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Influence of Comorbidities on the Length of Stay of Covid-19 Patients in Kenyatta National Hospital – Infectious Disease Unit (KNH–IDU), Nairobi County, Kenya

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Abstract

Purpose: To determine the influence of comorbidities on the LOS of COVID-19 patients in KNH-IDU between 1st June 2020 and 30th November 2020

Materials and Methods: This retrospective cohort study comprised of 558 COVID-19 patients of which 69% survived and 31% died. The overall median LOS was 7.5 days (IQR: 0-183) – 8 days (IQR: 1-171) for the survivors, and 6 days (IQR: 0-183) for the non survivors. Data was extracted from hospital records using a questionnaire and analyzed with STATA version 15. Chi-square tests determined associations, while regression analysis examined LOS determinants based on model coefficients and significance.

Findings: Significant differences were seen in age ($p<0.01$), with more survivors aged 20-40 years and non-survivors aged over 40 years. Non-survivors had higher referral rates ($p<.001$), ICU admissions ($p<.001$), and intubation needs ($p<.001$). Diabetes and hypertension were more common in non-survivors ($p<.001$). Non-survivors also had higher WBC counts ($p<.001$), higher neutrophil counts ($p<.01$), lower lymphocyte counts ($p<.001$), and lower platelet counts ($p<.001$).

Implications to Theory, Practices and Policy: Practically, the findings underscore the need for targeted clinical management strategies, particularly for younger patients and those with severe disease, to optimize LOS and improve survival rates.

Keywords: *Comorbidities, Length Stay, Covid-19 Patients, Kenyatta National Hospital*

1.0 INTRODUCTION

In December 2019, several cases of a peculiar acute respiratory tract infection were reported in Wuhan, China. The disease, later identified as COVID-19, was found to be caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Since then, this disease has rapidly developed into a global pandemic which is still ongoing (Bowmans, 2020; Chen et al., 2020; Lewnard et al., 2020; Ministry of Health, 2020; Mulu et al., 2021; Richards et al., 2022). Kenya confirmed its first case on 13th March 2020 (Ministry of Health, 2020). The course and prognosis of COVID-19 is poorly understood, with some patients remaining asymptomatic while others developing severe disease (Centers for Disease Control and Prevention, 2020; Zheng et al., 2020). COVID-19 not only strains the ability of the current health system to cater to the demands of patients with other illnesses, but also overburdens the wards and intensive care units (ICUs) with an surge of patients with complicated illnesses (Chen et al., 2020; Rees et al., 2020; Wu and McGoogan, 2020).

Public health protocols including strict social distancing and confinement (isolation, quarantine and lockdowns also known as cordon sanitaire), regular hand washing and sanitizing, contact tracing, and the wearing of face masks have been adopted to reduce the incidence and mortality of the disease (flattening the curve) (Bowmans et al., 2020; Centers for Disease Control and Prevention, 2020; Ministry of Health, 2020). However, COVID-19 continues to be a burden particularly in resource poor countries like Kenya (Ministry of Health, 2020). To address the influx of these cases in Kenya, the government implemented several strategies to strengthen the healthcare system's ability to handle and treat COVID-19 (Bowmans, 2020; Ministry of Health, 2020). The government converted several learning institutions and non-health facilities into quarantine and isolation facilities and increased its resources towards mitigating the effects of the disease (Bowmans, 2020; Ministry of Health, 2020; Owino, 2020).

The spectrum of COVID-19 disease ranges from asymptomatic to critical disease (Cascella et al., 2020). This classification is dependent on clinical features, laboratory reports and radiological findings (Centers for Disease Control and Prevention, 2020; Chen et al., 2020; Ministry of Health, 2020; Ombajo et al, 2020). The World Health Organization (WHO) states that more than 80% of infected patients suffer a mild to moderate form of the disease, while approximately 15% have severe symptoms. Less than 5% of patients with severe illness may require hospitalization and ICU care (WHO, 2021). According to the management protocols of COVID-19 in Kenya, patients with severe illness were to be admitted to designated institutions (such as the Infectious Disease Unit of the Kenyatta National Hospital (KNH-IDU)) for treatment, while those with mild to moderate illness were to be allowed to be on home based care whenever feasible (Ministry of Health, 2020). The length of hospital stay (LOS) varies among patients, among institutions, and among different countries (Rees et al, 2020; Wu et al, 2020). Several studies suggest that patients' attributes such as age and gender, disease severity and comorbidities may affect the LOS (Abate et al., 2020; D'ascanio et al., 2021; Gupta et al., 2020; Liu et al., 2020; Peckham et al., 2020; Sanyaolu et al., 2020; Swann et al., 2020; Zheng et al., 2020). However, most studies do not report LOS as a primary outcome and this variable is thus not analyzed extensively (Wu et al., 2020). In some cases, the differences in LOS could be attributed to different protocols for admission and discharge between institutions and even countries, and chronological differences within the course of the pandemic (Gupta et al., 2020; Rees et al., 2020).

Finding out the influence of comorbidities on the LOS of COVID-19 patients in KNH-IDU is important (Njoroge, 2019). This study included patients who were admitted to KNH – IDU, Nairobi County, Kenya, with laboratory-confirmed COVID-19 between 1st June 2020 and 30th November 2020. The study sought to establish the determinants of LOS in the aforementioned facility during the study period. By 30th November 2020 (the end of the study period), there were 83,618 confirmed positive cases in the country, with 1,469 mortalities, and 1,282 patients receiving hospital care in various health facilities countrywide (National Emergency Response Committee, 2020). About 1,200 patients received hospital care at KNH-IDU between March and November 2020. Vaccines were still in their early stages of development with none having been approved for medical use in the country by 30th November 2020 (Ministry of Health, 2020), which was the end of the study period.

Statement of the Problem

Due to the evolving nature of the disease and its treatment protocols, knowledge on COVID-19 is limited, and data is regularly updated as it becomes available (Centers for Disease Control and Prevention, 2020; Zheng et al., 2020), and keeping abreast with the latest information concerning the disease is a constant limitation to implementation of the treatment protocols and prevention procedures. COVID-19 overburdens the wards and intensive care units (ICUs) with an increase of patients with complicated illness (Chen et al., 2020; Rees et al., 2020; Wu et al., 2020). Length of stay has an impact on both the patient and the health system. In a meta-analysis including 27 studies and more than 11,000 patients, Rotter et al. (2010), showed that the longer a patient stays in hospital, the less likely they are to have a positive outcome. This is because longer LOS puts the patient at a greater risk of developing hospital acquired infections, and in facilities that require payment, a higher hospital bill. Moreover, longer LOS may mean that the bed and other hospital resources are not available for patients who may also require in-patient care. This may in turn lower the hospital's turnover and decrease revenue (Rotter et al., 2010; Richards et al., 2022). Therefore, shorter LOS is better for both the patients and the hospital.

