequency query in NVivo, a word cloud was developed to depict the various misinformation for easy visualization. The results are presented in theme and supported by direct quotes from extraction of the data.

During coding, memos were also created for documenting our thoughts, doubts and insights that were emerging. We used the queries function in NVivo to draw a word cloud to show the various misconceptions about COVID-19 in Ghana. Coded sections were regrouped into relevant categories and themes for presenting the results. Data triangulation strategy was used to strengthen the findings by embedding the findings from the various social media platforms (Teddlie & Tashakkori, 2010). Direct quotations were used where appropriate to support the themes.

3.10 Ethical Consideration

Although, this study does not involve collecting data from human participants' ethical approval was still sought as required by the University of Ghana. As such the research proposal was submitted for ethical approval at the Ghana Health Services Ethics Review Committee (GHS-ERC 026/06/21). The social media user information was not included this study were removed to ensure anonymity.

3.11 Quality Control

Research assistants were trained to extract social media data. Facebook monitoring was done by observing main posts and engagements in the comments section and on Twitter, quoted replies,

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replies and tweets were observed to be recorded for thematic analysis. Screening of all data was done and those not related to COVID-19 vaccines were removed before analysis. Daily virtual meetings were organized to discuss progress of the study and to share various misinformation that have been identified through the search and monitoring of various social media platform. The coding trial was shared with supervisor for input and finalization during coding.

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CHAPTER FOUR

RESULTS

4.1 Search Results and Screening

The search which was conducted between 1st March 2021 to 30th September, 2021 retrieved about 272 messages shared in various social media in Ghana. After deduplication, and screening of the messages and information, a total of 104 messages and information were included for analysis. The flow chart from which final messages and information inclusion have been summarized on Figure 2.

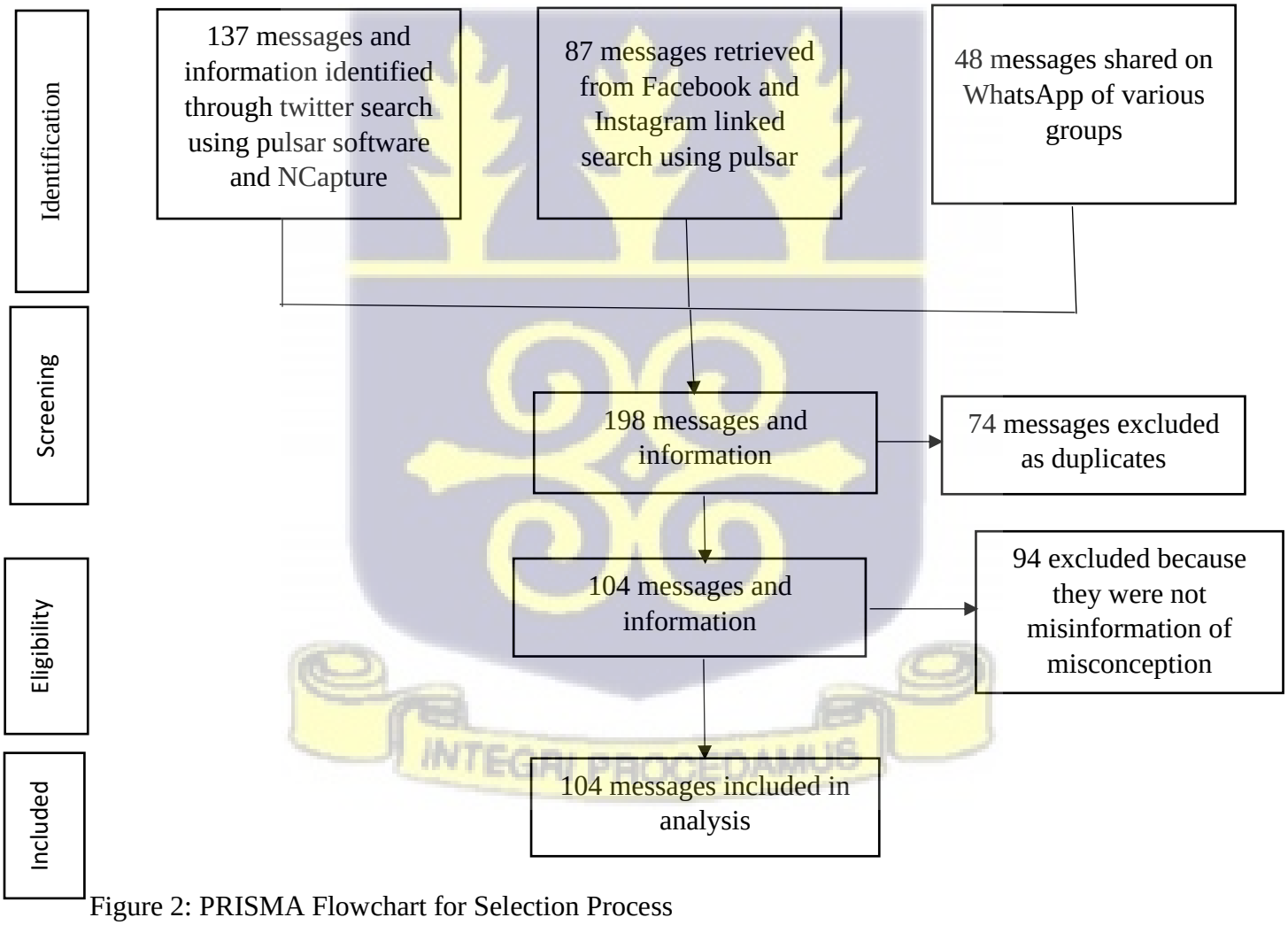

Figure 2: PRISMA Flowchart for Selection Process

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4.2 Types of misinformation about the COVID-19 vaccines

Rumors and misconceptions /conspiracies were found to be the most circulated types of misinformation on WhatsApp, Facebook and Twitter. Social media observation from this research revealed that a considerable number of online posts with regards to the COVID-19 vaccine are unverified information. Misinformation making rounds on the Ghanaian online spaces can be linked to the low vaccination rates in the country. A considerable number of posts retrieved for analysis fit under these categories represented in the Table 1, showing the source of misinformation and the dates:

Table 1: List of some Rumors Shared on Social Media in Ghana, 2021.

