FACTORS ASSOCIATED WITH ALL-CAUSE IN-PATIENT MORTALITY BETWEEN 2018 AND 2019 AT KISUMU COUNTY LEVEL FOUR HOSPITAL, KENYA

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DECLARATION AND APPROVAL

This thesis is my original work and has not been presented for a degree in any other University or for any other award.

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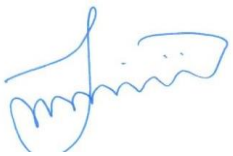
SUPERVISORS' DECLARATION

We confirm that the work reported in this thesis was carried out by the candidate under our supervision

Signature:  Date: 28/7/2023

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DEDICATION

I dedicate this thesis to my wife Claire, son Carlton, Daughter Genevieve and my father Antony whose words gave me hope in completing studies.

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ABSTRACT

A lack of demand for the analyzed mortality data has contributed to dwindling data management on inpatient mortality. Due to insufficient information on patient mortality, healthcare planners rarely use local data in resource allocation and hospital management. This results in missed opportunities to build hospital capacity to address common causes of death, and also results in a poor hospital reputation, fewer patients seeking hospital care, increased medical errors, and increased inpatient mortality. Deaths due to medical error are unmeasured and prevention discussions take place in limited and confidential forums such as hospital death conferences or hospital mortality meetings. The main aim of this study was to determine factors associated with all-cause in-patient mortality between 2018 and 2019 at Level Four Kisumu County Hospital, Kenya. Specifically, the study sought to establish patient related factors, trends, institutional and patient care factors associated with hospital mortality. The study was a cross sectional prospective study in which files of patients who died between January 2018 and December 2019 were randomly picked and examined across medical, pediatrics, surgery and reproductive health department. Sample size was determined using Yamane Taro formula which yielded 203 as sample size. The findings of this study suggest that 3% of deaths that occurred at Kisumu County level four hospital between 2018 and 2019 were avoidable and were contributed to by unavailability of supplies, patient care and existing medical condition of patient. According to the current study, medical ward had the highest 2-year in-hospital mortality at 13.86% while obstetrics and gynecology (reproductive health) had the least mortality at 0.47%. The current study found that infections caused 42% of deaths in patients aged below 35 years while non-communicable diseases caused 41% of hospital deaths in patients aged >60 years. The study found that there was a significant difference in the odds of a patient dying when a nurse and a doctor were all present (OR=0.697) meaning that presence of doctor and nurse protected the patient from death. Comorbidity was a significant factor associated with death among the patients who died in 2018 and 2019 ($p=<0.05$). Patient related factors such as age, education level and gender were not significantly associated with hospital deaths ($p>0.05$). This research clearly illustrates that hospital deaths among aged people is due to noncommunicable disease and deaths among young populations is due to infectious diseases but also raises the question of the need to enhance nurse-doctor relationship to reduce avoidable deaths among patients admitted in hospitals. This study was only conducted in one hospital and hence further research is needed to cover more hospitals before generalized conclusions can be drawn.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS: Acquired Immune Deficiency Syndrome

ART: Antiretroviral therapy

CD4: cluster of differentiation 4

CNS: Central nervous system

COPD: Chronic Obstructive pulmonary disease

COVID: Corona Virus Disease

CT: Computed Tomography

HIV: Human Immunodeficiency Virus

ICU: Intensive care unit

MoH: Medical Officer of Health

MS: Medical Superintendent

SDG: Sustainable development goals

UHC: Universal Health coverage

OPERATIONAL DEFINITION OF TERMS

Specific cause of death: Particular comorbidities beside that main diagnosis that could confound the cause of death

Mortality: People who die in the hospital

Patient management: diagnosis and patient care

Medical error: Occurs when a healthcare provider chooses an inappropriate method of care, improperly executes an appropriate method of care, or reads the wrong lab results.

All-cause mortality: death from any cause (not specific)

1.0 CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter will cover the background of the study, problem statement, objectives, and research questions, significance of the study, limitations and delimitations assumptions and operational definition of terms. The thesis is about hospital management of patients who suffer from various diseases, conditions and injuries. While some deaths are inevitable depending on uniqueness of a patient coming to seek medical care at hospital, most hospital deaths are preventable because hospitals have well trained medical personnel, well equipped to diagnose and treat diverse medical conditions, and well-funded by government to offer quality health care.