Understanding the dynamics of the length of hospital stay (LOS) for COVID-19 patients is crucial for the effective management of hospital resources and patient care, particularly in developing countries like Kenya (Wangari & Njihia, 2020). This knowledge is essential for accurately estimating hospitalization duration, predicting hospital bed demand, understanding disease progression, and optimizing resource planning and allocation (Rees et al., 2020; Richards et al., 2022; Wu et al., 2020). Firstly, the LOS of COVID-19 patients provides critical insights into disease progression and severity. By analyzing LOS data, healthcare providers can better understand the trajectory of the disease, which in turn informs clinical care strategies and patient management. Recognizing the factors associated with prolonged LOS is particularly important for identifying high-risk patients who may require more intensive care. Tailored treatment plans can be developed for these patients, ensuring they receive the appropriate level of care necessary for recovery (Rees et al., 2020; Wu et al., 2020).

Secondly, accurate data on LOS is vital for hospital capacity planning. This information ensures that healthcare resources are allocated efficiently, especially during pandemic peaks when the demand for hospital beds and medical supplies is high. Effective capacity planning helps in staffing and supply chain management, enabling hospitals to prepare adequately to meet patient needs and avoid resource shortages. This preparedness is essential for maintaining continuous, high-quality care during times of crisis (Rees et al., 2020).

The availability of detailed LOS information is crucial not only for enhancing the quality of patient care but also for facilitating strategic planning for the management of COVID-19 patients and the development of targeted interventions to minimize hospital stay durations. Such interventions could include the implementation of community-based care models and patient follow-up protocols. Therefore, this study evaluated the influence of comorbidities on the LOS of COVID-19 patients in KNH-IDU between 1st June 2020 and 30th November 2020. The selection of KNH-IDU as the study site was deliberate, given its status as one of the largest government-designated referral and isolation centers for COVID-19 patients in Kenya.

The availability of detailed LOS information is crucial not only for enhancing the quality of patient care but also for facilitating strategic planning for the management of COVID-19 patients and the development of targeted interventions to minimize hospital stay durations. Such interventions could include the implementation of community-based care models and patient follow-up protocols. Therefore, this study investigated the determinants of LOS among COVID-19 patients admitted to the Kenyatta National Hospital – Infectious Disease Unit (KNH-IDU) in Nairobi County. The selection of KNH-IDU as the study site was deliberate, given its status as one of the largest government-designated referral and isolation centers for COVID-19 patients in Kenya. This study aimed to describe the factors influencing LOS in this critical setting, thereby contributing critical insights that could inform policymaking, enhance patient management strategies, and improve the overall response to the COVID-19 pandemic within the region

Research Objective

To determine the influence of comorbidities on the LOS of COVID-19 patients in KNH-IDU between 1st June 2020 and 30th November 2020.

Study Limitations

The study faced various limitation. Data availability and completeness posed significant challenges, as incomplete or missing patient records can affect the accuracy and comprehensiveness of the analysis. Additionally, the single-site nature of the study limits the generalizability of the findings to other settings, as patient demographics, healthcare infrastructure and treatment protocols may differ across regions and hospitals. Variations in clinical practices and resource availability could also impact the applicability of the results to other contexts.

2.0 LITERATURE REVIEW

Theoretical Framework

The complexity of determining the LOS in healthcare settings is well-documented, with various factors contributing to its variability. Schorr's seminal work provides a foundational theoretical framework for examining LOS, positing that its determination transcends simplistic attributions to single factors. Instead, Schorr advocates for a multidimensional model that can be tailored and implemented across diverse healthcare environments. Such a model not only aids planning and resource distribution but also influences healthcare policy development and standardization of healthcare services, thereby enhancing the overall quality of patient care (Schorr, 2012).

To adequately understand the determinants of LOS, Schorr categorizes these factors into four distinct groups, each representing a different dimension of influence:

Patient factors: This category includes a variety of personal attributes that can significantly influence the management and outcomes of a patient's hospital stay. These characteristics encompass age, gender, race, religion, level of family support, the patient's knowledge of healthcare systems, medical history, comorbidities, health-seeking behaviors, and place of residence.

Age, gender, and ethnicity: These factors are critical as they can affect disease severity and recovery durations. Older age, male gender, and certain ethnic backgrounds have been associated with more severe COVID-19 outcomes and longer lengths of stay (LOS) in hospitals.

Comorbidities: The presence of existing medical conditions such as diabetes and hypertension can complicate COVID-19 treatment, leading to prolonged LOS. These conditions often require additional medical interventions and monitoring, which can delay recovery.

Health behaviors: Lifestyle choices such as smoking, alcohol consumption, and levels of physical activity also play a crucial role. Unhealthy behaviors can weaken the immune system and exacerbate disease severity, further complicating treatment and extending hospital stays.

Clinical factors: These factors play a critical role in determining the trajectory of COVID-19 patients during hospitalization. The severity of the disease upon admission, particularly the presence of respiratory distress and the need for ICU care, is a primary determinant of patient outcomes. Severe cases often require intensive interventions, including mechanical ventilation and continuous monitoring, which can extend the length of hospital stay. Additionally, the treatment protocols employed, such as the administration of antivirals and corticosteroids, significantly influence recovery. The timing, type, and effectiveness of these treatments are crucial in mitigating the impact of the virus and promoting faster recovery. Furthermore, complications that arise during hospitalization, such as secondary infections, organ failure, or other medical issues, can severely complicate treatment and prolong the duration of stay. Understanding and addressing these clinical factors are essential for improving patient outcomes and optimizing the use of healthcare resources during the length of stay.

Healthcare system factors: These factors are crucial in shaping patients' length of stay and outcomes during the COVID-19 pandemic. Key elements include hospital resources such as bed availability, ICU capacity, staffing levels, and the availability of medical equipment. These resources directly impact the ability of the hospital to accommodate and treat a surge in patients effectively. Additionally, the presence of well-defined policies and protocols, including guidelines on infection control, patient care, and discharge strategies, ensures that hospitals can maintain high standards of care and safety. Efficient care coordination within the hospital and with external providers is also essential. This involves communication and collaboration among healthcare teams and with external healthcare facilities to ensure continuity of care, optimize resource utilization, and improve patient outcomes. Overall, the healthcare system and its preparedness play a vital role in managing the hospital length of stay and providing effective patient care.