Types of Misinformation	List of Misinformation	Source	Date
Rumors	"The so-called Corona vaccines have been made into a pill and called it chloroquine. Once you take this chloroquine, you get directly contaminated"	WhatsApp	8th April, 2020.
	"This vaccine is poisonous; I'm telling u the truth because the white men's want to kill us. You should check yourself well before u vaccinate, it can change your DNA "	Facebook	2nd March, 2021.
	"The vaccine has some strange side effects in some people. A recent one was about it causing a guy not to get an erection"	Twitter	19th August, 2021.
	"So the vaccinated people carry more viral load according to recent researches"	Twitter	25th September, 2021.
	"All these countries are on record to have stopped using AstraZeneca because of serious side effects such as blood clotting"	Twitter	6th October, 2021.
	"The vaccine is a poison. So beware"	Facebook	5th December, 2021.
	"One student just developed complications and died after she had taken the shot. Should this slow murders still go on??"	Facebook	6th December, 2021.
	"You are advertising the doses so that it will prevent ladies from giving birth in 5 years' time. Is that the best way to control population"	Twitter	8th December, 2021.

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There were also speculations on the ability of the Food and Drug Authority to assess the vaccines for efficacy and safety. In a Facebook post, one retired health worker asked if the FDA had the capacity to detect the presence of nanochip in the vaccine. This was in response to concerns that were widely circulated on the presence of nanochip in some of the vaccines deployed to developing countries. On the 3rd April, 2021, he asked the following question which was liked by 100 followers and shared by 25 followers.

> "*Does FDA have the capacity to detect a Nano-chip in a vaccine?"*

Furthermore, the ability of the vaccines to cause negative structural and functional changes in the body were widely circulated. The vaccines were perceived to be capable of causing genetic disorders on future offspring. A message which was widely circulated on social media linked the vaccines to Klinefelter's and Down syndrome. This message was circulated on the 10th June, 2021 through WhatsApp as follows:

> "*They are not vaccines. Gene weapon! Vaccinated people will develop genetic defects like down syndrome, Klinefelter syndrome and genetic heart failure."*

The vaccines were also linked to the attempt by developed countries to control the population of developing countries. It was speculated that the vaccines could cause infertility and reduce one's ability to procreate. This was shared on Facebook, WhatsApp and Twitter and received several retweets and likes on 16th August, 2021.

> "*Don't go in for the vaccine, it meant to depopulate souls on the earth to secure the amount of human they need so they can control the world. Remember #OneWorldOrder is taking all over the earth."*

Another closely related misinformation was the use of the COVID-19 vaccines to control population which was also circulated in social media in Ghana is:

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> *"When your agenda is to help depopulation and extinct the bloodline of your own people who are ignorant."*
>
> *"Amazing how attempted suicide is a crime but deciding to take the vaccine with deadly and tragic side effects is a step to "saving the country""*

There were also concerns shared about the vaccines been used to change voting pattern to keep the incumbent government in power. This was largely circulated on WhatsApp and led by political conspirators:

> *"The vaccine is used to format our brains so that we do not remember who to vote for"*

There was also misinformation on the use of the World Health Organization staff to perpetuate global political agenda through the use of the vaccines. A Twitter messages which was widely retweeted states:

> *"Do not take the vaccine. Dr. Fauci is going to kill mass population around the world. Hydroxy-chloroquine is the treatment to end all of this but the Government took it all away to make money off the vaccine."*

These misinformation and misconceptions led to people sharing messages on social media to express their unwillingness to take the vaccines because of the potential harm. In a twitter post, a social media influencer in Ghana shared as follows on the 16th August, 2021:

> *"No I will not take it, is not safe for me and my family, given the toxic nature of it."*

The rumors and misconceptions surrounding the vaccines date back to as early as the first few months the virus was detected in Ghana. From the data collected, misinformation was circulating on social media since April 2020, a few weeks after Ghana confirmed the first 2 cases in March.

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4.2 Aspects of the COVID-19 vaccines that these misinformation target

The subthemes that emerged with respect to the misinformation and the aspect of the vaccines targeted include; development, licensing, adverse reaction and side effects.

4.2.1 Misinformation on Vaccine Development

A claim that the vaccines were laced with microchips emerged. The notion that microchips were purposely included in the vaccine to enable easy tracking of individuals was widely speculated. This misconception was not limited to the general public. Among health workers, there were doubts due to the belief that the Food and Drugs Authority did not have the capacity to conduct tests. In the Facebook post (Figure 3), a user expresses concern about chips in the vaccine:

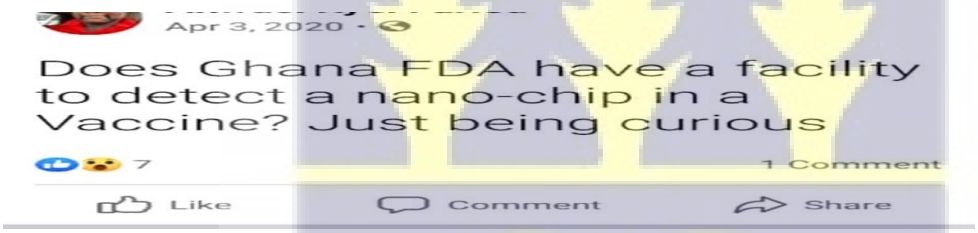

Figure 3: Facebook Post on Concern about FDA Ability to Conduct Safety Checks.