1.2 Background to the study

Reliable and timely specific mortality data form the basis for the allocation of health planning resources and the timely evaluation of health care interventions. Inadequate quality health care data can misrepresent local health care problems making it difficult to develop good health care policies. (Sifuna et al., 2011). In-patient mortality reflects the quality of healthcare. Information on the causes and trends in hospital mortality can improve hospital care for patients. Model-based estimates of mortality trends are widely used in sub-Saharan African countries but are subject to errors due to lack of information on hospital mortality. Examining patient and hospital trends can help identify those who are on-going and those who are lagging so you can strategize to address gaps in health care quality (Mboera et al., 2018). Not all in-patient mortality is attributed to institutional factors. Some are due to patient factors such as comorbidities, age and sex at the time of admission as well as existing medical diagnoses of the patient at the time of admission which may influence outcome of hospital care (Ma et al., 2017). The risk of in-hospital mortality associated with specific comorbidities is relatively higher in surgical patients compared to those without specific comorbidities but the frequency of postoperative complications is increased in elderly patients with acute trauma such as hip fracture (Ma et al., 2017; Sifuna et al., 2011). In addition, comorbidities such as infections, cardiovascular diseases, liver diseases and malignancies are most common cause of in-hospital deaths and therefore interventions targeting non–AIDS-associated conditions are needed to reduce inpatient mortality among HIV-infected patients. In-hospital mortality increase significantly with patient age and other causes. Diagnosis of pre-existing conditions requires a sufficient number of medical

personnel to immediately prevent complications that lead to hospital death (Cowell et al., 2015; Ma et al., 2017). Mortality remained higher in misdiagnosed patients even after adjusting for patient background site infection and severity (Abe et al., 2020). Deaths due to errors such as misdiagnosis are not counted and discussions about preventing such errors are limited to reviewing only a subset of adverse events identified in confidential forums in which case, lessons learned are not shared outside the department (Makary & Daniel, 2016). Epidemiological data on sepsis at the population level are scarce in low- and middle-income countries and there is an urgent need to implement a global strategy to measure sepsis-related morbidity and mortality especially in low- and middle-income countries (Fleischmann et al., 2016). To the Researchers knowledge there is no data on all-cause inpatient mortality at Level Four Kisumu County Hospital, Kenya and therefore this study provides information on this crucial data on mortality. The purpose of the proposed study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources in the hospital.

1.3 Statement of the problem

This study aimed at addressing the problem of missing data on causes and trends in hospital mortality. Hospital mortality is a quality indicator that can reflect both improvements in medical care and mortality trends over time. Reliable and up-to-date information on the leading causes of death in a population is an important contribution to public health policy. In developed countries where these data are available hospital outcomes are improving and mortality is decreasing. Poor quality health data can lead to misunderstanding of local health problems, making it difficult to formulate optimal health policies. Model-based estimation methods have been used with estimation errors resulting from a lack of information on causes and trends in hospital mortality in many regions of sub-Saharan Africa. Insufficient information on inpatient mortality is contributed by the lack of computerized data, and the information collected is also unreliable. A lack of demand for the analyzed mortality data has contributed to dwindling data management on inpatient mortality. Due to insufficient information on patient mortality, healthcare planners rarely use local data in resource allocation and hospital management. This results in missed opportunities to build hospital capacity to address common causes of death, and also results in a poor hospital reputation, fewer patients seeking hospital care, increased medical errors, and increased inpatient mortality. Deaths due to medical error are unmeasured and prevention discussions take place in limited and confidential forums such as hospital death conferences or

hospital mortality meetings. In these forums only a fraction of reported adverse events are reviewed and lessons learned are not disseminated outside many hospitals (Makary & Daniel, 2016). There is need to utilize hospital data on mortality to objectively improve health service delivery in hospitals.

1.4 Purpose statement

The purpose of this study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources in the hospital.

1.5 Objectives and Research Questions

1.5.1 General objective

The general objective of this thesis was to determine factors associated with all-cause in-patient mortality between 2018 and 2019 at Level Four Kisumu County Hospital, Kenya.

1.5.2 Specific objectives

The research was guided by the following specific objectives:

1. To analyze patient factors associated with all-cause in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya
2. To assess the diagnosis process and patient care on in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya.
3. To determine trends of all-cause in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya
4. To determine institutional factors associated with all-cause in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya

1.6 Research questions

The research was guided by the following questions which correspond to each specific objective

1) What are the patient factors associated with all-cause mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya?
2) How is the the diagnosis process and patient care on in-patient mortality between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya?
3) What were the trends of cause-specific in-patient mortality between January 2015 and December 2019 at Level Four Kisumu County Hospital, Kenya?
4) What institutional factors contributed to the trends of cause specific in-patient mortality

between January 2018 and December 2019 at Level Four Kisumu County Hospital, Kenya?

