SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

PREVALENCE OF FEVER AND ITS ASSOCIATED FACTORS AMONG HOSPITALISED COVID-19 PATIENTS AT THE EASTERN REGIONAL HOSPITAL, KOFORIDUA

BY

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE

SEPTEMBER, 2022

Declaration

With the exception of duly acknowledged references, I, Muhyideen Alhassan Bashir hereby declare that this research work was carried out by myself under the supervision of Dr Thelma Ohene-Agyei. I further declare that this work has not been presented elsewhere for any other degree.

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Dedication

This work is dedicated to the Almighty God and to my entire family and friends.

Acknowledgement

My profound gratitude goes to Dr Thelma Ohene-Agyei who supervised and supported me throughout this research work.

I acknowledge all staff members at the COVID-19 Isolation & Treatment Centre of the Eastern Regional Hospital, Koforidua for providing me with all the necessary access during data collection.

Abstract

Background: In Ghana, temperature check at various points of entry was being used as a means of screening people for coronavirus disease 2019 without taking into consideration a local data on the prevalence of fever. In order to establish a well-grounded knowledge of fever among hospitalised patients with coronavirus disease 2019 in Ghana, this study was designed.

Objective: To assess fever prevalence and its associated factors among hospitalised coronavirus disease 2019 patients at the Eastern Regional Hospital, Koforidua.

Methods: A cross-sectional retrospective study involving review of medical records of all 301 eligible coronavirus disease 2019 patients admitted and discharged at the Eastern Regional Hospital, Koforidua between May 5, 2020, and August 31, 2021, was conducted. Data collected on a pre-designed compilation form was processed, entered and analysed using Microsoft excel 2019 and Stata/IC version 16.1 software. Prevalence of fever was estimated and a multivariable logistic regression model was fitted to establish factors associated with fever among hospitalised coronavirus disease 2019 patients. A relationship was accepted to be significant at 5% level of significance.

Results: The prevalence of fever among hospitalised coronavirus disease 2019 patients at the Eastern Regional Hospital, Koforidua was 21.6% (95% CI, 17.1%-26.7%). The factors associated with fever were age (AOR, 0.97; 95% CI, 0.96-0.99), comorbidity (AOR, 2.37; 95% CI, 1.11-5.06) and disease severity [moderate (AOR, 3.4; 95% CI, 1.22-9.52); severe (AOR, 3.61; 95% CI, 1.18-11.07); critical (AOR, 5.71; 95% CI, 1.23-26.58)].

Conclusion: Prevalence of fever was low among hospitalised coronavirus disease 2019 patients at the Eastern Regional Hospital, Koforidua. A more significant number of cases were likely being missed with the temperature screening policy. Factors such as age, comorbidity, and disease

severity predicted the category of patients who presented with fever in this sample. Revision of case detection and management policy by Ghana Health Service/ Eastern Regional Hospital, Koforidua is required. Healthcare workers should not be oblivious to the fact that majority of symptomatic patients do not present with fever during triaging.

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List of Abbreviations

2019-nCoV	2019 novel Coronavirus
AOR	Adjusted Odds Ratio
BT	Body Temperature
COVID-19	Coronavirus Disease 2019
ERHK	Eastern Regional Hospital, Koforidua
GHS	Ghana Health Service
ROC	Receiver Operating Characteristics
HAMS	Hospital Administration and Management System
ICU	Intensive Care Unit
MOH	Ministry of Health
PCR	Polymerase Chain Reaction
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organisation

Definition of Terms

Acute kidney injury: A condition in which the kidneys suddenly fail to filter waste from the blood as a result of a clinical insult.

Acute respiratory distress syndrome: A condition in which there are new or worsening respiratory symptoms within a week of known clinical insult causing fluid collection in the air sacs of the lungs.

Comorbidity: Refers to a medical condition that is simultaneously present with another in an individual.

Coronavirus: A microscopic organism that belongs to a vast family of viruses and may cause illness ranging from common cold to more severe respiratory disease. E.g., SARS-CoV-2

Cytokines: Refer to molecules or proteins that are secreted by specific cells of the immune system and help in cell-to-cell communication during the body's response to infectious or foreign agents.

Discharge outcome: An event used to describe the outcome at the time of patient's discharge from the hospital or ward. This has been summarised as either 'discharged alive' or 'discharged dead' for the purpose of this study.

Epicentre: Refers to a geographical area during an outbreak where most of the cases are occurring at a specified period of time.

Fever: For the purpose of this study, fever refers to an elevated body temperature of 37.5˚C and above, recorded by means of a handheld non-contact infrared thermometer directed on the forehead of the patient.

Genetic sequence: Refers to the order in which a particular gene is organised in a living organism.

Hospitalised COVID-19 patients: Individuals with COVID-19 who have been admitted to the hospital for the purpose of isolation and/or treatment.

Multiple organ failure: The failure of two or more systems of a human body usually as a result of sepsis or septic shock.

Pandemic: Refers to the occurrence of a disease or an event over the whole world.

Pneumonia: A lower respiratory tract infection involving the air sacs in one or both lungs.

Sepsis: Refers to a life-threatening organ dysfunction caused by a dysregulated host response to suspected or proven infection.

Septic shock: This refers to a potentially fatal condition where there is low or absent blood perfusion of vital organs as a result of persistent low blood pressure caused by sepsis.

Virulence: Defines how severe or harmful an infectious agent or a disease can manifest.

CHAPTER ONE

Introduction

1.1. Background to the study

Diverse healthcare systems across the globe were being challenged by the coronavirus disease 2019 (COVID-19) pandemic (Meister et al., 2022). It all started on the 31st December, 2019, when cases of pneumonia of unknown aetiology were detected in Wuhan City, Hubei Province of China (World Health Organisation [WHO], 2020a). Upon investigations, the causative agent was identified as a novel coronavirus (2019-nCoV) on the 7th January 2020 (Ministry of Health [MOH], 2020). Due to similarity in its genetic sequence to severe acute respiratory syndrome coronavirus (SARS-CoV), the novel coronavirus was later named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) while the disease associated with it was referred to as COVID-19 (MOH, 2020).

SARS-CoV-2 belongs to a group of viruses called coronaviruses and it is transmitted mainly through exposure to respiratory droplets from an infected person (MOH, 2020). It takes about 2 to 14 days after exposure for the virus to manifest as a disease in human body (MOH, 2020). Majority of COVID-19 infected individuals show no or mild symptoms, while others may present with symptoms of either moderate, severe or critical disease (MOH, 2020). The symptoms include but are not limited to fever, cough, shortness of breath, body aches, fatigue, sore throat and loss of smell or taste. The disease can be complicated by sepsis, septic shock, acute respiratory distress syndrome, acute kidney injury and multi-organ failure, among others.

For the purpose of triaging and case management, the levels of COVID-19 disease severity are defined as below (MOH, 2020, p. 22).

1. Mild Disease: Individuals who are asymptomatic or symptomatic with non-specific symptoms such as fever, cough, sore throat, diarrhoea, headache, muscle ache, loss of smell or taste, and maintain normal oxygen saturation on room air (SpO2 >95%).
2. Moderate Disease: Patients who present with clinical evidence of pneumonia but maintain oxygen saturation of ≥94% on room air.
3. Severe Disease: Patients who present with respiratory rate of >30cycles per minute, in respiratory distress or oxygen saturation of <94% on room air.
4. Critical Disease: Patients who present with clinical evidence of sepsis, septic shock, respiratory failure and/or multiple organ failure.

The COVID-19 outbreak was declared a pandemic on the 11th March, 2020 (MOH, 2020, p. 2). As of 25th November 2021, there had been over 258 million reported cases of COVID-19, including over 5million deaths globally (WHO, 2021). Approximately, 7.7 billion doses of COVID-19 vaccines had been served across the globe (WHO, 2021). In Ghana, there had been 130,920 reported cases and 1,209 deaths as of 20th November, 2021 (Ghana Health Service [GHS], 2021). A total of 3,493,688 doses of COVID-19 vaccines had been administered in Ghana (GHS, 2021).