Environmental factors: The dynamics of the COVID-19 pandemic have impacted healthcare systems, particularly through case surges and increased hospitalizations that strain resources and capacities. Socioeconomic factors, including socioeconomic status, insurance coverage, and healthcare accessibility, further influence patient outcomes by affecting the ability of individuals to seek and receive timely medical care. These factors significantly impact access to healthcare, where individuals from lower social-economic backgrounds may face barriers such as inadequate

insurance coverage, limited access to quality medical care, and delayed treatment seeking due to financial constraints. In addition, public health interventions such as lockdowns, social distancing measures, and vaccination programs play a crucial role in mitigating the spread of the virus and reducing the burden on healthcare systems. These interventions help control infection rates, protect vulnerable populations, and ultimately improve the overall effectiveness of the pandemic response.

The study hypothesized several relationships influencing the LOS) for COVID-19 patients. Firstly, patient factors such as advanced age, male gender, and the presence of comorbidities are expected to be associated with prolonged LOS due to increased illness severity and slower recuperation rates. Secondly, clinical factors, including heightened disease severity at admission and complications arising during hospitalization, are anticipated to extend LOS. Thirdly, the role of healthcare system factors relating to hospitals equipped with adequate resources and effective policies, which are likely to reduce LOS by providing timely and high-quality care. Lastly, environmental factors, such as higher socioeconomic status and public health interventions, may decrease LOS by facilitating faster recovery and more efficient discharge processes.

While Schorr's model is multifaceted, this study elected to focus primarily on the first two categories regarding patient-inherent characteristics and clinical factors. This deliberate focus aims to understand how individual differences among patients influence LOS, recognizing that personal attributes and circumstances can significantly affect the duration of hospitalization. Furthermore, the study examined how clinical factors, including COVID-19 severity at admission, treatment effectiveness, and the occurrence of secondary infections or complications during hospitalization, affected the length of stay. By anchoring the investigation within this theoretical framework, the study seeks to advance knowledge of the personalized aspects of healthcare management and clinical factors and their impact on LOS. Schorr’s framework emphasizes the interplay between patient characteristics, healthcare system factors, and environmental influences in determining health outcomes. Applying this framework, we can understand how patient-level factors such as age, sex, and comorbidities interact with system-level factors like ICU availability, staffing, and treatment protocols at KNH-IDU.

Review of Related and Empirical Literature

A portion of the literature review for this study is derived from journals published during the early phases of the COVID-19 pandemic, many of which had not undergone the peer-review process. However, given the rapid expansion of knowledge and the urgent need for timely information during the pandemic, it was necessary to incorporate these early publications. The fast-evolving nature of the COVID-19 situation often exceeded the traditional publication timelines of many peer-reviewed journals, making these early reports crucial for capturing real-time developments and initial findings. To mitigate the potential bias, a balanced approach was adopted. Articles from early, non-peer-reviewed sources were complemented with more recent publications from peer-reviewed journals. This dual approach ensured that the study benefitted from the immediacy and relevance of early findings while also grounding its conclusions in the rigor and credibility of peer-reviewed research. By integrating both types of literature, the study aimed to provide a well-rounded review of the current state of knowledge on COVID-19, thereby reducing the risk of bias and enhancing the validity of its conclusions. This approach also acknowledges the dynamic landscape of COVID-19 research, offering the most relevant and accurate insights available at the time of the study.

Among the myriad factors influencing the clinical outcomes of COVID-19 patients, age has consistently emerged as a significant determinant of disease severity and hospitalization duration. Globally, studies consistently report a worse prognosis for older patients. Older adults are more likely to experience severe disease, necessitating longer hospital stays and intensive care, and resulting in higher mortality rates compared to younger and middle-aged individuals. In a study involving adults with COVID-19 who were admitted to intensive care units in 65 sites in the United States, Gupta et al. (2020), reported that older age was independently associated with longer LOS and death (Gupta et al., 2020). Similarly, from a study done in China by Liu et al., (2020) it was reported that age significantly determined the clinical features and prognosis of COVID-19, with a worse prognosis seen in patients older than 60 years (Liu et al., 2020). In a study done in Italy comparing two groups according to their age (Elderly: 65–80 years old; Very Elderly > 80 years old) D'ascanio et al. (2021) found that very elderly patients had an increased mortality rate (D'ascanio et al., 2021). Brill et al. (2020) found that patients aged 70 and above had a median hospital stay of 15 days, significantly longer than the 10-day median stay observed in patients aged 40 to 69. (Brill et al., (2020). In Africa, Diop et al. (2020) projected the prognosis of the pandemic in Ghana, Senegal and Kenya. They reported that Africa's younger population is likely to experience a milder form of the infection compared to an older demographic seen in regions such as Europe (Diop et al., 2020).

Emerging evidence from studies done in globally suggests that COVID-19 infection has a higher mortality rate for men as compared to women. A systematic review and meta-analysis revealed that the pooled prevalence of COVID-19 confirmed cases in men was 55%, indicating a higher susceptibility among males (Abate et al., 2020). This trend was further supported by recent reports from Switzerland and Germany, which provided incidence rates (cases per 100,000 inhabitants by age and sex). These reports confirmed an increased disease incidence in men over 60 years of age (Abate et al., 2020). Similarly, data from the United States identified male sex as an independent risk factor for death from COVID-19, with older men being one and a half times more likely to die from the disease compared to women (Gupta et al., 2020). Consistent with these findings, another study reported that men had a 1.39 times higher risk of death than women (Peckham et al., 2020). Similar findings were reported by Biswas et al. (2021), who found that male COVID-19 patients had a significantly increased risk of mortality (RR =1.86) compared to female patients. Their study indicated that men were much more likely to die from COVID-19, highlighting a substantial gender disparity in mortality rates. This growing body of evidence depicts the significant sex differences in COVID-19 susceptibility and outcomes, particularly highlighting the heightened vulnerability of older men to severe disease and mortality (Biswas et al., 2021).

Disease severity has been consistently linked to prolonged hospital stays, not just for COVID-19, but for many other illnesses (Setareh et al., 2021). This relationship between disease severity and length of stay (LOS) is well-documented in numerous studies, highlighting the complexity of managing severe COVID-19 cases and the strain they place on healthcare resources. Disease severity in COVID-19 patients ranges from mild symptoms to critical conditions requiring intensive care. The severity is often classified based on clinical features, laboratory findings, radiological findings, and the need for advanced medical interventions (Centers for Disease Control and Prevention, 2020; Ministry of Health, 2020). Mild cases typically involve symptoms such as fever, cough, and fatigue, while severe cases can progress to pneumonia, acute respiratory distress syndrome (ARDS), multi-organ failure, and death (Guan et al., 2020; Cascella et al., 2020).