Concerns were also raised about the licensing procedure. It was widely circulated that the vaccines had gone through the normal procedure in clinical trial for approval. The short duration of approval meant that vaccines were deployed without completing clinical trials. A message which was shared on Facebook reads:

> *"These vaccines had not completed clinical trial and have been hurriedly deployed. No wonder people are suffering severe effects after taking the vaccine"*

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4.2.2 Safety and Efficacy

The observation on social media revealed that COVID-19 vaccine-related misinformation targeted the safety of the vaccines. It was widely insinuated that people who received the vaccine will die within two years. This claim was alleged to come from a noble prize winner, which circulated WhatsApp. The claim has gained popularity as the pandemic continues and many more vaccines are being approved by WHO and the FDA. Some of these concerns on the safety of the vaccines were purported to be coming from world renounced scientist. A snapshot of this claim is shown below in Figure 4:

Figure 4: Misinformation of Safety of Vaccine

Additionally, there emerged claims that the Pfizer vaccine contained a deadly compound. On WhatsApp, an article that was forwarded many times affirmed claims that purported Pfizer Chief

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Executive Officer (Figure 5) had warned unvaccinated people to stay away from the vaccine because it contains a deadly compound that was meant to discontinue the human race:

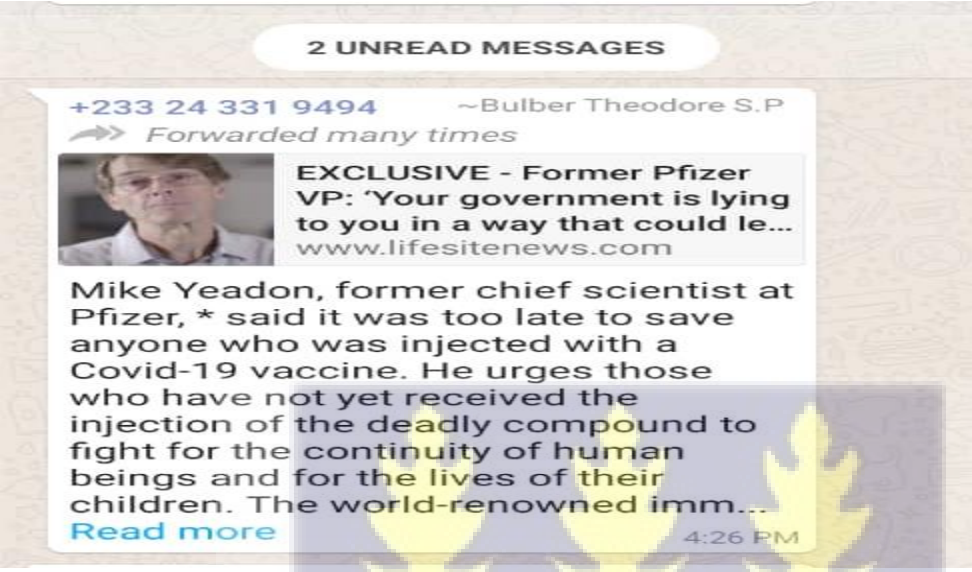

Figure 5: Misinformation of Claims that Pfizer CEO Warning on Vaccine Safety

The results from the study highlight some concerns about the safety of the vaccine amongst musicians, athletes, actors and actresses. A significant number of posts shared around the world make way into Ghanaian online spaces due to their social impact. Figure 6 is a snapshot of a statement from a famous musician on twitter who encouraged the general public to stay vigilant and be careful of what they accept as vaccines due to fertility rumors:

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Figure 6: Concerns about Safety of Vaccines

In the above Twitter post, a medical doctor attempts to educate the musician about the difference between COVID-19 symptoms and side effects of the vaccine.

4.2.3 Immediate side effects

Social media users re-shared online content that they claimed were obtained from trusted sources including blog sites, private websites and other government websites. These websites have published some claims about the magnetic properties of the COVID-19 vaccines, in addition to causing blood clots and damaging people's immune systems. A twitter user shared a section of an

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article from what seemed to be research that claimed the WHO approved vaccines contained 99% graphene oxide as shown in the following snapshot (Figure 7):

Figure 7: Misinformation on immediate Side effects of COVID Vaccine

4.2.4 Future adverse effects

Some online users were duly concerned about the adverse effects of the COVID-19 vaccines. For many users, they were hesitant because of rumors and claims that the adverse effects of the vaccines were extreme and could cause serious health complications for whoever accepts the vaccine. Another WhatsApp broadcast message contained alleged adverse effects of Pfizer

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vaccines from a UK government website. It listed all the adverse effects and the number of people who experienced them. Figure 8 are snapshots of this claim:

Figure 8: List of Side Effects of COVID-19 Vaccines, 2021

The widely circulated claims of adverse effects of the COVID-19 vaccines continued making rounds on Facebook, WhatsApp and Twitter. Many of which appeared to be from unquestionable sources. Social media users who shared these sources claimed the long lists of adverse effects were compiled by health workers and public health professionals. In the snapshot below, the adverse effects of the Pfizer vaccine captured in an online report which upon opening the link, states that the content of the document is confidential, were shared multiple times by Twitter users to justify their position on COVID-19 vaccination:

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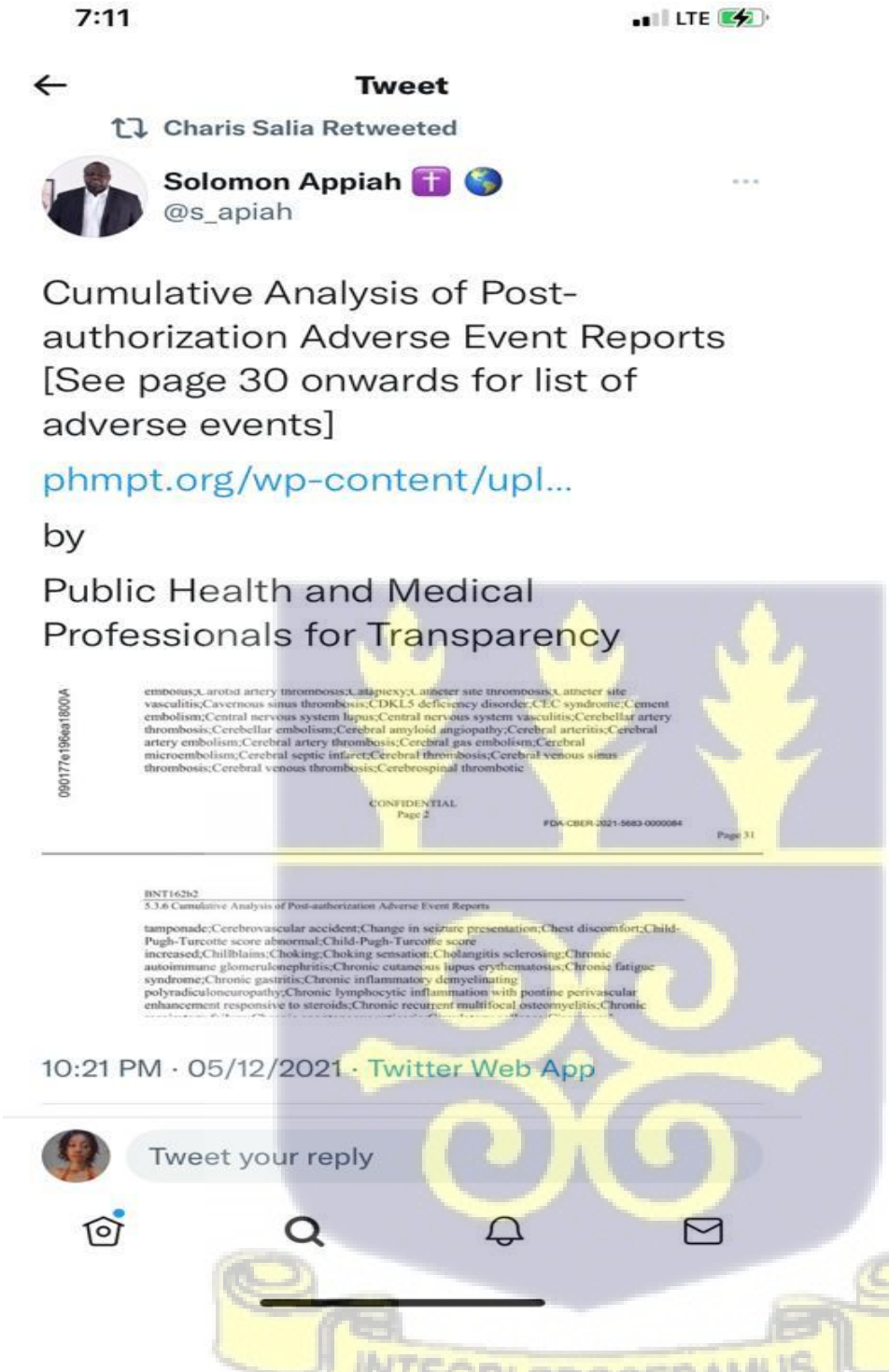

Figure 9: A Twitter Post on Post Approval Side Effects of COVID-19 Vaccines, 2021.

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Some of these adverse effects captured in the above document included a tall list of conditions claiming to be from the use of the Pfizer vaccines: acute kidney injury, arteritis, arteriovenous graft thrombosis, acute respiratory failure, acute cutaneous lupus erythematosus, repetitive partial seizures among others.

When put together, out of the 104 messages and information that were analyzed, majority targeted future adverse effects of the vaccines. The bar chart shows the distribution of the messages as analyzed.

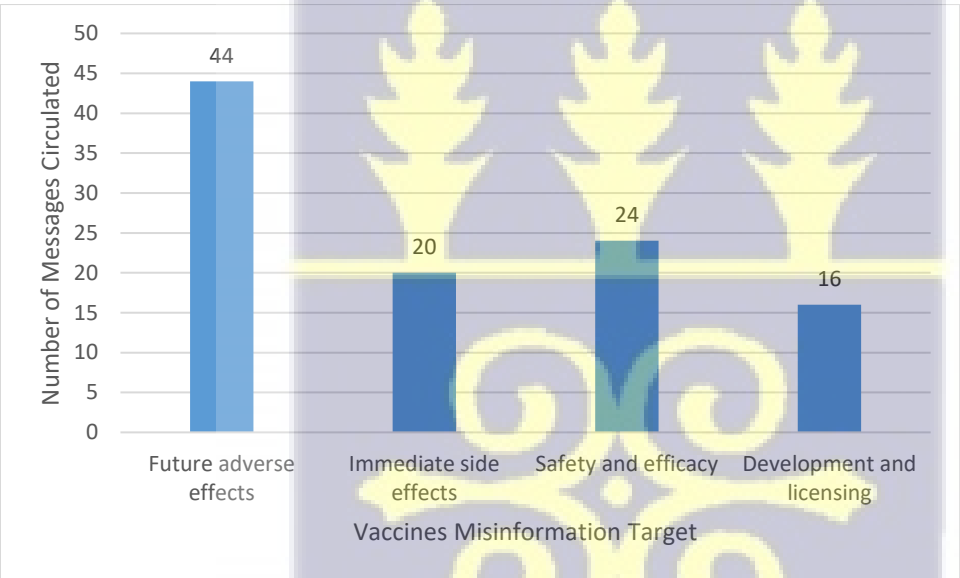

Figure 10: Aspects of vaccines Targeted by Misinformation

4.3 The Social media platforms popularly used to spread the misinformation.

The results from the keyword search on the three social media sites observed in this study revealed that the majority of rumors and misconceptions were found on Facebook and WhatsApp. Rumors

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and misconceptions obtained from blogs and news websites were possible to share on other social media platforms which justified the ability to reach the source of the misinformation. WhatsApp posts that had been shared many times were indicated on the messages, while on Facebook, a post can be shared multiple times to personal pages of users who have come across it.

4.4 Government's strategy to minimizing the spread and effects of misconceived information on social media

The main subthemes that emerged as strategies adopted to minimize the negative effects of the misinformation shared on social media include; health education, debunking and enforcement.