The WHO had released various protocols to guide as an emergency response to the COVID-19 pandemic. Notable among the protocols was the application of temperature screening to guide early detection of COVID-19 (WHO, 2020b). Fever or temperature screening as the means to detecting COVID-19 was probably proposed for implementation based on the findings in some of the earliest study conducted in Wuhan, China, where up to 98.6% of hospitalized COVID-19 patients presented with fever (Wang et al., 2020). In Ghana, it was a requirement to provide thermometer guns and use same to check body temperature at various entry points and gatherings,

as a way of detecting COVID-19 cases early in order to intervene (Zhang, Novingnon, Dixit, Mao & Yamey, 2020). However, the novel coronavirus had been unpredictable when it comes to its epidemiological and clinical features (WHO, 2020b).

Fever usually occurs when one's body temperature rises above the person's known normal daily values, primarily in response to an infectious agent (Bush, 2020; Ogoina, 2011). In practice, fever refers to an elevated body temperature >37.4˚C when a contact thermometer is placed in a person's armpit (WHO, 2014). For the sake of infection control, a noncontact thermometer is preferred when screening patients for COVID-19, despite no consensus on the cut-off temperature for this device (Mackowiak, Chervenak, & Grünebaum, 2021). It is important to determine if fever screening as being employed is effective or adequate to detect the majority of COVID-19 cases during pre-triaging and triaging in Ghana.

1.2. Problem statement

Since the onset of COVID-19 pandemic emphasis has been on temperature screening at various points of entry as a way of early detection of cases (WHO, 2020b). However, two different studies conducted on the clinical characteristics of COVID-19 in Accra, Ghana showed a low prevalence of fever (Ashinyo et al., 2020; Oduro-Mensah et al., 2020). Ashinyo et al. (2020) reported 29.6% fever prevalence in a retrospective study of some discharged COVID-19 patients, whereas Oduro-Mensah et al. (2020) reported 7.6% of patients who had a history of fever as a symptom of COVID-19.

It was therefore unclear if temperature screening was the most appropriate or rapid screening tool for detecting COVID-19. In the Eastern Regional Hospital, Koforidua (ERHK), the researcher observed that a number of symptomatic clients visiting the hospital pass temperature screening, only for them to be diagnosed of COVID-19 on subsequent assessment by physicians. Yet there

had been increasing demand for logistics and human resource by healthcare workers to man and check temperatures at COVID-19 screening centres and various points of entry across the country. On the other hand, there were some reports of fever or peak body temperature being associated with mortality among COVID-19 patients. Unremitting high-grade fever can be counterproductive during a dysregulated inflammatory process described as cytokine storm (Gul, Htun & Inayat, 2021). This was evidenced in a study conducted in an intensive care unit (ICU) setting where there was a linear relationship between body temperatures and mortality (Choron et al., 2021). While overall mortality was 61.1% for the studied population, mortality was lower (40%) among patients with peak temperature less than 102˚F. Conversely, mortality was higher (70.6%) among patients with peak temperature greater than 104˚F and there was 100% mortality among the 14 patients who had hyperthermia greater than 105˚F (Choron et al., 2021). In another study conducted in the United States it was reported that maximum body temperature (BT) during COVID-19 infection was significantly correlated with mortality rate (Tharakan, Nomoto, Miyashita & Ishikawa, 2020). For every 0.5 °C increase in body temperature there was a significant increase in mortality; the mortality was as high as 42% in those with maximum BT > 40.0 °C (Tharakan et al., 2020).

In view of the above data on fever and mortality, and the inconsistent data on fever prevalence among COVID-19 patients, it became necessary to estimate the prevalence of fever and unravel the factors associated with fever among symptomatic COVID-19 patients who were otherwise hospitalised at the ERHK.

1.3. Justification of the study

Globally, data on prevalence of fever among COVID-19 patients revealed diverse findings. It appeared that only one study conducted in Ghana assessed the prevalence of fever by analysing data on temperature recorded among COVID-19 patients (Ashinyo et al., 2020). Even so, the study

did not focus primarily on fever and its associated factors. In fact, study that solely assessed factors associated with fever among COVID-19 patient was scarce, despite the association found between fever and mortality among patients in some studies like that of Choron et al. (2021).

The current study was designed to help unravel the uncertainties in the COVID-19 temperature screening implementation and case management in Ghana (Zhang et al., 2020). Information from the study would add onto the baseline data upon which a review of the temperature screening policy could be made if necessary. Supposing the reported adverse findings on fever and mortality elsewhere applies to Ghana, knowledge on the associated factors of fever among those who present with it could help identify high risk group, predict disease progression and outcome; it may provide a basis for deciding who should undergo home-isolation and who should be hospitalised for close monitoring. Thus, it may help realign service delivery and provide health information with respect to COVID-19 in Ghana's health system.

Moreover, as new strains of SARS-CoV-2 emerged and the scientific knowledge of the novel virus kept evolving globally, real time data of local setting was required in understanding certain dynamic features of the disease. This study could serve as a cornerstone or foundation for conducting further studies to determine if controlling body temperature may improve or worsen outcomes.

In summary, analysed prevalence of fever among symptomatic COVID-19 patients as presented in this study may provide a room for review of our screening tool, prediction and anticipation of disease progression, and add on to the global knowledge of the disease.

1.4.0. Objectives of the study

This section presents the objectives of the study categorised as general and specific below.

1.4.1. General objective

The general objective of the study was to assess prevalence of fever and its associated factors among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua.

1.4.2. Specific objectives

The specific objectives, which helped to find answers to address the general objective were;

1. To estimate the prevalence of fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua.
2. To determine the factors associated with fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua.

1.5. Research questions

The research questions, which helped to find answers to address the specific objectives were;

1. What is the prevalence of fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua?
2. What are the factors associated with fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua?

CHAPTER TWO

Literature Review and Conceptual Framework

2.0. Introduction

This chapter presents the review of published work, theoretical perspective and conceptual framework for the prevalence of fever and its associated factors among hospitalised COVID-19 patients.

The single most employed screening method at various points of entry for COVID-19 was body temperature check (WHO, 2020b). This was motivated by the initial report from WHO that, officers at various entry points detected the majority of exported cases of COVID-19 during the current outbreak by the use of temperature screening (WHO, 2020b).

There was no specific temperature range associated with COVID-19. When body temperature was analysed in a study involving some 7,614 COVID-19 patients in Mount Sinai and its affiliated hospitals in the New York area, the average body temperature recorded at first encounter was 37.0˚C (Tharakan et al., 2020). A retrospective cohort study conducted in Ghana found a mean presenting temperature of 36.3°C on admission of COVID-19 patients (Ashinyo et al., 2020).

2.1. Prevalence of fever among hospitalised COVID-19 patients

Fever in the general population is one of the commonest reasons for medical consultations globally (Urbane, Likopa, Gardovska & Pavare, 2019).The inflammatory response to an infectious agent such as SARS-CoV-2 in the human body may trigger the hypothalamus to reset the body's 'thermostat' to a higher threshold of temperature regulation (Ogoina, 2011**)**. Whereas, this response may be heightened in some individuals, others may not show fever either by virtue of the pathogen (virulence) or due to factors associated with the individual host.

Fever was present in up to 98.6% of hospitalised COVID-19 patients in one of the earliest studies conducted in Wuhan, China (Wang et al., 2020). In a systematic review and meta-analysis of 148 studies involving 24,410 adults with confirmed COVID-19 from 9 countries, fever prevalence was as high as 78% (Grant et al., 2020). In a similar study involving 17,142 adults and 373 paediatrics, the pooled prevalence of fever in adult and paediatric COVID-19 patients was 79.43% and 45.86%, respectively (Islam et al., 2021). A case series involving COVID-19 patients admitted to 12 hospitals in New York City, Long Island, and Westchester County reported fever prevalence of 30.7% during triaging (Richardson et al., 2020). In a single retrospective study, fever was reported in 42.8% of the COVID-19 patients at the time of admission and 88.7% during hospitalisation; the conclusion was that fever will often not be present at the time of admission (Guan et al., 2020). Again, a published data in Ghana involving 307 COVID-19 patients in the epicentre (Accra) at the time reported only 29.6% fever prevalence (Ashinyo et al., 2020).

2.2. Factors associated with fever among COVID-19 patients

This section presents analysis of literature on factors associated with fever among COVID-19 patients, focusing on socio-demographic factors, epidemiological factors, and clinical factors below.