The presence of comorbidities, such as cardiovascular disease, diabetes, and obesity, exacerbates the severity of COVID-19 and contributes to longer hospitalizations (Sanyaolu et al., 2020). Richardson et al. (2020), analyzed data from COVID-19 patients hospitalized in the New York City area and found that those with comorbid conditions experienced more severe disease and prolonged hospital stays. The study highlighted that patients with multiple comorbidities had a median LOS of 11 days, compared to 7 days for those without comorbid conditions (Richard et al., 2020). This suggests that the interplay between disease severity and underlying health issues significantly affects patient recovery times. The compromised immunity of patients with concurrent chronic illnesses leads to prolonged hospitalization, and poor prognosis in COVID-19 patients. This causes a huge burden to healthcare facilities (Rodriguez-Morales et al., 2020; Zheng et al., 2020). Stokes et al. reported that patients with COVID-19 and a concurrent medical condition were six times more likely to be admitted, and 12 times more likely to die due to COVID as compared to those without a medical condition. Additionally, a meta-analysis of studies published between January and April 2020 revealed that patients with comorbidities, regardless of age, are at a higher risk for COVID-19 infection and its subsequent complications (Sanyaolu et al., 2020).

Identification of the Knowledge Gap

The literature review conducted as part of this study highlighted a significant knowledge gap in the existing body of research, particularly concerning data from Kenya on the management of COVID-19 patients, with a specific focus on LOS in hospitals. This gap is notable given the critical importance of understanding LOS dynamics to enhance patient care and optimize hospital resource utilization amidst the pandemic. Recognizing the paucity of localized data on factors influencing LOS among COVID-19 patients, this study aims to understand the determinants that affect LOS within the Kenyan healthcare context.

The analysis of recent literature has identified several key factors influencing the LOS in COVID-19 patients, such as disease severity, comorbidities, age, and gender. However, there remains a significant gap in region-specific data, particularly for Kenya and other sub-Saharan African countries. Firstly, most reviewed studies originate from high-income nations such as the United State, Italy, and the United Kingdom, as well as middle-income countries such as China and Saudi Arabia. Broad, large-scale studies from sub-Saharan Africa, including Kenya, are scarce. These regions may face unique healthcare system challenges and demographic characteristics that are not captured in the existing literature. Secondly, the contextual differences in healthcare systems need attention. The examined studies highlight the impact of healthcare system elements on LOS, including ICU capacity and the availability of medical resources. However, the healthcare infrastructure in Kenya and similar areas might face distinct constraints affecting LOS differently. Region-specific investigations are essential to understand these unique challenges. Thirdly, sociocultural factors play a significant role. Research suggests that delays in seeking medical attention and health-related behaviors influence disease severity and LOS. These cultural and behavioral factors can vary greatly across regions and require examination within the context of Kenyan and regional populations to design appropriate public health interventions. Lastly, there is a need to explore regional variability in comorbidities and demographics. The prevalence and impact of comorbidities such as HIV, tuberculosis, and malaria, which are common in sub-Saharan Africa, have not been thoroughly investigated concerning COVID-19 LOS.

Even in this current period, where sporadic cases of COVID-19 continue to emerge, accurately determining the future healthcare needs such as the required number of hospital beds, the necessary healthcare workforce, and essential medical equipment becomes increasingly vital for countries globally, including Kenya. Addressing this gap necessitates a detailed investigation into the proportion of COVID-19 patients requiring hospitalization and their expected LOS across various levels of hospital care. Such an analysis is essential for informing healthcare planning and resource allocation decisions, ultimately enabling the healthcare system to prepare adequately for ongoing and future challenges posed by the pandemic. This study, therefore, seeks to contribute to the body of knowledge regarding the LOS of COVID-19 patients in Kenya, addressing a critical gap in the literature and aiding in the strategic management of healthcare resources during these unprecedented times.

3.0 METHODOLOGY

The study employed a single-site retrospective cohort design, extracting information from patient medical records. These records were sourced from electronic and physical files of patients admitted to a specialized COVID-19 facility at IDU-KNH, Nairobi County, Kenya. The primary advantage of this design is the efficiency in data collection, which significantly reduces the time required to gather information. Retrospective studies enable rapid processing and dissemination of findings, which is crucial during public health emergencies. They provide real-world insights into clinical practices and outcomes, influencing patient care directly. From an ethical standpoint, retrospective studies pose minimal risk to patients since they do not involve new therapies or alterations to standard care procedures. Instead, they analyze pre-existing data, avoiding the ethical and practical challenges associated with conducting prospective research during a pandemic. This approach allowed for the collection of extensive data within the scope of the study.

The study was conducted at the Kenyatta National Hospital – Infectious Disease Unit (KNH-IDU), situated in Nairobi County, Kenya (geographical coordinates: 1° 23' 0" South, 36° 46’ 0" East). KNH-IDU, under the Department of Clinical Medicine, is the largest public, tertiary, teaching, and referral hospital in Kenya. It provides specialized care to patients with infectious diseases. In March 2020, a new facility with a bed capacity of 102 patients was established at KNH specifically to treat COVID-19-positive cases, including a 6-bed ICU. As a government facility, the cost of treatment was largely funded by the Ministry of Health under the COVID-19 fund.

Several critical factors were considered in selecting KNH-IDU for this study to ensure its success and relevance. KNH-IDU is one of the leading facilities in the region with a high caseload of COVID-19 patients, offering a diverse patient demographic that enhances the generalizability of the findings. The hospital is equipped with specialized COVID-19 treatment units and managed by a team of qualified medical personnel adhering to prescribed local and global treatment guidelines. Additionally, the hospital is outfitted with advanced diagnostic tools, ensuring the collection of high-quality clinical data. The hospital has a comprehensive health records system and supportive data-sharing policies which facilitate data collection and analysis. KNH also has an established history of conducting robust clinical and scientific research and collaborating with other universities, providing a conducive environment for scientific studies.

Given the significant role played by the hospital as one of the first and main designated COVID-19 treatment centers by the Ministry of Health, the study findings may have substantial public

health implications, informing both local and national health policies. This study aimed to create an objective assessment of the determinants affecting the LOS of COVID-19 patients at this facility. The epidemiology of COVID-19 in Sub-Saharan Africa remains under-documented, with limited information regarding hospitalization duration (Ministry of Health, 2020). Conducting this study at KNH-IDU thus provided insights for a better understanding of COVID-19 management in the region. The selection of 1st June 2020 to 30th November 2020 as the study period for the research is also strategic and significant. This is because this period encompasses the two highest peaks of COVID-19 cases observed in the country during the early stages of the pandemic; the first peak was experienced in July 2020, followed by a more severe peak in October 2020 (Ministry of Health, 2020).