4.4.1 Health Literacy and Education

In collaboration with the Ghana Health Service, UNICEF, WHO and Ministry of Information there were online campaigns to combat the growing misinformation ecosystem, and to educate the online community about the mechanism and importance of vaccination for COVID-19. Health literacy and vaccine education were prioritized on Twitter and Facebook, using graphic illustrations to encourage vaccination against COVID-19. Many users shared these graphics, however, received little to no social media reach.

The following image represents the efforts Ghana Health Service put into combating misinformation and encouraging vaccination as the pandemic rages on. The Greater Accra Regional Health Directorate's (GARHD) Twitter account shared a graphic illustration and assured social media users of the safety of the COVID-19 vaccines and their ability to protect individuals and their communities in the following snapshot (Figure 11).

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Figure 11: Twitter Message to Educate People on COVID-19 Vaccine, 2021.

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4.4.2 Debunking

Efforts to debunk misinformation of social media has particularly been evident on Twitter. As part of the strategies to mitigate the effects of COVID-19 vaccine-related misinformation on social

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media, credible health institutions like the Ghana health service have been tasked to present factual information about the on-going vaccine hesitancy in Ghana. Widely speculated claims have been addressed by GHS by stating the misconception, then presenting facts to address whether said claims are true or false and encouraging verified information seeking. This is a proposed strategy by the World Health Organization and UNICEF (UNICEF, 2020) , adopted by GHS.

In the following snapshot, the official Ghana Health Service Twitter account is seen debunking a rumor circulating WhatsApp, Facebook and Twitter concerning vaccine hesitancy among Krobo residence (Figure 12):

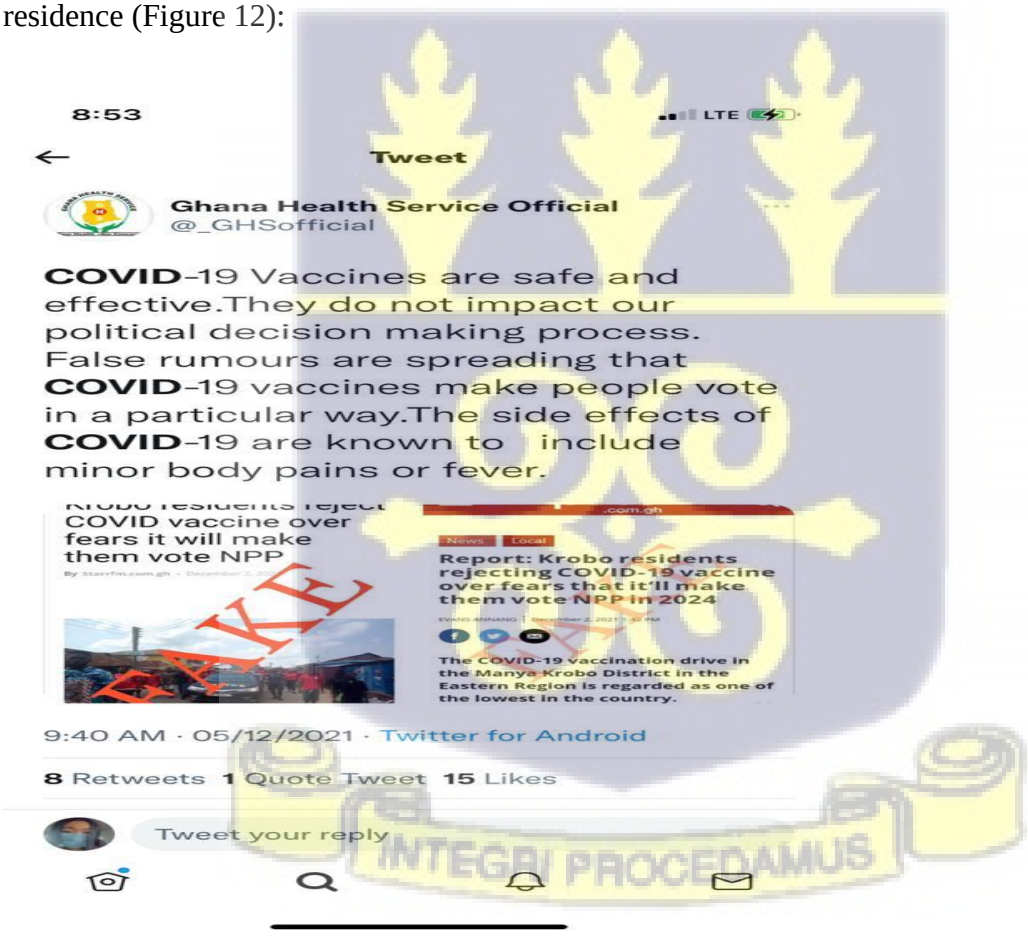

Figure 12: Debunking of Misinformation.

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4.4.3 Enforcement

The Ghana Health Service introduced a vaccine mandate early December, 2021 for international travelers. The mandate suggested that only fully vaccinated travelers could exit and enter the country. The Ghana Health Service on 9th December, 2021 published a "Review of COVID-19 Protocols for International Travelers." It categorically stated that all persons above 18 years should provide evidence of full vaccination before they would be allowed entry into the country, while Ghanaians returning are exempt from this but would be vaccinated at the airport. The following snapshot contains the complete directive:

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Figure 13: Message on Changes in COVID Protocol to Vaccine Mandate.