2.2.1. Socio-demographic factors and fever among hospitalised COVID-19 patients

Age: Generally, human physiology assumes a lower body temperature for older people as compared to the younger ones (Bush, 2020). As well, febrile response in older people is reduced (Roghmann, Warner & Mackowiak, 2001). Metabolism, whose by-product is heat tends to slow down as one is ageing. Fat tissue under the skin, which helps cushion the body from heat loss also reduces with age and for that matter the body temperature tends to be lower. Nevertheless, there

may be situations where an elderly will record relatively higher temperatures particularly when other demographic or epidemiological factors come into play (Roghmann et al., 2001).

Contrary to the general theory that elevated body temperature is less common in the extremes of age (especially the elderly), an elevated temperature of >39.0˚C was observed to be about two-fold more common in the older patients (age ≥60years) compared with younger patients (age <60years) in one retrospective study involving medical review of COVID-19 patients in Zhejiang province (Lian et al., 2020).

Sex: The sex of an individual may have a bearing on the tendency to develop a fever or not, probably due to immunity and hormonal differences (Dana et al., 2020). The extent of immunity females will mount when infected with a virus may be different from that in males. In immunology, females tend to produce stronger immunity against viral infection and this, may in one way or the other affect occurrence of fever (Kang & Ellgen, 2020).

It was reported that fever was significantly experienced by men than women among COVID-19 patients (Lechien et al., 2020).

2.2.2. Epidemiological factors and fever among COVID-19 patients

Different strains of the same virus e.g., influenza virus may trigger temperature response differently due to their distinct ability to elicit endogenous pyrogen from phagocytes (Tinsley, Coates, Sweet & Smith, 1987). Mutation of SARS-CoV-2 occured over time, which gave rise to new strains (Morang'a et al., 2022). The time period of infection or the pandemic as an epidemiological factor may therefore play a role in the prevalence of fever among infected individuals. From January 2021, Ghana started genomic sequencing on all positive samples from travellers to identify the genetic diversity of SARS-CoV-2 infections in the country (Morang'a et al., 2022). One may therefore assume that, the calender year 2021 might have had enough new

strains of COVID-19 to change the fever prevalence among patients in Ghana. There was however no empirical data in literature to support the association between the year or time period of COVID-19 pandemic and fever prevalence.

2.2.3. Clinical factors and fever among COVID-19 patients

Comorbidity: In general, patients presenting with an ill-health may be having two or more co-existing disease conditions (El-Badawy et al., 2022). This may be in a form of pre-existing/chronic condition(s) or/and co-infection. In some cases of infectious disease, more than one pathogen could co-exist in an individual. Diabetes mellitus, hypertension and malignancies were commonly observed in COVID-19 patients (El-Badawy et al., 2022). Up to 32.9% of COVID-19 patients had at least one comorbidity (Soares, Mattos & Raposo, 2020).

A comorbidity may independently cause fever or alter febrile response to SARS-COV-2 (Bush, 2020). Individuals who already have a fever-causing disease like lymphoma, tuberculosis among others, may present with a heightened form of fever when co-infected with coronavirus. In fact, infection, inflammation and neoplasm (cancer) can all cause fever (Bush, 2020). Also, state of immunosuppression in conditions like retroviral infection and diabetes can reduce the body's febrile response to COVID-19 (Bush, 2020). There was however a scarcity of empirical data on the association between comorbidity and fever prevalence among COVID-19 patients.

Disease severity and fever: The severity of a disease resulting from a highly invasive pathogen may be a predisposing factor for fever (Leulseged et al., 2022). Theoretically, inflammatory processes increase with disease severity, and therefore fever may be a sign of severe disease (Leulseged et al., 2022).

There was an association between severity of disease and fever in a study conducted by Leulseged et al. (2022). A consistent finding was reported in a meta-analysis, where there was a significant

difference for fever between severe and non-severe disease (Li et al., 2021). However, in one systematic review and meta-analysis, which assessed the association between symptoms and severity of disease in hospitalised COVID-19 patients, fever was not found to be associated with severity of COVID-19 despite it been the most common reported symptom (Talukder, Razu, Alif, Rahman & Islam, 2022).

2.3. Theoretical perspective

This section presents analysis of functionalist perspective, which was applied as the basis of the design of the conceptual framework for prevalence of fever and its associated factors among hospitalised COVID-19 patients. Functionalism is a theory that "emphasises the interconnectedness and interdependency of the society by focusing how each part influences and is influenced by other parts" (Saleem, 2018, slide 7). One believes that every phenomenon must function to continue to exist in a society.

With this perspective, fever among COVID-19 patients do not occur without associated factors. The presence and extent of some factors influenced the prevalence of fever during the COVID-19 pandemic. Even so, some of these factors may be interconnected independent of fever so long as they exist among COVID-19 patients. More importantly, what this fever among COVID-19 patients means to the case detection and management of COVID-19 was the basis for ascertaining the prevalence of fever and its associated factors.

2.4. Conceptual framework

Figure 2.1 below was developed by the researcher as a conceptual framework for factors associated with fever prevalence among hospitalised COVID-19 patients.

Factors associated with fever were broadly categorised as socio-demographic, including age and sex; epidemiological, such as year of infection; clinical such as comorbidity and disease severity.

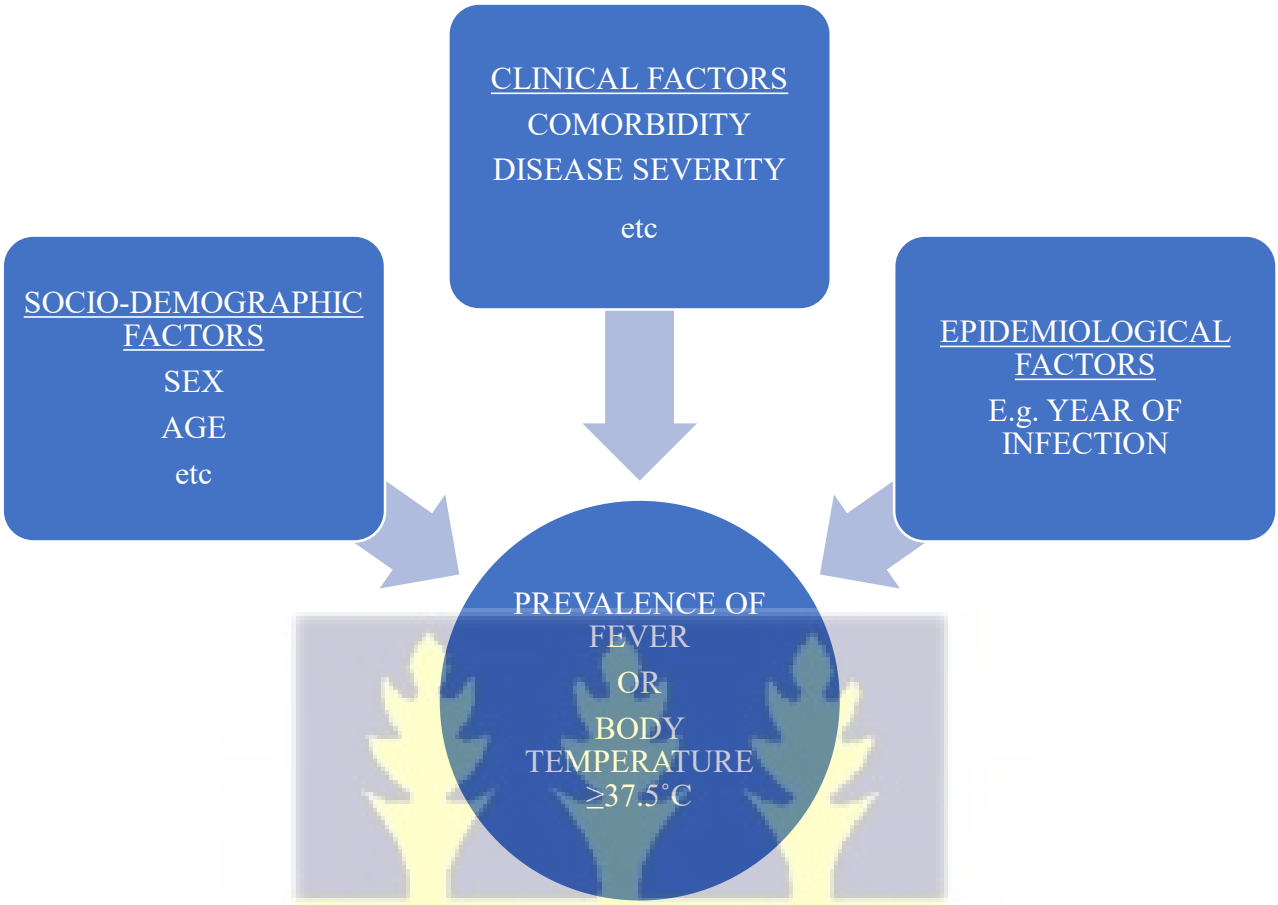

Figure 2.1: Conceptual framework for prevalence of fever and its associated factors among COVID-19 patients.