The study included the medical records of all patients diagnosed with COVID-19 with a positive reverse transcriptase-polymerase chain reaction (RT-PCR) or rapid antigen-based test admitted at the hospital between June 1, 2020, and November 30, 2020. This period coincided with the two highest peaks in the incidence of COVID-19 infections in Kenya and globally. Due to the evolving nature of the disease, it was challenging to predict future peaks or the success of interventions as the pandemic progressed. The records department routinely collected data from the hospital admissions database, as reporting confirmed COVID-19 cases to the Ministry of Health (MOH) has been mandatory for Kenyan hospitals since the onset of the pandemic. The collected data included patient demographics (e.g., age, gender, nationality), hospital diagnoses, ICU status, treatments (including invasive mechanical ventilation and kidney replacement therapy), comorbidity status (e.g., asthma, chronic kidney disease, chronic lung disease, chronic cardiovascular disease, diabetes, hypertension, hemoglobin disorder, or liver disease), and outcomes (e.g., LOS, discharge, readmission, and mortality).

The sample size for this study was determined to achieve a 95% confidence level and a 5% margin of error, ensuring reliable results. The study aimed to include patient records for both COVID-19 survivors and non-survivors. Firstly, the proportions of patients who were discharged and those who succumbed to the disease in the sample were calculated. Out of the 558 patient records, 385 patients survived, and 173 patients succumbed to COVID-19. Using the formula by Fisher et al. (1983), as cited by Taherdoost (2016), the required sample size for survivors (69% of the patient population) was determined.

Fisher's Formula: $N = \frac{Z^2 [P (1-P)]}{D^2}$

Where:

Z = Standard error associated with chosen significance level (1.96)

D = Sampling error margin (0.05)

P = prevalence/proportion with characteristic of interest (i.e. p = 0.69)

For the survivors or patients who were discharged (p1 = 0.69), the sample size was determined as follows:

$n1 = (1.96)^2 * 0.69 * (1 - 0.69) / (0.05)^2$
$n1 = (3.8416 * 0.69 * 0.31) / 0.0025$
$n1 = 0.8216 / 0.0025$
$n1 \approx 328.64$

Given the availability of more patient records, we extended the sample size for survivors to 385, exceeding the calculated requirement of approximately 329. This expansion allowed for a more extensive analysis and increased the statistical power of the study. In addition, it was crucial to include the 173 patients who succumbed to COVID-19, as this provided a more complete understanding of COVID-19 impact and ensured that the analysis encompassed both outcomes. Therefore, the total sample size was extended to 558 patient records, including both survivors and non-survivors. This approach maintained the desired confidence level and margin of error, providing reliable and valid results.

Data collection for the study was carried out using a structured data abstraction tool designed by the researcher and guided by relevant literature. The tool was created using REDCap software and developed to align with the objectives of the study. Research Electronic Data Capture (REDCap) is a modern, secure software application for building and managing online clinical research databases and survey forms. REDCap has the required safeguards for research data security and privacy. The application allows users to create research databases and data entry web-based forms that link the data collected with existing statistical software tools. REDCap was created, launched and is managed by Vanderbilt University (USA). For each patient, data were systematically entered into the structured tool to capture demographic information, medical history, underlying comorbidities, clinical symptoms, laboratory findings, treatment measures, and outcomes. Specific variables included patient biodata (coded identity, age, gender, country and county of origin); dates of admission, referral, discharge, or death; clinical information such as signs and symptoms and their duration; severity of illness; comorbidities such as diabetes, hypertension, and immunosuppression; mode of admission (hospital vs. self-referral); and the need for oxygen and/or ICU care.

The collected data was reviewed for consistency and entered and cross-checked to ensure quality and accuracy. The structured tool was chosen for its efficiency, cost-effectiveness, and ability to guarantee uniformity in the collected information. Ethical principles outlined in the Declaration of Helsinki were strictly followed during data collection, handling, and storage. Patient confidentiality was protected through data coding and encryption. Furthermore, all COVID-19 protocols and guidelines from the Ministry of Health were adhered to during the data collection process. This adherence was not only critical for the safety of the research team and the patients but also vital for maintaining the ethical standards of the study. Observing these guidelines ensured that the study did not compromise the health or privacy of the participants or the integrity of the collected data.

Ethical approval for the study was obtained from several relevant bodies, including the Kenyatta National Hospital – University of Nairobi Ethics and Research Committee (Approval number: P354/04/2022), and AMREF International University Ethical and Research Committee (Approval number: P1074-2021). In addition, a research permit providing approval for the study to be undertaken was obtained from the National Commission for Science, Technology, and Innovation (NACOSTI) (Approval number: P/24/36842). These approvals ensured compliance with established ethical standards and regulatory requirements. Throughout the study from data collection through to analysis, presentation, and discussion, strict adherence to data protection standards was maintained to ensure the confidentiality and security of patient information.

Access to the data collected via the abstraction tool was strictly limited to the principal investigator. This restrictive access was a critical measure to safeguard patient confidentiality and prevent any

unauthorized use of sensitive information. To further enhance the security of the data, advanced encryption techniques were employed. This step ensured that all patient data remained confidential and protected against potential breaches. After the completion of data analysis, all coded data abstraction tools were kept in safe storage. In addition to these confidentiality measures, specific COVID-19 prevention protocols were utilized to protect both hospital staff and data collectors. These safety measures were in accordance with the guidelines from health authorities to minimize the risk of virus transmission during the study. The collected data was handled with the utmost discretion and was utilized solely to achieve the objectives of the study. The researcher also confirmed the absence of any conflicts of interest that could influence the study outcomes or integrity.

4.0 FINDINGS

Patient and Clinical Characteristics

Data was collected from 558 individuals diagnosed with COVID-19 during the study period. Out of these participants, approximately 69% (n=385) survived, while the remaining 31% (n=173) succumbed to the disease. The sample included a diverse range of patients with varying demographic characteristics, comorbidities, and clinical presentations. Detailed demographic data, such as age, gender, and comorbid conditions including diabetes and hypertension, were collected to provide an overview of the population affected by COVID-19. The inclusion of both survivors and non-survivors allowed for a comparative analysis of factors influencing outcomes. The overall median LOS was 7.5 days (IQR: 0-183). For survivors, the median LOS was 8 days (IQR: 1-171), while for non-survivors, it was 6 days (IQR: 0-183).