1.7 Justification of the study

With increasing number of hospital deaths due to emerging diseases and injuries, there is need for improving healthcare quality systems in an effort toward reducing avoidable hospital deaths. In Kenya, the limited use of mortality data prevents system evaluation on health care interventions' processes yet this might be a key contributor to hospital mortality. Despite the growing number of studies on this problem, not much attention has been devoted to understanding the connection between avoidable causes of deaths in hospitals and trends of hospital mortality. This study focuses on all cause hospital mortality and factors that contribute to hospital mortality so as to generate information that can be used by hospitals to optimize resources in reducing avoidable deaths in hospitals. Understanding of the relationship between various factors in relation to avoidable mortality in hospitals would not only lead to reduced avoidable deaths in hospitals but broadly would lead to improved quality health care in the country. Further, the findings of this study may identify correctable factors that may necessitate retraining of healthcare workers on specific areas to improve service provision to the public at large. Improvement in service provision would redefine health seeking behavior among the public thus contributing to the overall goal of the ministry of health. This study is significant in identifying all these aspects of hospital deaths and help the national and county governments in upgrading their current policies on mortality data management and utilization in optimization of resources allocation thus contributing to achievement of sustainable development goal number 3 (Good health and wellbeing).

1.8 Scope of the study

This study involved only examining files of patients who died while receiving treatment at Kisumu County Hospital between January 2018 and December 2019. Only available and accessible files for the patients who died during the study period January 2018 and December 2019 were sampled. Files of patients admitted through referral and who died before intervention at Level Four Kisumu County Hospital, Kenya were excluded from the sampling frame.

1.9 Limitations and delimitations of the study

The researcher envisaged that health records might not be maintained appropriately or not up-to-date. The researcher requested the Medical Superintendent through the hospital training manager for access to the data of patients who died at Kisumu County and teaching hospital during the period January 1, 2019 and December 31, 2020. This study did not cover mortality records of patients who were brought to the hospital dead at the time of admission because they had not received treatment at the hospital. This study was also limited to deaths that occurred between 2018 January 1, 12:00AM and December 2019 11:59AM at Level Four Kisumu County Hospital, Kenya.

1.10 Assumptions of the study

This study assumed that all health records for the patients who died while receiving care at the hospital between January 2018 and December 2019 were available at the hospital. After the permission to access the records was granted, the researcher used the hospital records staff to ensure the files were available. The researcher also assumed that the hospital would allow unlimited access to patient files and data. The Medical Superintendents' express approval was sought to allow the researcher access the records. The researcher also assumed that the information in deceased files was accurate and individual files were maintained as at the time of death certification. Hospital staffs were interviewed to clarify information that was not clear from the patient's file.

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources utilization in the hospital. This chapter presents general literature review, theoretical literature review, empirical literature review by objective, conceptual framework and chapter summary.

2.2 General literature review

Hospital mortality rates are used to highlight clinical failings and to encourage hospitals to investigate and improve care quality (McCormick et al., 2015). While imperfections are acknowledged, Mcormick indicated that such information on mortality can be helpful in measuring hospital performance. Complete and timely hospital mortality reporting is a key attribute of a functioning health system because it can support efforts to transition to higher quality health systems and the role of medical staffs cannot be ignored in changing the trends of hospital mortality (English et al., 2018; McCormick et al., 2015). Capitalizing on nurses to increase patients' access to emergency and critical care is appealing and generally improves patient outcomes even though, the work of medical personnel has to conform to quality standards (Woo et al., 2017). Reducing medical errors and minimizing complications are priorities for improving quality of care with survival failure defined as death following preventable surgical complications (Abe et al., 2020).

Countries globally are making efforts to improve health care outcomes. The 2030 Agenda for Sustainable Development aims to achieve comprehensive goals related to social environmental and economic factors (Doctor et al., 2018). Doctor also pointed out that Universal Health Coverage (UHC) was included as part of SDG 3 as target 3.8 to address the shortfall in healthcare delivery with the aim of achieving UHC. Each health care provider should strive to follow established procedures for patient diagnosis treatment and follow-up visits. Diagnosis is a multi-step process where a patient experiences a health problem and then chooses to engage with the healthcare system (Balogh E et al., 2015). Balogh further states that when a patient seeks health care there is a process that combines history taking, examination and prescribing or

gathering information through consultation with other physicians to provide an explanation and effective diagnosis.