2.5. Summary of the chapter

Despite limited empirical data on the prevalence of fever and its associated factors among COVID-19 patients, analysis of relevant literature and theoretical foundation on the topic was successfully presented. Data on prevalence of fever among hospitalised COVID-19 patients were not consistent across a number of studies. Generally, socio-demographic, epidemiological, and clinical factors were associated with fever among COVID-19 patients in literature.

The next chapter presents the research methods applied in the conduct of the current study.

CHAPTER THREE

Methods

3.0. Introduction

This chapter presents the action sequence or techniques which were undertaken to arrive at the results of this study.

3.1 Philosophical assumption

The research method of this study was designed based on the positivists' philosophy. Positivism is a knowledge paradigm acknowledging only that can be scientifically verified through observation and measurement (Gilson, 2012). Positivists' position is that facts about phenomena of interest exist independent of how people understand and see them (Gilson, 2012). In this line of assumption, deductive approach is used to test existing theories to reveal facts surrounding phenomena (Gilson, 2012).

The current study sought to explore some understanding of fever in COVID-19 in terms of epidemiology and clinical science. Concepts and theories surrounding fever and its associated factors among COVID-19 patients were analysed in the literature review. It was expected that the true prevalence of fever and its associated factors would be unravelled by the use of observable and measurable data of patients who were managed for the disease. Scientifically verifiable data such as body temperature and oxygen saturation, among others were extracted from the electronic medical records of patients to aid deduce the facts surrounding fever among COVID-19 patients through quantitative analysis. Results may provide basis to have a second look at what interventions in case detection and management of COVID-19 might work best.

3.2. Study design

This study was a cross-sectional retrospective study designed to assess the prevalence of fever and its associated factors among hospitalised COVID-19 patients at the ERHK between May 5, 2020, and August 31, 2021.

Cross sectional studies "seek to explore, describe or explain a phenomenon at a particular moment in time" (Schneider & Bennett, 2012, p.72). In this type of study design, researchers therefore gather observed or measured parameters, analyse and disseminate results at a single point of time without any follow-up for additional data (Hess, 2004). When one uses an existing data recorded or recalled in the past, the study is as well referred to as retrospective study (Hess, 2004).

In this study, the electronic medical records (e-folders) of eligible participants who were discharged between May 5, 2020 and August 31, 2021 were reviewed, and data on socio-demographic and epidemiological factors, presenting body temperature, oxygen saturation (SpO_2), comorbidities and outcome at discharge collected using data extraction sheet. Data was then processed, analysed and results presented without any follow-up for additional data.

3.3. Study area

Geography: ERHK (the study setting) is located in the Eastern Region of Ghana. The region is found in the south eastern part of Ghana and has a total land area of 19, 323 square kilometres, constituting 8.1% of Ghana's total land area (Eastern Regional Co-ordinating Council, n.d.).

Demography: The Ghana Statistical Service (2021) reported 2,925,653 population size (accounting for 9.5% of Ghana's population) for Eastern region, which made the region the third most populous in Ghana after Greater Accra Region and Ashanti region. The population was 50.9% female and 49.1% male with a Rural-Urban split of 54.1% and 45.9% respectively (Ghana Statistical Service, 2021).

Economic status: The Eastern region had diverse economic activities but the pre-dominant one was agriculture which employs about 53% of the population (Eastern Regional Co-ordinating Council, n.d.).

Health care provision: The region had a total of 1,226 healthcare facilities and being supervised by 33 Municipal/ District Health Directorates to provide various levels of healthcare (Ghana Health Service, n.d.). Among the facilities were sixteen (16) district hospitals and a regional hospital (i.e., ERHK) (ERHK, n.d.).

Eastern Regional Hospital, Koforidua (ERHK): The hospital was established in 1926 and serves as the referral centre for about 3 million inhabitants of 33 districts (mainly rural) in the Eastern Region of Ghana (ERHK, n.d.). Its catchment area includes adjoining districts in the Central, Greater Accra, Ashanti, Bono East and Volta regions.

The facility operates under the GHS and it provides comprehensive medical (primary and specialist) care in all major aspects of health care (ERHK, n.d.). The services include Obstetrics and Gynaecology, Internal Medicine, including infectious diseases (Tuberculosis, COVID-19 etc.), Paediatrics, Surgery, Dental, and Ophthalmology, among others.

In the Internal medicine department where the researcher was working as a medical officer, there were three (3) physician specialists, nine (9) medical officers and twenty-one (21) house officers at the time this study was conducted. The department manages the Isolation and Treatment Centre in collaboration with the Institutional Public Health Unit. The researcher together with another medical officer were in-charge of the Isolation and Treatment Centre since the onset of the COVID-19 pandemic.

The Isolation and Treatment Centre was a 13-bed capacity ward designated at the onset of COVID-19 pandemic for inpatient management of the disease. The hospital had the laboratory capacity of

testing for COVID-19. There was a functional COVID-19 management team comprising diverse health workers such as physicians, nurses, disease control officers, pharmacists, anaesthetists, medical laboratory scientists, among others who were specially trained to provide both clinical and public health care to the COVID-19 patients. The researcher recalls that the hospital recorded its first case of COVID-19 on the 5th May, 2020.

The ERHK were using the Hospital Administration and Management System (HAMS), an electronic management system which contains information on all services provided to every client including clients' socio-demographic and clinical characteristics, out-patient and in-patient services, pharmacological and non-pharmacological treatments, and laboratory results. Each client had a unique folder number which was used to log onto the electronic folder during service delivery.

Though a single centre, the ERHK was chosen for this study because the region found itself between the two most populous regions in Ghana (i.e., Greater Accra and Ashanti), and as such, "influx" of COVID-19 cases from the neighbouring regions was expected. The researcher had over the period managed COVID-19 clients with diverse physical and demographic characteristics in the ERHK. The centre usually admits confirmed COVID-19 patients who present with at least a symptom. Asymptomatic individuals are made to undergo home isolation and self-monitoring.

3.4. Study population

The study was made up of persons of any age group who were diagnosed with COVID-19 through a polymerase chain reaction (PCR) confirmation, and were admitted and discharged at the COVID-19 Isolation and Treatment Centre of the Eastern Regional Hospital, Koforidua.

3.4.1 Inclusion criteria

Folders of all confirmed COVID-19 patients who were hospitalised and discharged at the Eastern Regional Hospital, Koforidua between May 5, 2020, and August 31, 2021, were eligible to be included in the study. This was necessary at the time because the first case of COVID-19 which required patients' admission at the Eastern Regional Hospital, Koforidua was recorded on the 5th May, 2020 while data collection was done in September, 2021.

3.4.2. Exclusion criteria

Folders of patients with no records of temperature at presentation and patients with clinically invalid temperature were excluded from the study. This was applied because 'fever', as the primary dependent variable of the study was only derived from the level of body temperature at presentation.

3.5. Sampling strategies

This section presents the methods applied to sample folders of patients into the study.

3.5.1. Sample size determination / Power analysis

Data from all the 301 folders available and eligible for the study was conveniently used in the final analysis. There was therefore the need to conduct power analysis in order "to determine the level of statistical power in the completed study for detecting an effect of a certain magnitude given the sample size in the study" (Lu et al., 2013, p. 260). For that purpose, a simple and generalised formular below was adopted. A sample size (N), an effect size (eta), and a significant level (α) were required to estimate the power, '1-b' where 'b' represents type II error (Kumar, 2020).