This directive caused an uproar and a full-blown social media conversation about ulterior motives attached to the policy. It was widely speculated on Twitter that a mandate was not needed for a vaccine that does not cure the COVID-19. Others suggested that there were other forms of curing COVID-19, like in the snapshot provided on Figure 14:

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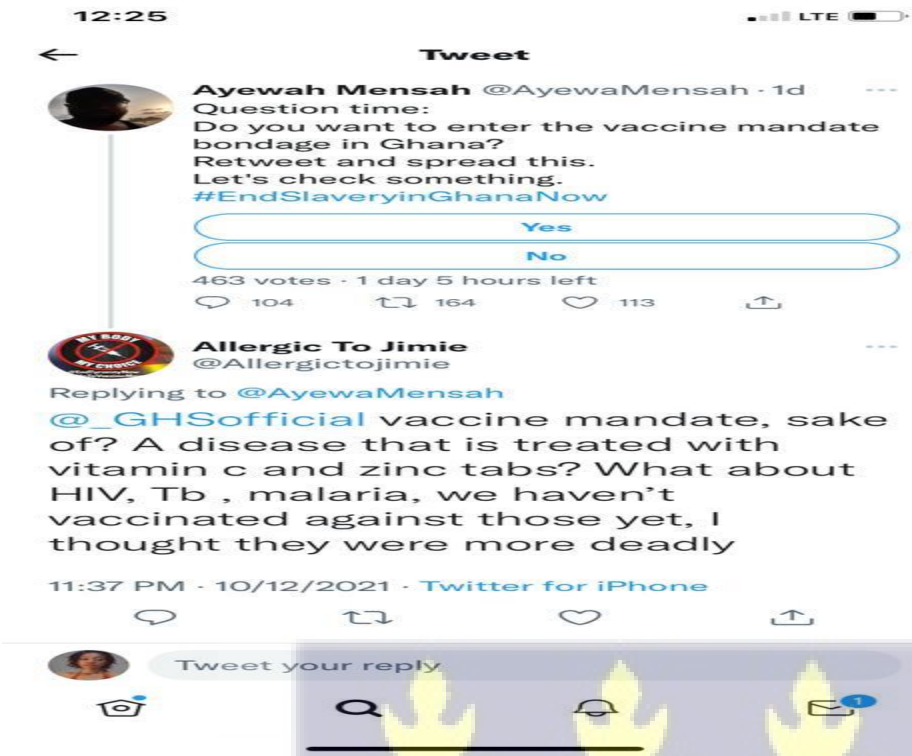

Figure 14: Twitter Comments on Vaccine Mandate.

The study results showed that efforts employed by the Ghanaian government to increase the rates of COVID-19 vaccine uptake in December 2021 were met with anti-vaccination comebacks and misinformation as shown below:

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Figure 15: Comments on Vaccine Mandate.

Further, employers were required to ensure all employees have been vaccinated against COVID-19 before resuming work after the Christmas festivities, including restaurants, commercial vehicle drivers and public recreational spaces.

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CHAPTER FIVE

DISCUSSION

5.1: Type of Misinformation and Misconceptions Shared on Social Media

The study observed social media content to document COVID-19 vaccine-related misinformation circulating social media in Ghana. Ghanaians have resorted to the use of social media to obtain information about the on-going pandemic. It has been a source for reinforcing misconceptions about the COVID-19 pandemic as a whole, not isolating vaccine hesitancy fueled by rumors and the effects of infection and reinfection. The emergence of new variants (Delta and Omicron) in 2021 exposed new forms of misconceptions from social media users about the ineffectiveness of all the approved vaccines. Although some news sources are legitimate and are constantly in an attempt to properly inform, they were met with hysteria and doubts from social media users. The challenge however remains the inadequate social media sources that aim at debunking misinformation and presenting evidence-based COVID-19 epidemiological updates. This caused mistrust for global and public health institutions in Ghana among social media users, laying emphasis on the inability to decipher facts and falsehood.

As presented, vaccine-related misinformation spread fast throughout social media platforms. People consume misinformation unintentionally because of their failure to verify content before sharing (Tabong & Segtub, 2021). Ghanaians' proximity to social media exposes them to a diverse and ever evolving misinformation landscape. While COVID-19 vaccine rollout was in progress, an underwhelming number of Ghanaians had been fully vaccinated against the virus as of December, 2021. Further attempts by health institutions and media houses to encourage vaccination on social media, after declaring December as vaccination month, was met with more

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rumors and conspiracies about the ineffectiveness of the vaccines. The study revealed that with every attempt to encourage vaccination in order to achieve herd immunity among the Ghanaian population, many more social media users confirmed they were either hesitant, rejecting or indifferent about the vaccines which was evident through their comments and replies.

While social media is an effective tool for public health communication, monitoring and disease surveillance (Fung et al., 2015), the effects of misinformation directly affects all efforts to use social media as a viable tool in public health. Large scale vaccine hesitancy negatively affects herd immunity (Loomba et al., 2020). Social media companies created a method to recognize, restrict, and delete falsehoods and misinformation throughout their platforms to reduce the spread of misconceptions. Despite this, some information still managed to find way on social media. During pandemics like COVID-19, these beliefs and misconceptions can be harmful (Tabong & Segtub, 2021).

As the pandemic progressed, the conversation significantly shifted from whether people understood the uses of vaccines, operating mechanism inside a human body and the effects of rejecting the vaccines to whether the vaccines are doing what experts claim they should do due to vaccinated individuals still contracting the disease. The vaccine mandate introduced in December 2021 in Ghana sparked a raging debate between people who had been fully or partially vaccinated and those who had not. The focus of the debate ranged from efficacy of the vaccines to human rights infringement, as many Ghanaian social media users expressed disagreement with forced vaccinations. They also felt there was something suspicious about mandating vaccines as they

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claimed the vaccines were ineffective. This stance was derived from the idea that people should be allowed to choose what happens with their bodies regardless of public health emergencies.