The mean age of the participants was 48.6 years (SD± 15.7 years), and the median was 48 (IQR: 36 - 61 years) indicating a wide range of ages among the study group. Participant characteristics, which include a variety of demographic and clinical variables, are summarized in Table 1. This table provides a comparison of survivors and non-survivors across multiple parameters, including age, sex, presence of comorbidities, and key laboratory results. Furthermore, the geographic distribution of the participants revealed that the vast majority hailed from Nairobi County, with 90% (n=503) residing in this region.

Table 1: Summary of Demographic and Clinical Characteristics and Comparison by Survival Status

	Levels	Total N = 558 (n/%)	Alive (n = 385) (n/%)	Died (n= 173) (n/%)	Test statistic Chi-square	p value
Demographic Characteristics						
Age	<20	5 (0.9%)	3 (0.8%)	2 (1.2%)		
	20-40	168 (30.1%)	133 (34.5%)	35 (20.2%)		0.003*
	>40	385 (69.0%)	249 (64.7%)	136 (78.8%)		
Sex	Male	321 (57.5%)	219 (56.9%)	102 (59.1%)	0.190	0.646
	Female	237 (42.5%)	166 (43.1%)	71 (41.0%)		
Clinical Characteristics						
Comorbidities	None	143 (25.6%)	124 (32.2%)	19 (11.0%)	47.14	< .001*
	Diabetes/HTN	87 (15.6%)	49 (12.7%)	38 (22.0%)		
	Diabetes only	172 (30.8%)	127 (33.0%)	45 (26.0%)		
	Hypertension	66 (11.8%)	35 (9.1%)	31 (17.9%)		
	Other comorbidities	90 (16.1%)	50 (13.0%)	40 (23.1%)		

**Statistically significant p-values*

The age distribution revealed significant differences between survivors and non-survivors (Fisher's exact test, $p < .01$). Participants under 20 years constituted a mere 0.9% of the total sample. A substantial disparity was noted in the 20-40 years age group, comprising 30.1% of the total participants, with survivors occupying this age range (34.5%) compared to non-survivors (20.2%). Most participants over 40 years were non-survivors (78.8%) compared to 64.7% among survivors. Gender distribution was balanced across survival statuses, with males accounting for 57.5% of the total sample, showing negligible differences between survivors (56.9%) and non-survivors (59.1%). Females made up 42.5% of the sample, with 43.1% among survivors and 41.0% among non-survivors, indicating no significant association between gender and survival ($X^2 = 0.190$, $p = 0.646$).

Comorbidities significantly impacted survival outcomes ($X^2 = 47.14$, $p < .001$). A considerable proportion of participants without comorbidities were survivors (32.2%) compared to non-survivors (11.0%). Diabetes and hypertension together were more common in non-survivors (22.0%) than in survivors (12.7%). Participants with only diabetes constituted 30.8% of the total, with a slightly higher prevalence among survivors (33.0%) compared to non-survivors (26.0%). Hypertension alone was more frequent among non-survivors (17.9%) compared to survivors (9.1%). Other comorbidities were significantly higher among non-survivors (23.1%) compared to survivors (13.0%). The severity of illness significantly impacted survival outcomes (Fisher's exact test, $p < .001$). Mild cases were exclusively observed in survivors (2.7%), while moderate cases

were also confined to survivors (69.4%). Severe cases were exclusively observed among non-survivors (100%).

Role of Comorbidities in Length of Stay

To assess the influence of comorbidities on the LOS for COVID-19 patients, descriptive statistics and OR calculations were performed, including the calculation of IQR and confidence intervals (CI) for the ORs. Among the 385 patients who survived COVID-19, the analysis revealed that patients with diabetes had a median LOS of 10 days (IQR: 7-13) and an adjusted OR of 0.91 (95% CI: 0.55, 2.52), indicating no significant difference in LOS compared to those without comorbidities after adjusting for other variables. Patients with hypertension had a median LOS of 8 days (IQR: 4-15) with an adjusted OR of 1.24 (95% CI: 0.94, 2.75), suggesting no significant impact on LOS. Similarly, patients with both diabetes and hypertension had a median LOS of 9 days (IQR: 5-16) and an adjusted OR of 0.99 (95% CI: 0.45, 2.27), showing no significant influence on LOS. Lastly, patients with other comorbidities had a median LOS of 7 days (IQR: 3-15) with an adjusted OR of 0.69 (95% CI: 0.51, 3.28), indicating no significant effect on LOS when controlling for other factors. These findings suggest that comorbidities, including diabetes, hypertension, and their combination, did not independently predict the length of hospital stay when other variables were considered (Table 2).

Table 2: Influence of Comorbidities on LOS in Patients Who Survived

Comorbidity category	Number of patients (n)	Percentage (%)	Median LOS (IQR)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
None	124	32.2%	7 (4-9)	ref	ref
Diabetes	127	33.0%	10 (7-13)	1.87 (0.84,3.22)	0.91 (0.55,2.52)
Hypertension	35	9.1%	8 (4-15)	1.20 (0.56,2.55)	1.24 (0.94,2.75)
Diabetes/HTN	49	12.7%	9 (5-16)	1.65 (0.84,3.22)	0.99 (0.45,2.27)
Others	50	13.0%	7 (3-15)	1.05 (0.544,2.02)	0.69 (0.51,3.28)

OR: Odds Ratio, CI: Confidence Interval, LOS: Length of Stay

Among the 173 patients who did not survive COVID-19, the analysis showed that the patients with diabetes had a median LOS of 6 days (IQR: 3-10), with an adjusted OR of 2.20 (95% CI: 0.63, 7.62), indicating no significant difference in LOS compared to those without comorbidities. Patients with hypertension had a median LOS of 7 days (IQR: 3-11), with an adjusted OR of 2.31 (95% CI: 0.69, 7.73), also showing no significant impact on LOS. Patients with both diabetes and hypertension had a median LOS of 6 days (IQR: 3-15), with an adjusted OR of 2.97 (95% CI: 0.83, 10.56), indicating no significant difference. Patients with other comorbidities had a median LOS of 7 days (IQR: 3-12), with an adjusted OR of 2.01 (95% CI: 0.58, 6.91), showing no significant impact on LOS when controlling for other factors (Table 3).