Sample size, $N = [(1.960 + Z_{1-b})/eta]^2$. It implies that $Z_{1-b} = eta\ (\sqrt{N}) - 1.960$.

The sample size, N=301, the significant level, α=0.05 and effect size, eta=0.5 were computed into the above formular as $Z_{1-b} = 0.5(\sqrt{301}) - 1.960$. Therefore, $Z_{1-b} = 6.715$.

The power of the study (1-b) is therefore >99% read from a Z 1-beta table.

3.5.2. Sampling method

Convenience sampling, where researchers utilise medical information at their disposal during the period of data collection is the most common sampling method employed in medical records review (Vassar & Holzmann, 2013). At the beginning of data collection in September, 2021 the available medical data involving the study population were records of patients who were admitted and discharged between 5th May, 2020. and 31st August, 2021. In view of that, all the 307 records available at the time were reviewed without further sampling. This was applied to help shield the power of the study. At the end of the review, 301 patients were finally enrolled into the study for analysis after applying the exclusion criteria.

3.6. Study variables

The variables measured in the study were divided into both dependent and independent as shown below.

3.6.1. Dependent variable

The dependent variable of the study was fever among hospitalised COVID-19 patients.

3.6.2. Independent variables

The independent variables of the study were categorised as; socio-demographic factors, epidemiological factors, and clinical factors based on the available data.

3.7. Data collection

A pre-designed data compilation form (appendix A) was used to extract relevant information during a retrospective review of medical records of 301 hospitalised COVID-19 patients who were discharged between 5th May, 2020, and 31st August, 2021. Data collection was undertaken solely by the researcher between 21st and 29th September, 2021.

The folder numbers of the patients were obtained in an admission book at the Isolation and Treatment Centre of the ERHK. Records of participants were accessed on the electronic management system using their folder numbers. Relevant data were then extracted and entered into the compilation form, opened in a Microsoft excel sheet. Data for all 307 clients admitted and discharged between 5th May 2020 and 31st August 2021 were initially collected. However, six (6) out of the 307 participants were finally omitted after applying the exclusion criteria.

3.7.1. The data collection form (appendix A)

The data collection form was sectioned to cover key themes below.

Section A. Socio-demographic and epidemiological characteristics: In this section, raw data on patient's folder number, sex, age in completed years, date of admission and date of discharge were collected. Variable named 'sex' was collected on a nominal scale and binary levels as 'male' or female. 'Age' though a continuous variable, was collected in discrete form (completed years of life) measured on a ratio scale. This was done to allow appropriate age categorisation by the researcher during data entry. Both the date of admission and discharge were collected in the format 'dd/mm/yyyy' which helped the researcher to derive the epidemiological factor 'year of COVID-19 infection' during data entry.

Section B. Comorbidity: This section of the data collection form helped the researcher to collect list of comorbidities recorded in the patient's folder. This included concurrent infection(s), pre-existing or chronic diseases identified by physicians during case management.

Section C. Temperature at presentation: Temperature measured in degree Celsius, which was first recorded at presentation of patient was collected as a continuous variable on an interval scale.

Section D. Prevalence of fever: Fever, which was operationally defined as an elevated recorded temperature of 37.5˚C and above at the time of presentation, was derived from the temperature

collected in section C of the data collection form. Patient's status on fever was then collected as a binary categorical outcome variable with levels 'fever' and 'no fever'. This was measured on a nominal scale.

Section E. Severity of disease at presentation: Data collected under this section were patients' oxygen saturation and disease severity at presentation. Oxygen saturation in percentage (%) was a continuous variable measured on a ratio scale. The variable 'disease severity', which was measured on an ordinal scale based on standardised clinical features at the time of triaging by physicians was also collected (MOH, 2020, p. 22). The ordinal levels assigned to the variable 'disease severity' were 'mild', 'moderate', 'severe' and 'critical'.

Section F. Discharge outcome (mortality): The variable named 'discharge outcome (mortality)' was a binary data with levels 'discharged alive' and 'discharged dead' to signify the presence and absence of mortality respectively. This data was collected from the software interphase named 'discharge outcome' on the electronic management system (HAMS).

3.7.2. Quality assurance

All temperatures recorded were taken on the patients' foreheads with an infrared thermometer.

As a medical officer who was involved in the management of COVID-19 and as well conversant with the hospital's electronic medical records, the researcher solely collected all data in the best possible manner.

Few unexpected or invalid data were detected on the electronic medical records. However, triage sheets for such patients were used to cross-validate data. Compilation form was thoroughly examined for completeness and errors.

The completed compilation form was protected with a password and copies saved on a personal computer.

3.7.3. Pretesting

On the 19th September, 2021 the compilation form was pre-tested by prior review of medical records of 10 randomly selected COVID-19 patients who were discharged between 1st September, 2021 and 19th September, 2021 at the ERHK. All variables were noticed to be applicable; the challenge of possible missing or wrongly entered vitals was anticipated even before the actual data collection.

3.7.4. Validity and reliability

This study was designed with the validity and reliability of the study in mind.

The COVID-19 patients who were included in the study were persons of all age group, sex, social class residing within and outside the borders of the Eastern Region of Ghana. As well, the hospital had the capacity to manage COVID-19 patients of any severity. Participants cut across all levels of severity the disease could manifest.

Moreover, the data collected were from the cases managed spanning from the onset of COVID-19 pandemic through period of emergence of new viral strains to the full enrolment of COVID-19 vaccines in the region.

Furthermore, the temperatures recorded of patients in the hospital during the pandemic were done with the handheld infrared thermometer which was acceptable globally. Although the oxygen saturations that contributed to the disease severity classification of patients were measured with pulse oximeters of diverse brands, the devices were regularly serviced by the Quality Assurance Unit of the hospital.

The researcher could therefore assure the public of the internal validity of the study. The external validity however could not be assured since the study was conducted in a single centre/region. Expertise in the management of COVID-19 differ across the country depending on the availability

of ICU, infectious disease specialist, and anaesthesiologist. This therefore could influence the outcome of the study and for that matter the generalisability beyond the borders of Eastern Region.

3.8. Data management and analysis

This section describes how data collected on the compilation form was entered, processed and analysed to arrive at the study results.

3.8.1. Data entry and processing

Each row, representing data of a participant on the compilation form, was assigned a serial number. New variables such as 'age-group', 'year of infection', and 'comorbidity' were derived from the raw data for the purpose of data entry and analysis. Age was categorised as < 60years and ≥60 years. The date of admission and date of discharge were used to derive the 'year of infection' (signifying the calendar year patients got infected). Categorical data were then coded appropriately and entry done into an excel sheet using Microsoft Excel 2019.

Data entry file was converted into a comma-separated values (CSV) file before importing into STATA statistical software for analysis.

3.8.2. Data analysis

Descriptive analysis was first conducted to summarise baseline characteristics of hospitalised COVID-19 patients at the ERHK. For each categorical data including sex, age-group, comorbidity, year of infection, disease severity, discharge outcome, and fever, a frequency table was generated. Frequencies and percentages for these categorical variables were then presented. For each continuous variable including age, temperature, and oxygen saturation, test for normality was conducted using both histogram plot and Shapiro-Wilk test. All the three (3) continuous variables were not normally distributed. They were therefore summarised and reported as median age,

median temperature, and median oxygen saturation together with their respective range and interquartile range.

To estimate the prevalence of fever with 95% confidence interval and standard error among hospitalised COVID-19 patients at the ERHK, a proportion estimate using fever as an outcome variable was computed and output was generated on the software.

Given that the variable, 'fever' was a binary outcome, and there were multiple predictor variables considered in the study by the researcher, the factors associated with fever among hospitalised COVID-19 patients at the study setting were determined using Multivariable Binomial Logistic Regression. The model was fitted using sex, age, comorbidity, year of infection, disease severity and oxygen saturation to predict the occurrence of fever among hospitalised COVID-19 patients. The model fitted the data well (LR X^2 (8), 22.91; p-value, <0.05). Analysis of the Receiver-Operating Characteristics (ROC) was computed to assess the performance of the model in predicting the occurrence of fever relative to others. The model performed well (Area under ROC curve, 0.70). Adjusted odds ratios (AOR) together with their respective 95% confidence intervals and p-values for predictors were summarised in a table. Variables with p-value <0.05 were considered as significantly associated with fever among hospitalised COVID-19 patients.