As discovered by this study, there had been a decline in adherence to COVID-19 safety protocols but this decline did not necessarily translate to more people accepting the vaccines in order to be protected. While there have been technological and scientific research advancement in this day, there seem to be a growing community of anti-vaccination, vaccine hesitant people who believe their natural immunity cannot be compromised. The underlying issue remains that there is overwhelming misinformation surrounding the development of the vaccines online, emphasizing the adverse effects of the vaccines. Anti-vaccine activists would occasionally share valid scientific studies reporting rare vaccination side effects, while exaggerating the documented harmful effects and pushing for vaccine boycotts; the appearance of legitimacy is created by sharing a scientific study in a tweet (Muric et al., 2021), Facebook comment or WhatsApp content. This procedure dwells on the fact that most people coming across the narrative would barely take time to read the full article hence, successfully sharing false information and conspiracies. This research found that for a lot of the accessible misinformation shared, people demanded a source. Whether the source was credible or not, the mere fact that there existed a supposed backing was enough to silence people who probed further. One element that appears to be missing in Ghana's COVID-19 response is a surveillance mechanism to examine, detect, and respond immediately to rumors and misconceptions, particularly on social media. Hence, in creating a monitoring system and controlling disease outbreaks like COVID-19, it is critical to include a mechanism to track misconceptions (Tabong & Segtub, 2021).

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The growing evidence of COVID-19 vaccinated individuals being a source of spread for new variants implies that unvaccinated individuals may not find the need for vaccination, as a recent study demonstrated that the viral load of vaccinated and unvaccinated people with COVID-19 are at par (Singanayagam et al., 2021). The cited study including others are evidence that vaccine hesitant people may not necessarily be uninformed but are critical of every detail with regards to the COVID-19 vaccines. While the study states that vaccination reduces the risk of infection, it may not convince vaccine hesitant people enough.

5.2: Aspect of Vaccines Targeted by Misinformation and Misconceptions

As the study findings suggest, vaccine misinformation mirrors skeptic perceptions with regards to development, immediate side effects, future adverse effects and its safety and efficacy. Individuals make decisions based on their impression of danger rather than the real risk, which means they may ascribe particular symptoms to the infection or the vaccine (Bhattacharyya et al., 2019). In view of this, online social media users may have little to no evidence of adverse reactions to the vaccines but are likely to express hesitancy based on misinformation from untrusted sources. The notion that the Pfizer vaccines contained poisonous chemicals for example, as expressed by social media users were likely to have obtained this rumor from broadcast articles that were not peer-reviewed. Rumors and misconceptions targeting the vaccine development also seemed to be a valid reason for social media users to form opinions and make decisions that affect uptake. Observation on Twitter and Facebook showed that users who expressed sentiments over side effects and the safety of the COVID-19 vaccines had strong convictions for perceived danger. These users would typically explicitly or figuratively imply that other people should resist every attempt to taking the vaccine. As such, there exists a snowball effect of vaccine hesitant tweets and Facebook posts which creates an online coalition of anti-vaccine or vaccine hesitant individuals. They tend to identify with each other's posts and share similar ideas from all over other social media networks

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and worldwide sources. Some users identified a close contact with side effects of the immediate use of the vaccine and extrapolated that it was evidence for future adverse effects. In an attempt to explain where these rumors come from and how credible these sources are, vaccine hesitant social media users retrieve information with unrelated and/or edited articles and what appears to be a joint article from acclaimed group of scientists.

Certain users with learning difficulty, older age, lesser literacy, and low technological literacy, have been shown to be more susceptible to these strong emotional arguments of social media (Callender, 2016). This claim is applicable in the COVID-19 era because of the reduced likelihood of information verification among people who have strong convictions about the vaccine's safety. The presence of such articles and news sources that justify these claims produce a sense of evidence for users who believe the COVID-19 vaccines are dangerous, cause illness, are ineffective and consequently, have a probability of causing fertility issues and even deaths.

Individual vaccination decisions are affected differently by rare, severe vaccine adverse reactions than by common, mild occurrences, and that certain network types are particularly susceptible to the negative consequences of fabricated narratives about severe vaccine adverse outcomes (Bhattacharyya et al., 2019).

5.3.Strategies Adopted to Minimize the Negative Effects of the Misinformation and Misconceptions

As part of the long-term solution for mitigating the effects of misinformation about COVID-19 vaccines, the Ghanaian government have implemented the use of debunking misinformation outright on social media. Further, health institutions responsible for health education have created social media graphics to help users understand the use of vaccines and how they work. Corporate

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institutions have been mandated to enforce vaccination by demanding that every worker provides a proof of vaccination. The law enforcement agencies were also tasked to inspect vaccination cards from public transport drivers. These strategies saw effectiveness after the emergence of the Delta variant. Social media users pushed back on mandates for international travelers and corporate workers, claiming that the use of vaccination mandates was against human rights and unethical. Some twitter users were of the opinion that demanding a proof of vaccination before arriving in Ghana, resuming work and going to public events, restaurants and recreational centers was a step in the right direction to reduce the spread of coronavirus. However, another section of social media users found it troubling; they imagined this intervention strategy unfruitful, while establishing that public health education about the COVID-19 vaccines was inadequate. Delayed implementation of these strategies may have generated negative attitudes towards vaccine uptake. Information conveyed by trusted sources like Ghana Health Service also saw rebuttals from misinformed online users. Participants would usually adjust messages and responses to correspond with their fundamental point of view and statements that resonated with the individual's attitudes were viewed as more persuasive (Germani & Biller-Andorno, 2021;Puri et al., 2020). Therefore, attempts to debunk misinformation were generally met with more uncited claims affirming the rumors that were being debunked.

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CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1: Summary

The approval of COVID-19 vaccine and deployment in Ghana came as a relief to many Ghanaians. However, concerns have been raised on safety of vaccines. Social media is awash with misinformation on the vaccines. This study adopted a netnography which is an online ethnography to analyze the content of COVID-19 vaccines related messages shared on three main social media in Ghana: Facebook (with extension to Instagram), Twitter and WhatsApp. The messages were retrieved using various search strategies that allow access to messages shared on these platforms. Content analysis was employed with the aid of NVivo 12 software. The main findings of the study include:

1. COVID-19 vaccine related misinformation and misconception are widespread in social media in Ghana.
2. Social media fueled vaccine hesitancy is a threat to uptake of the vaccines to among people living in Ghana.
3. The misinformation covers the entire vaccine manufacturing, licensing and deployment process. Largely, the misinformation targets the future adverse effects of the vaccines, immediate effects and concerns about safety of the vaccines.
4. The Ministry of Health and Ghana Health Service recognized the circulation of misinformation on social media and have employed health education, debunking such information using the same social media platform.
5. Introduction of vaccine mandate has been adopted as strategy to increase vaccine uptake and coverage.