Table 3: Influence of Comorbidities on LOS in Patients Who Died

Comorbidity category	Number of patients (n)	Percentage (%)	Median LOS (IQR)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
None	19	11.0%	5 (2-7)	ref	ref
Diabetes	38	22.0%	6 (3-10)	2.03 (0.61,6.81)	2.20 (0.63,7.62)
Hypertension	45	26.0%	7 (3-11)	2.04 (0.63,6.65)	2.31 (0.69,7.73)
Diabetes/HTN	31	17.9 %	6 (3-15)	2.62 (0.75,9.08)	2.97 (0.83,10.56)
Others	40	23.1 %	7 (3-12)	1.87 (0.56,6.20)	2.01 (0.58,6.91)

OR: Odds Ratio, CI: Confidence Interval, LOS: Length of Stay

Demographic and Clinical Characteristics Associated with LOS for Survivors

To assess the demographic and clinical characteristics of COVID-19 patients who survived, chi-square tests were performed to compare those with a LOS of less than 8 days to those with a LOS of more than 8 days (Table 4). The duration of symptoms prior to admission significantly influenced LOS. Patients with symptoms lasting less than 7 days were more likely to have a shorter LOS compared to those with a longer LOS. Conversely, patients with symptoms lasting more than 7 days were more likely to have a longer LOS compared to those with a shorter LOS. This difference was statistically significant ($X^2 = 6.34$, $p = 0.04$). ICU admission status showed a strong association with LOS ($X^2 = 31.19$, $p < .001$). The type of oxygen therapy required was another significant factor. Patients not requiring oxygen therapy were more likely to have a shorter LOS (64.9%) compared to those with a longer LOS (35.1%), with a statistically significant difference ($X^2 = 77.16$, $p < .001$). Patients requiring high flow/NIV were more likely to have a longer LOS (83.7%) compared to a shorter LOS (16.3%). Severity of illness was a critical determinant of LOS. Patients with severe illness were significantly more likely to have a longer LOS (75.0%) compared to a shorter LOS (25.0%), with this difference being statistically significant ($X^2 = 34.58$, $p < .001$). The median platelet count was significantly higher in patients with a longer LOS (270 $x10^9$/L) compared to those with a shorter LOS (248.5 $x10^9$/L), with a statistically significant difference ($p = 0.03$). Other laboratory parameters, such as hemoglobin level, WBC count, neutrophil count, lymphocyte count, and D-dimer levels, showed no significant differences between the groups.

Table 4: Demographic and Clinical Characteristics Compared by LOS in Patients Who Survived

	Levels	Length of stay<8 days n = 177 (n/%)	Length of stay >8 days n = 208 (n/%)	Test statistic Chi-square	p value
Demographic characteristics					
Age	<20 years	1 (33.3%)	2 (66.7%)		
	20 – 40 years	(46.6%)	7 (53.4%)	0.21	0.90
	More than 40 years	114 (45.8%)	135 (54.2%)		
Sex	Female	85 (51.2%)	81 (48.8%)	3.27	0.07
	Male	92 (42.1%)	127 (57.9%)		
Clinical Characteristics					
	None	66 (53.2%)	58 (46.8%)		
	Diabetes/HTN	20 (40.8%)	29 (59.2%)		
Comorbidities	Diabetes	48 (37.8%)	79 (62.2%))	8.85	0.12
	Hypertension	17 (48.6%)	18 (51.4%)		
	Other comorbidities	26 (52.0%)	24 (48.0%)		

**Statistically significant p-values*

Demographic and Clinical Characteristics Associated with LOS for Non-Survivors

To assess the demographic and clinical characteristics of COVID-19 patients who did not survive, a series of chi-square tests and Fisher's exact tests were performed to compare those with a LOS of less than 8 days to those with a LOS of more than 8 days. Among non-survivors, referral status significantly impacted LOS. Patients not referred from another hospital were more likely to have a longer LOS, with 59.3% staying longer than 8 days compared to 40.7% with a shorter LOS. Conversely, patients referred from another hospital predominantly had a shorter LOS, with 89.2% staying less than 8 days compared to only 10.8% who stayed longer, a statistically significant difference ($X^2 = 40.33$, $p < .001$). ICU admission status was also significantly associated with LOS ($X^2 = 0.08$, $p < .001$). The type of oxygen therapy required by non-survivors showed significant impacts on LOS. Severity of illness was a critical determinant of LOS. All non-survivors had severe illness, with 58.9% having a shorter LOS and 41.0% having a longer LOS. Since all cases were severe, no comparison could be made with mild or moderate cases (Table 5).

Table 5: Demographic and Clinical Characteristics Compared by LOS in Patients Who Died

	Levels	Length of stay <8 days n = 102 (n/%)	Length of stay >8 days n= 71 (n/%)	Test statistic Chi-square	P value
Demographic characteristics					
Age	<20 years	1 (50.0%)	1 (50.0%)		
	20 – 40 years	22(62.9%)	13(37.1%)		0.84
	More than 40 years	79 (58.1%)	57 (41.9%)		
Sex	Female	48 (67.6%)	23 (32.4%)	3.74	
	Male	54 (52.9%)	48 (47.1%)		
	Diabetes/HTN	22 (57.9%)	16 (42.1%)		
	Diabetes	26 (57.8%)	19 (42.2%))	2.63	0.05
	Hypertension	16 (51.6%)	15 (48.4%)		
	Other comorbidities	24 (60.0%)	16 (40.0%)		

**Statistically significant p-values*

To assess the association between various demographic and clinical characteristics and a LOS of more than 8 days for COVID-19 patients who survived were analyzed using logistic regression and OR calculations were performed. The presence of comorbidities was not statistically significant for diabetes, hypertension, or their combination (Table 6).

Table 6: Association between Demographic and Clinical Characteristics and Length of Stay Longer Than 8 Days for Participants Who Survived

Demographic characteristics		Unadjusted OR 95% CI	Adjusted OR 95%CI
Age Category in years	<20	Ref	Ref
	20-40	0.57 (0.05,6.47)	0.67 (0.05,8.60)
	>40	0.59 (0.05,6.61)	0.68 (0.05,8.52)
Sex	Female	Ref	Ref
	Male	1.45 (0.96,2.17)	1.56(0.99,2.43)
Clinical characteristics			
Comorbidities	None	Ref	Ref
	Diabetes/HTN	1.65 (0.84,3.22)	0.91 (0.55,2.52)
	Diabetes	1.87 (1.13,3.10)	1.24 (0.94,2.75)
	Hypertension	1.20 (0.57,2.55)	0.99 (0.45,2.27)
	Other comorbidities	1.05 (0.54,2.03)	0.69 (0.51,3.28)

OR: Odds Ratio, CI: Confidence Interval

Various demographic and clinical characteristics associated with a LOS greater than 8 days for COVID-19 patients who died were analyzed using logistic regression. The analysis revealed that male non-survivors had an adjusted OR of 1.85 (95% CI: 0.96,3.57) compared to females, suggesting a slightly higher likelihood of an extended LOS but the finding was not statistically significant.