All results were presented mainly in texts and tables. All analyses were performed at 5% level of significance using Stata/IC version 16.1 software.

3.9. Ethical considerations

The necessary ethical procedures were followed in the conduct of the study.

3.9.1. Ethical clearance

Ethical clearance for the study was obtained from the Ethics Review Committee of Ghana Health Service with reference number: GHS-ERC045/08/21 (refer to appendix B).

3.9.2. Permission from the study site

A written permission was obtained from the management of the ERHK to access patients' medical records for the purpose of the study (refer to appendix C).

3.9.3. Participants' consent

Individual consent was not feasible or practicable during the medical records review of patients. COVID-19 had some adverse psychological impact on patients (Dawra et. al., 2021). So, calling each and every of the 301 eligible participants to discuss consent on the use of data recorded from their past experience was not only time and financially costly, but also might cause some psychological discomfort to the individuals. Nevertheless, permission was accordingly sought from the ERHK, the custodians of the patients' data before the study was conducted.

3.9.4. Risks and benefits

The study involved no more than minimal risk and no direct benefit to patients whose folders were reviewed.

3.9.5. Confidentiality and anonymity

Patients' names were not included in the data collection, to ensure the needed confidentiality and anonymity. Data was collectively analysed and reported without singling out any individual's detail.

3.9.6. Voluntary withdrawal

It was not applicable for participants to withdraw from the study, as they were not directly involved during the retrospective review of medical records and collection of data.

3.9.7. Compensation

There was no compensation of any form set in this study, as participants were not directly involved during the retrospective review of medical records and collection of data.

3.9.8. COVID-19 protocols

COVID-19 safety measures during data collection in the hospital setting included regular decontamination of electronic gadgets used to abstract data, regular use of alcohol-based hand sanitizer and wearing of facemask.

3.9.9. Data storage and usage

The electronically completed data collection form, data entry sheet and the STATA dataset were all stored on a password protected personal computer. Data was collected solely for the conduct of this research. The data would be completely deleted after this study is accepted and published.

3.9.10. Results dissemination

The School of Public Health, University of Ghana and the Eastern Regional Hospital, Koforidua will each receive a hardbound copy of this dissertation when passed. The researcher will subsequently work together with the supervisor to process the study findings for publication.

3.9.11. Conflict of interest

The researcher declares no conflict of interest in the conduct of this study.

3.9.12. Funding

The study was funded solely by the researcher.

3.10. Summary of the chapter

The 'Methods' chapter presented above has sequentially described the steps the researcher undertook to arrive at the research findings that will be presented in the next chapter.

CHAPTER FOUR

Results

4.0. Introduction

This chapter presents the main findings obtained from the data analysis, addressing the key research questions.

4.1. Baseline characteristics of hospitalised COVID-19 patients

At the time of data collection, a total of 307 patients who tested positive to COVID-19 were admitted and discharged at the Eastern Regional Hospital, Koforidua. Out of this number, there were missing temperatures for 6 patients and therefore were excluded from the analysis.

Table 4.1 below presents the demographic, epidemiological and clinical characteristics of COVID-19 patients at the Eastern Regional Hospital, Koforidua. Out of 301 patients who were included in the final analysis, 148 (49.2%) were males and 153 (50.8%) were females. The median age of patients was 56 years (IQR, 36-70 years; range, 0.3-102years). Majority of the patients were <60 years old (164/301, 54.5%) while 45.5% were ≥60years. There was a surge in the total number of cases in the year 2021 (during the first 8 months) compared to 2020 (232, 77.1% versus 69, 22.9%). One or more comorbidities were identified in 210 (69.8%) patients. At the initial encounter, patients presented with a median temperature of 36.6 °C (IQR, 36.3-37.2°C; range, 34.7-40.0°C), and 21.6% of these patients had fever (temperature ≥37.5°C). However, only 298 patients had their oxygen saturation recorded at the time of presentation. Their median oxygen saturation was 91% (IQR, 83-98%; range, 27-100%). Approximately, half of the patients (n=299, 150, 50.2%) presented with severe disease; 7.4% (22/299) presented with critical disease. Sixty seven out of the 301 individuals (22.3%) were discharged dead following hospitalisation.

Table 4.1. Baseline characteristics of hospitalised COVID-19 patients

Variables	No. (%) N= 301
Demographic and epidemiological data	
Age, median (IQR) [range], years	56 (36-70) [0.3-102]
Age-group	
< 60 years	164 (54.5)
≥ 60 years	137 (45.5)
Sex	
Male	148 (49.2)
Female	153 (50.8)
Year of infection	
2020	69 (22.9)
2021	232 (77.1)
Clinical data	
Presenting temperature, median (IQR) [range], ˚C	36.6 (36.3-37.2) [34.7-40.0]
Fever (Presenting temperature ≥37.5 ˚C)	65 (21.6)
No fever	236 (78.4)
Comorbidity	
One or more comorbidities [a]	210 (69.8)
No comorbidity	91 (30.2)
Presenting Oxygen saturation, median (IQR) [range], % (n=298)	91 (83-98) [27-100]
Disease severity (n=299)	
Mild	66 (22.07)
Moderate	61 (20.40)
Severe	150 (50.17)
Critical	22 (7.36)
Discharge outcome	
Discharged alive	234 (77.7)
Discharged dead	67 (22.3)

Abbreviations and symbols: COVID-19, coronavirus disease 2019; IQR, interquartile range; No., number of observation or frequency; N, total sample size.

[a]Comorbidities identified among others were hypertension, diabetes, heart failure, asthma, retroviral infection, pulmonary tuberculosis, lung fibrosis, chronic kidney disease, and sickle cell disease.

[b]Disease severity was determined using presenting oxygen saturation, clinical symptom(s) of pneumonia and the presence or absence of end organ damage (World Health Organisation, 2020).

4.2. Prevalence of fever among hospitalised COVID-19 patients

A proportion estimate of fever using the study sample was computed to address the research question 'what is the prevalence of fever among hospitalized COVID-19 patients at the Eastern Regional Hospital, Koforidua?'. It was found that the prevalence of fever (defined as an elevated presenting temperature of ≥37.5°C) among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua was 21.6% (95% CI, 17.1%-26.7%; SE, 2.4%) (Table 4.2). The researcher was 95% confident that the true prevalence of fever will fall between 17.1% and 26.7%.

Table 4.2. Prevalence of fever among hospitalised COVID-19 patients

Variable	Sample size	Proportion	95% CI	Standard Error
Fever	301	21.6%	17.1%–26.7%	2.4%

CI, confidence interval; COVID-19, coronavirus disease 2019.

4.3. Factors associated with fever among hospitalised COVID-19 patients

A multivariable logistic regression was used to determine factors associated with fever among hospitalised COVID-19 patients. The relationship between sex, age, comorbidity, year of infection, disease severity, oxygen saturation level and fever were analysed in a model which was statistically significant (LR X^2 (8), 22.91; p-value, <0.05; area under ROC curve, 0.70).

As portrayed in Table 4.3 below, it was found that the factors associated with fever among hospitalised COVID-19 patients were age, comorbidity, and disease severity (p<0.05). The odds of fever occurring decreased by 3% (AOR, 0.97; 95% CI, 0.96-0.99) for a unit increase in age of patients, holding all the other factors constant. There were over 2-fold increased odds of fever (AOR, 2.37; 95% CI, 1.11-5.06) among patients who had one or more comorbidities compared to

patients who had no comorbidity, controlling for the effects of all the other factors. Moderate disease, severe disease and critical disease were associated with 3.41 times (95% CI, 1.22-9.52), 3.61 times (95% CI, 1.18-11.07) and 5.71 times (95% CI, 1.23-26.58) higher odds of fever respectively, compared to mild disease.

Sex and year of infection were not however found to be significantly associated with fever among hospitalised COVID-19 patients ($p>0.05$) (Table 4.3).