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6.2: Conclusions

This study recognizes that tracking social media content can provide insight for public health risk communication and a perspective into the social media users' sentiments on vaccination and other pandemic response strategies. The increasing use of social media networks to learn about vaccines and infectious diseases could have a negative impact on vaccine coverage (Bhattacharyya et al., 2019). Vaccine hesitancy, not limited to COVID-19 vaccines has traditional, socio-cultural, socio-economic backing and is influenced by the growing online conversation on vaccination around the world, which are accessible to Low-and-middle-income regions via the rising use of smartphones and social networking websites. The low rate of immunization literacy especially on social media fuel a raging debate about the effectiveness of vaccines and their possible adverse effects. Hence, the unceasing false narratives about vaccines in general, trickling down to unsuspecting, inadequately informed individuals with social media access are passed on to the general population.

6.3: Recommendations

Based on the conclusion of the study, the following recommendation can help address the challenges in the sue of social media to propagate misinformation and misconceptions

1. To establish appropriate risk communication messages, governments and other Ministry of Health/Ghana Health Service should regularly analyze the patterns of COVID-19 vaccine-related rumors and conspiracy theories on social media. This would provide insight on how to debunk rumors, present facts and ensure vaccine uptake.
2. The Ministry of Health and Ghana Health Service should establish a social team at the Health Promotion and Risk Communication Directorate to develop strategies to timely recognized and handle misinformation.

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3. Further studies should focus on extracting data and grouping anti-vaccine and vaccine hesitant content into specific geographical area or regions. This would guide intervention policies targeting mass vaccination in different areas of the country. Additionally, a system that targets vaccine content on social media can be scrutinized for accuracy and flagged in order to distinguish facts and fallacy.

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APPENDICES

Appendix A: Data Collection Tool

S. No.	Category	Rumor	Present	Active	Online	Reach	Community Trust	Importance	Response	Social sources	Response and type of response
1	Safety and Efficacy	Causes illness									
2		Causes the disease it is trying to protect from	All these vaccines are nonsense because it doesn't cure or prevent you from getting the virus	no	yes	4 likes	Affects community trust negatively.	Implies vaccine is ineffective.	No response	Facebook	Facebook comments
3		Affects fertility	You're advertising the doses so you can prevent ladies from giving birth in 5 years. My cousin in Trinidad won't get the vaccine because his friend did and became impotent.	No yes	Yes yes	1 like 296,000 likes, retweets and replies	Affects trust	Misinform-ation	None I'd love to talk to you about the COVID-19 vaccines. Impotence is significantly more likely from COVID-19 and there haave been no documented cases of impotence associated with the vaccines	Twitter	Replies
4		Is not safe									
5		Contains dangerous ingredients or poison	The vaccine is a poison. So beware	no	yes	No engagement	Affects community trust	misleading	none	Facebook	comments
6		Cannot be given									

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		multiple times									
7		Is untested or being tested on us	The experimental vaccine is rather killing people.	no	yes	none	Affects community trust.	Implies ulterior motives	none	Twitter	Replies
8		Cannot be given to aged									
9		Was not properly tested									
10		Can't be given to sick people									
11		Is at risk for contracting COVID	Research proves that 100% of FULLY vaccinated, after taking 3-4 shots are the one dying and transmitting the virus to themselves!	no	yes	none	Reduces community trust for vaccines.	Discourages people from the vaccines	Exactly. The evidence clearly shows the most vaxed countries are experiencing FAR more cases and fatalities than Ghana. This makes ZERO sense, other than financial benefit for pharma and their agents.	Facebook	Comments
12	Motives	Is a conspiracy to make money									
13		Is a conspiracy to control population									
14		Is a conspiracy to decrease our population	Don't go for the vaccines, it is meant to depopulate souls on the earth to secure the amount of humans they need so they can control the world. Remember #oneworldorder is	No	Yes	3 likes	Reduces community trust.	Implies ulterior motives.	None	Facebook	Facebook comment, no response.

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			controlling the earth.								
15		Is another vaccine in disguise									
16		Why is it being pushed so much									
17		Is controlled by Bill Gates									
18	Access	Is difficult to get									
19		Is expensive									
20	Social / Religious	Is not Halal or contains not Halal ingredient									
21		Not allowed by household or community leader									
22		Prayer is as or more effective than vaccines									
23		Is not for my country or ethnicity or race									
24	Genetics	Is being tested on us									
25		Is genetically modified	They are not vaccines. Gene weapon! Vaccinated people will develop genetic defects	no	yes	4 follow up messages	Undermines community trust	Unverified rumors	It is false imformation,	Whats-App	message
26		Is not tested									
27		Is not safe	This vaccine is poisonous, am telling u the truth because the	No	Yes	No engagement	Affects community trust negatively.	It expresses unverified rumors.	None	Facebook	Comment section

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			white men's want to kill us. check yourself well before u vaccinate, it can change your DNA								
28		Is a cover for COVAX testing									

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Appendix B: Ethical Clearance

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GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
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Email: ethics.research@ghsmail.org

My Ref. GHS/RDD/ERC/Admin/App 21 | 3059
Your Ref. No.

2nd August, 2021

Maniru Yahya Siba
C/O, P.O. Box 567, Accra-Newtown.
University of Ghana, Legon.

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC 026/06/21**
Project Title	Covid-19 Vaccine-Related Misinformation Shared on Social Media in Ghana
Approval Date	2nd August, 2021
Expiry Date	1st August, 2022
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months.
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol.

SIGNED.....
Dr. James Akazili
(Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

INTEGRI PROCEDAMUS