Table 7: Association between Demographic and Clinical Characteristics and Length Of Stay Longer Than 8 Days for Participants Who Died

Demographic characteristics		Unadjusted OR 95% CI	Adjusted OR 95%CI
Age Category in years	<20	Ref	Ref
	20-40	0.59 (0.04,10.27)	0.52 (0.03,9.60)
	>40	0.72 (0.04,11.78)	0.64 (0.04,11.28)
Sex	Female	Ref	Ref
	Male	1.86(0.99,3.45)	1.85 (0.96,3.57)
Clinical characteristics			
Comorbidities	None	Ref	Ref
	Diabetes/HTN	2.03 (0.61,6.81)	2.20 (0.63,7.62)
	Diabetes	2.04 (0.63,6.65)	2.31 (0.69,7.73)
	Hypertension	2.62 (0.75,9.08)	2.97 (0.83,10.56)
	Other comorbidities	1.87 (0.56,6.20)	2.01 (0.58,6.91)

OR: Odds Ratio, CI: Confidence Interval, LOS: Length of Stay

Discussion

The average age of the participants was approximately forty-nine years, with a median age of forty-eight years. The lower average age of our participants may reflect the younger general population of Kenya, which is supported by data from the Kenya National Bureau of Statistics (2021). These findings align with other African studies: in Ethiopia, the median participant age was forty years (Birhanu et al., 2020), while in Uganda, it was fifty-two years (Ingabire et al., 2022). In contrast to other reviewed studies, this study revealed that LOS did not vary significantly across different age groups among both survivors and non-survivors. About one-third of survivors were below the age of forty. This demographic profile presents a younger cohort compared to other studies that have associated older age with more severe disease progression and consequently extended lengths of hospital stay and a higher need for intensive care (Gupta et al., 2020; Liu et al., 2020; Swann et al., 2020; D'ascanio et al., 2021). Additionally, the initial pandemic response protocols in Kenya, which were implemented by the Ministry of Health in 2020, mandated hospital admission for all individuals testing positive for COVID-19, irrespective of age or severity of symptoms. This policy led to a broader demographic representation of COVID-19 patients, including a considerable number of younger individuals who otherwise might not require hospitalization based solely on their clinical presentation.

In our study, the gender distribution demonstrated a male-to-female ratio of approximately one point three five to one, with males comprising fifty-seven percent of the study participants who either survived or succumbed to COVID-19. This predominance of male patients aligns with findings from assorted studies which suggest that while infection rates of COVID-19 are comparable between sexes, males are at a higher risk for more severe outcomes, including prolonged LOS in hospitals and increased mortality rates (Gebhard et al., 2020; Gupta et al., 2020). The analysis indicated that males had a longer median LOS compared to females, both among survivors and non-survivors. The unadjusted and adjusted odds ratios suggested a higher likelihood of extended hospitalization for males, though these differences did not achieve statistical

significance. This finding suggests that while sex may play a role in influencing the length of hospital stay for COVID-19 patients, the observed differences were not statistically significant in this study. Several hypotheses have been proposed to explain the observed disparity in outcomes between males and females. Biological factors, such as genetic and hormonal differences, might influence the immune response to infections, potentially making males more susceptible to severe forms of COVID-19 (Arnold et al., 2022). Furthermore, lifestyle factors, including higher rates of smoking and alcohol consumption commonly reported among males, could exacerbate the risk of adverse outcomes when infected with the virus (Dai et al., 2020; Peckham et al, 2020).

Most of the COVID-19 patients were presented with one or more underlying chronic conditions. This high prevalence illustrated the interconnection between chronic illnesses and the severity of COVID-19 outcomes. The analysis revealed that among survivors, the presence of diabetes was associated with a longer median LOS, but this difference was not statistically significant after adjustment for other variables. Similarly, hypertension, both diabetes and hypertension and other comorbidities did not significantly impact LOS compared to those without comorbidities. Among non-survivors, comorbidities suggested a trend towards longer LOS, but these differences were also not statistically significant.

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusion

This study contributes a unique perspective to the existing literature on COVID-19. An analysis of patient and clinical factors at KNH offers a crucial observation into the determinants of hospital stay duration and mortality among COVID-19 patients. Age emerged as an insignificant factor influencing LOS. Among survivors, younger patients (under twenty years) had the longest median LOS, while those in the twenty to forty and over forty age groups had progressively shorter stays. This trend was also observed among non-survivors, where the youngest age group had the longest LOS. These findings highlight the complexity of age-related factors in COVID-19 outcomes. While younger patients had longer hospital stays, they also had a higher survival rate, suggesting that age interacts with other factors to influence the course of the disease. Sex differences in LOS were also noted. Male survivors tended to have longer LOS compared to female survivors, although this trend was not statistically significant. Among non-survivors, males again had a longer LOS compared to females, with a trend towards significance. These findings suggest that while sex may influence LOS, the effect is not strong enough to be statistically significant in this study. Nonetheless, the observed trends indicate potential areas for further research on the impact of sex on COVID-19 outcomes.

Disease severity was a critical predictor of LOS. Survivors with severe disease had significantly longer hospital stays compared to those with mild or moderate disease, underlining the impact of disease severity on hospitalization duration. All non-survivors were classified as having severe disease, which highlights the crucial role of disease severity in determining patient outcomes. The study findings suggest that managing disease severity is essential for reducing LOS and improving survival rates among COVID-19 patients. Comorbidities such as diabetes and hypertension were analyzed to determine their impact on LOS. The presence of comorbidities did not independently predict LOS when other variables were considered, indicating no significant impact among both survivors and non-survivors. This finding suggests that while comorbidities are important factors

in the clinical management of COVID-19 patients, their influence on LOS may be moderated by other factors such as disease severity and the need for ICU admission.

Recommendations

Considering the findings and the context of the Kenyan healthcare setting, several recommendations can be made. The study recommends that although comorbidities did not significantly affect hospital stay duration, their role in complicating COVID-19 management cannot be overlooked. Healthcare systems should integrate chronic disease management into their pandemic preparedness plans. Regular health check-ups and proactive management of chronic illnesses can mitigate their impact during infectious disease outbreaks. Public health initiatives aimed at controlling the prevalence of chronic diseases through lifestyle interventions and preventive measures will contribute to better outcomes during future pandemics.

The Contributions Made to Theory, Practice and Policy

Theoretically, this study advances our understanding of how various patient and clinical factors such as age, sex, disease severity, and comorbidities, interact to influence hospital stay durations and outcomes. Practically, the findings underscore the need for targeted clinical management strategies, particularly for younger patients and those with severe disease, to optimize LOS and improve survival rates. Additionally, the study highlights the significance of early invention and appropriate ICU care, providing actionable insights for healthcare providers. From a policy perspective, the results advocate for enhanced resource allocation and efficient patient referral systems to manage several cases effectively.

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