Table 4.3. Multivariable logistic regression analysis of factors associated with fever among hospitalised COVID-19 patients

Factor	Adjusted Odds Ratio	95% CI	P-value
Sex			
Male	1.00 (reference)		
Female	1.17	0.64 – 2.11	0.61
Age, years	0.97	0.96 – 0.99	**0.00**
Comorbidity			
No comorbidity	1.00 (reference)		
One or more comorbidities	2.37	1.11 – 5.06	**0.03**
Year of infection			
2020	1.00 (reference)		
2021	1.38	0.61 – 3.13	0.43
Disease severity			
Mild	1.00 (reference)		
Moderate	3.41	1.22 – 9.52	**0.02**
Severe	3.61	1.18 – 11.07	**0.03**
Critical	5.71	1.23 – 26.58	**0.03**
Presenting oxygen saturation, %	1.02	0.99 – 1.06	0.19

Abbreviation: CI, confidence interval.

P-values highlighted in bold were considered statistically significant ($p<0.05$).

4.4. Summary of the chapter

The above chapter concisely presented the main findings obtained from data collection and analysis, addressing the key research questions. The next chapter will present discussion of the findings.

CHAPTER FIVE

Discussion of Findings

5.0. Introduction

This chapter seeks to relate the main findings of the current study to literature, making comparative analysis and inferring findings to the functionalist theoretical perspective.

5.1. Characteristics of hospitalised COVID-19 patients

Over the 16-month period, a total of 307 patients were admitted and discharged at the Isolation and Treatment Centre of the regional hospital in Koforidua. This figure was coincidentally the same as the number recorded at the two centres in the Greater Accra Region between the months of March and June of the year 2020 (Ashinyo et al., 2020).

In this study, there were slightly more females (50.8%) than males (49.2%), contrary to reports from previous studies conducted in Accra by Ashinyo et al. (2020) and Oduro-Mensah et al. (2020), where the prevalence of COVID-19 was higher among males (56.7% and 54.5% respectively). The current finding on sex distribution was as well not consistent with what had been reported in a number of studies conducted outside Ghana. In fact, up to 59.3% of patients were males in one study conducted in a New York City Hospital (James, Kishore & Lee, 2020). Perhaps, the men had improved from their risky behaviours over time during the course of the pandemic.

The average age of participants was 56 years as against 37.9 years and 40.7 years respectively found in the two different studies conducted in Accra (Ashinyo et. al., 2020; Oduro-Mensah et al., 2020). Like the study conducted in Accra, a higher proportion of COVID-19 patients were found to be less than 60 years old. The consistent findings support the assertion that the virus infects a younger and economically viable population (Ashinyo et al., 2020).

There was a surge in the COVID-19 admitted cases at the Eastern Regional Hospital, Koforidua in the first 8 months of 2021, which contributed up to 77.1% of the cases admitted within the first 16 months of COVID-19 admissions in the hospital. This rise may be associated with a possible increased viral spread among people during the Christmas, New year, Easter and Eid festivities which happened consecutively from December, 2020.

Comorbid conditions were found in over 69% of patients in this study which was far higher than 25.1% and 39% reported in Accra by Ashinyo et al. (2020) and Oduro-Mensah et al. (2020). This increased percentage may be attributed to the nosocomial COVID-19 infection among in-patients who were otherwise admitted on account of their pre-existing conditions at the Eastern Regional Hospital, Koforidua.

The study found a median temperature at presentation of 36.6˚C, which was clinically consistent with the mean temperature of 36.3˚C reported in the previous study in Accra (Ashinyo et al., 2020). The significance here was that, on average COVID-19 patients were presenting with temperatures less than the cut off for fever (i.e., <37.5 ˚C). Tharakan and his colleagues also reported an average body temperature of 37.0˚C at first encounter in Mount Sinai (Tharakan et al., 2020). This consistent normal average temperature indicates that the viral illness on average does not cause elevated body temperature.

Over 50% of the patients presented with severe disease in this current study which analysed data for only hospitalised patients. As low as only 5.1% presented with moderate to severe disease in the study conducted by Oduro-Mensah et al. (2020) which analysed both outpatient and in-patient data. This discrepancy was compounded by the increased cases of nosocomial COVID-19 among hospitalised patients who already were severely ill at the Eastern Regional Hospital, Koforidua

before testing positive to SARS-CoV-2. It may as well explain the high number (22.3%) of patients who were discharged dead in the current study.

5.2. Prevalence of fever among COVID-19 patients

Contrary to the report of 98.6% fever prevalence among hospitalised COVID-19 patients in one of the earliest studies conducted in Wuhan, China (Wang et al., 2020), the prevalence of fever in the current study was as low as 21.6%. This finding was somewhat consistent with findings in both the published data in Ghana, where prevalence of fever was reported as 29.6% by Ashinyo et al. (2020) and the case series involving COVID-19 patients admitted to 12 hospitals in New York City, Long Island, and Westchester County where 30.7% presented with fever during triaging by Richardson et al. (2020). Therefore, a more significant number of COVID-19 cases may be missed by the sole reliance on temperature screening in Ghana.

5.3. Factors associated with fever among hospitalised COVID-19 patients

Since the onset of COVID-19 outbreak in Wuhan, China, various topics regarding the novel coronavirus were explored by researchers globally. In this current work, the researcher assessed factors associated with fever after estimating the fever prevalence among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua. To the best of the researcher's knowledge, there was a scarce literature on the chosen topic.

In a functionalist perspective, the researcher presumed that the occurrence of fever among COVID-19 patients must be associated with certain factors. Based on the multivariable logistic regression analysis in this study, the factors significantly associated with fever among hospitalised COVID-19 patients were found to be age, comorbidity and disease severity.

Keeping other factors constant, hospitalised patients who were a year older had 3% less odds of presenting with fever from COVID-19. This finding was consistent with the theory that older

people tend to have reduced febrile response (Roghmann et al., 2001). That means younger hospitalised COVID-19 patients were more likely to present with fever. Consequently, temperature screening, despite its limitations was likely to detect COVID-19 better among the younger patients compared to the older ones.

The second factor found to be associated with fever was comorbidity. Patients with at least one comorbidity compared to those without any comorbidity had more than 2-fold odds of presenting with fever. Despite lack of comparative data, the association between comorbidity and fever was likely to be multifactorial. It may be argued that some other fever-causing disease conditions among the patients with at least one comorbidity might had independently led to fever. This study did not analyse how each comorbidity associated with fever among the patients. Nevertheless, comorbidity in general played a role in the prevalence of fever among hospitalised COVID-19 patients. That means temperature screening may detect COVID-19 patients better among those with at least a comorbidity. More so, such group of patients may require close monitoring and management, considering the literature that supports the link between fever and mortality.

From the study results, different levels of disease severity were interestingly associated with the odds of fever. The higher the level of disease severity, the greater the odds of presenting with fever. This finding is consistent with the assumption that disease severity increases the body's inflammatory processes and therefore may increase body temperature. The association found between severity of disease and fever also conformed with the findings in previous studies (Leulseged et al., 2022; Li et al., 2021). The implication of this finding is that temperature screening may detect more COVID-19 cases at late stage of the disease. Using temperature screening alone therefore may be misleading in early detection of patients with the disease.

Factors such as sex and year of infection did not show any significant association with fever among hospitalised COVID-19 patients, contrary to what was theorized in the literature review of this study. Perhaps, there were other factors needed to be included in the model to help modify or reveal the association between fever and those two variables.

CHAPTER SIX

Summary, Conclusion and Recommendations

6.0. Introduction

This chapter seeks to summarise, present appropriate conclusion and recommendations to various stakeholders based on the findings of the study.

6.1. Summary of the study

The current study was specially conducted to analyse the prevalence of fever and its associated factors among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua. Data was collected through a retrospective medical records review of COVID-19 patients admitted and discharged at the hospital. The prevalence of fever was estimated with 95% confidence interval and a multiple logistic regression model was used to determine the factors associated with fever at 5% level of significance. It was found that the prevalence of fever among the hospitalised COVID-19 patients was 21.6%. Also, factors associated with fever were age, comorbidity and disease severity.

6.2. Conclusion of the study

This section presents the conclusions in relation to the specific objectives of the study. The specific objectives were; 1) to estimate the prevalence of fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua and 2) to determine the factors associated with fever among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua.

6.2.1. Prevalence of fever among hospitalised COVID-19 patients

Similar to the findings in the study by Ashinyo et al. (2020), on average, COVID-19 patients did not present with elevated body temperature and therefore fever was not common at presentation among symptomatic patients hospitalised at the Eastern Regional Hospital, Koforidua. A more

significant number of COVID-19 cases were likely being missed with the temperature screening policy in Ghana (WHO, 2020b). The temperature screening may not be a rapid tool or enough for detecting individuals with COVID-19. A checklist of other symptoms/signs should be employed in conjunction with the temperature screening to help improve early case detection.

6.2.2. Factors associated with fever among hospitalised COVID-19 patients

Despite the low prevalence of fever, factors including age, comorbidity and disease severity were significantly associated with fever among hospitalised COVID-19 patients. Therefore, temperature screening may play its role better when applied on individuals who are older, have at least a comorbidity and/or have severe disease than its use on the general population. Prompt admission would be necessary for close monitoring and management of older patients, patients with comorbidities and/or severe disease.

A higher-level study may however be required to cross-validate and enhance the generalisability of this research findings beyond the Eastern Regional Hospital, Koforidua.

6.3. Contribution to knowledge

This section presents the contribution of this study to knowledge in the areas of policy and practice, theory, and methodology as presented below.

6.3.1. Contribution to policy and practice

This study provides a good basis for reshaping and improving the implementation of the policy regarding early detection and management of COVID-19 adopted by GHS. The study revealed that temperature screening was not enough for early detection of cases, since fever was not that prevalent among COVID-19 patients. In the area of practice, healthcare workers would not be deceived by the absence of fever in early case detection of COVID-19, based on the current

knowledge on the low prevalence of fever. A management protocol established to include the factors associated with fever as a risk stratification tool could be considered by health facilities.

6.3.2. Contribution to theory

The functionalists' perspective might have been applied in studies conducted elsewhere, but this study may be one of few studies that seems to have applied it in a study on prevalence of fever and its associated factors among hospitalised COVID-19 patients at the Eastern Regional Hospital, Koforidua. Based on the perspective held by the researcher, factors associated with fever in a disease caused by a novel coronavirus was unravelled. This strengthens the role of functionalism in generating possible interconnectedness and association between two or more variables as applied in social and clinical sciences.

6.3.3. Contribution to methodology

Either quantitative or qualitative methods or both could be applied in medical records review in the conduct of similar studies to assess associated or risk factors of a selected outcome variable. However, this study applied quantitative methods to help objectively quantify the prevalence of fever and its associated factors. The data collected included temperature and oxygen saturation which were measured and recorded primarily not for the purpose of this study (secondary quantitative data). Although, the researcher failed to apply both methods, a qualitative method alone would not have been able to achieve what the quantitative method applied in this study did.

6.4. Recommendations of the study

Based on the study findings and conclusions, this section presents the appropriate recommendations to the stakeholders presented below.

6.4.1. Ministry of Health/ Ghana Health Service

The Ministry of Health in collaboration with the Ghana Health Service should seek to revise the policy on early detection of COVID-19, especially the sole use of temperature screening at entry points in health facilities across the country. Other screening tools such as the use of symptom checklist and/or rapid diagnostic kits for COVID-19 should be employed together with the temperature screening to augment early detection and management. The Ghana Health Service could as well perform a nationwide economic evaluation of the temperature screening policy in the country. This will help clearly spell-out the need or otherwise to review the policy.

6.4.2. Management of the Eastern Regional Hospital, Koforidua

The management of the Eastern Regional Hospital, Koforidua where the findings of this research directly apply to should seek to provide organisational policies and guidelines towards early detection and management. For example, aside the thermometer guns provided, management should develop and make available a comprehensive COVID-19 early detection algorithm at various entry points and on the wards of the hospital. The hospital with the support of GHS should acquire and make available rapid diagnostic kits for COVID-19 to aid in screening of patients other than the sole reliance on low prevalent symptom like fever.

6.4.3. Healthcare Providers/ Staff

Healthcare providers/ staff should consider and pay attention to factors like travel history and symptoms other than fever to rapidly screen and detect COVID-19 before admitting patients to the regular wards. This would help curtail nosocomial spread of the virus among severely ill patients in the hospital. Prompt admission would be necessary for close monitoring and management of older patients, patients with comorbidities and/or severe disease, who are at higher risk of fever and for that matter mortality, supposing data in literature is applicable to the Ghanaian setting.

6.5. Limitations to the study

The study was limited to only one COVID-19 Isolation and Treatment Centre in a single region among 16 regions in Ghana. Findings therefore may be difficult to be generalised to the larger population of Ghana.

The study did not consider patients who were referred or translocated from other facilities as a potential factor that might have influenced the temperature on arrival at the Eastern Regional Hospital, Koforidua. Some patients might have received antipyretics from their referring facilities before been translocated.

Also, records on socio-demographic and epidemiological data were limited to only sex, age and year of infection for majority of eligible participants on the electronic medical system of the Eastern Regional Hospital, Koforidua. Factors such as place of residence, occupation, travel history, among others were therefore not included in the data collection and analysis.

Lastly, the COVID-19 pandemic itself had restricted the researcher in the conduct of the study. The researcher could not physically engage patients and healthcare providers in qualitative interviews which would have helped to consolidate data and as well provide explanations to the quantitative findings.

6.6. Future Research

In order to enhance generalisation beyond the Eastern Regional Hospital, Koforidua, the Ghana Health Service should conduct further and broader study involving all COVID-19 Treatment Centres across the country. Future study with similar topic could even consider a cohort study design where non-COVID-19 patients could be included as control group to be able to compare the temperatures across the groups. Both qualitative and quantitative methods could be applied

together in such future studies to help consolidate data and provide both exploratory and explanatory findings.

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Appendices

University of Ghana

College of Health Sciences

School of Public Health

Appendix A: Data compilation form

Serial number	Section A: Socio-demographic and epidemiological characteristics					Section B: Comorbidity	Section C: Temperature at Presentation(˚C)	Section D: Prevalence of Fever	Section E: Severity of disease at presentation		Section F: Discharge outcome(mortality)
	Folder #	Sex	Age (completed years)	Admission Date	Discharge Date			Fever status	Oxygen saturation (%)	Disease Severity at presentation	

Appendix B: Ethical approval by Ghana Health Service Ethics Review Committee

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
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Fax + 233-302-685424
Email: ethics.research@ghsmail.org

MyRef. GHS/RDD/ERC/Admin/App/21/381
Your Ref. No.

13th September, 2021

Bashir, Alhassan Muhyideen
University of Ghana
School of Public Health

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

GHS-ERC Number	**GHS-ERC045/08/21**
Study Title	Analysis of Trends in Fever among Hospitalized COVID-19Patients at The Eastern Regional Hospital, Koforidua
Approval Date	13th September, 2021
Expiry Date	12th September, 2022
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a 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.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

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

Appendix C: Approval to conduct research at the Eastern Regional Hospital, Koforidua

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

GHANA HEALTH SERVICE
Your Health · Our Concern

EASTERN REGIONAL HOSPITAL
P.O. BOX 201
KOFORIDUA, E/R.
GHANA – WEST AFRICA.

TEL. # 03420- 23011
FAX # 03420- 25294
Website:www.erhk.org
Email:info@erhk.org /
eastern.rh@ghs.gov.gh

My Ref. No.: GHS/ERHK/ GF 037

Your Ref. No.:.....

5TH AUGUST, 2021.

THE HEAD OF DEPARTMENT
HEALTH POLICY, PLANNING AND MANAGEMENT
SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF GHANA
LEGON, ACCRA

Dear Sir,

APPROVAL TO CONDUCT RESEARCH AT THE EASTERN REGIOAL HOSPITAL MUHYIDEEN ALHASSAN BASHIR

Management of the Eastern Regional Hospital, Koforidua wishes to inform you that approval is hereby given to Muhyideen Alhassan Bashir, who is a student of the aforementioned university to conduct research on the topic **"Analysis of Trends in Fever among Hospitalized COVID-19 Patients at The Eastern Regional Hospital, Koforidua"**.

You may therefore accord him the necessary assistance for the research project to continue.
Thank you.

Yours faithfully,

.....
Dr. Arko Akoto-Ampaw
Medical Director.

CC:
Muhyideen Alhassan Bashir.