Hospital mortality rates might be helpful measures of the standard of treatment, but rigorous statistical analysis is necessary to prevent misattributing variations in mortality to variations in medical care when they are actually caused by variations in case mix (Goodacre et al., 2015)

In-hospital mortality depends on the specific condition or type of surgical procedure. The model procedure can improve perioperative mortality risk prediction in cirrhotic patients and condition-specific in-hospital mortality data used to assess the quality-of-service delivery (English et al., 2018; Mahmud et al., 2019). For example, myocardial infarction patients with high levels of NT-proBNP have an increased risk of mortality and NT-proBNP levels may be a useful predictor of hospital stay independent of clinical characteristics. Patient outcomes in bedridden adult patients (Benmachiche et al., 2018). Another predictor of outcome in patients is the site of condition. Among patients with infection, misdiagnosed site of infection is associated with more than ten percent increase in in-hospital mortality and that atrial fibrillation is an independent predictor of in-hospital mortality among patients with heart problems. There seem to be an increasing comorbidity burden in regions with lower levels of socioeconomic development and that ethnicity effect is not related to differences in susceptibility to covid and access to health care including intensive care across ethnicities (Baqui et al., 2020; Egbe et al., 2019).

2.3 Empirical Literature Review

2.3.1 Patient factors associated with all-cause in-patient mortality

In a study by (Kachingwe et al., 2022) on factors associated with in-hospital mortality of patients admitted to an intensive care unit in a tertiary hospital in Malawi, 822 participants ranged in age from 21 to 43 years old, with 50 percent being female and several patient factors at admission were associated with in-hospital mortality. Such factors included the presence of one or more severely deranged of: vital signs, treatment with vasopressors, cardiopulmonary resuscitation and mechanical ventilation. Same study found that surgery showed a negative connection with in-hospital mortality. In a separate study by (Asgedom et al., 2020), substantially higher number of patients died at the hospital and majority of the patients admitted to the hospital had developed complications, aspiration pneumonia being the most frequently affirmed complication during their stay in the wards. Patients with severe and moderate Glasgow Coma Scale during

admission were more likely to die at the hospital than patients with mild Glasgow Coma Scale. (Asgedom et al., 2020) further indicated that to precisely determine the mortality prevalence and medical complications frequency and to generalize the findings to the general population a multicenter prospective cohort study should be conducted.

COVID-19 infection was related with significant ICU admission and in-hospital death rates in cohort analysis of patients with COVID-19 infection in US acute care facilities and the use of statins, angiotensin-converting enzyme inhibitors, and calcium channel blockers was linked to a lower risk of mortality (Rosenthal et al., 2020). In another study on characteristics and outcomes of patients with COVID-19 admitted to hospital and intensive care in the first phase of the pandemic in Canada by (Murthy et al., 2021), the most prevalent comorbidities were diabetes mellitus, hypertension, heart, renal, and respiratory disorders. In this study, of the 328 individuals were admitted in ICU treatment and were hospitalized for a median of 0 (IQR 0-1) days following hospital admission. Such patients required interventions such as invasive mechanical breathing (88.8 percent), renal replacement therapy (14.9 percent), and extracorporeal membrane oxygenation (4.0 percent). Despite the interventions, overall 26.2 percent died and 31.2 percent of individuals receiving mechanical ventilation died. In this case, age was a significant predictor of death (odds ratio per additional year of life 1.06, 95 percent confidence interval 1.03-1.09). similar findings were reported by (Vardavas et al., 2022) who reported that because there is a strong relationship between specific prognostic factors and mortality and hospital admission, prioritizing booster vaccinations and implementing nonpharmaceutical protective measures for these populations may contribute to a reduction in COVID-19 mortality, ICU, and hospital admissions.

In a study by (Myślicka et al., 2021), male sex, older age, hypertension, atherosclerosis, history of myocardial infarction, heart failure, cirrhosis, TB, history of cancer, anemia, and inflammation were independent risk factors for death among inpatients of a mental institution. In this study, delirium not caused by alcohol or other psychoactive drugs was linked to the greatest mortality risk of any mental diagnosis, whereas unemployment was linked to a twofold increase in the chance of in-hospital death. According to Myslicka et al. (2021), medical comorbidities have a considerable and clinically significant influence on in-hospital mortality in mental patients in Poland. Furthermore, doctors must be aware of and actively manage medical issues in such patients in order to lower the risk of in-hospital death in mental hospitals. Another study by

(Oliveira et al., 2019) agrees with Myslicka et al. (2021) that in patients over 79 years old with ischemic stroke, the following risk variables were related with a greater in-hospital death rate: older age, Glasgow coma score less than or equal to 8, total anterior circulation infarction, infection, and diabetes mellitus. In a study by (Zahid et al., 2021) it was discovered that individuals with severe bleeding have a higher death rate, and that baseline comorbidities such as ESRD, liver disease, coagulopathy, and colonic cancer are key predictors of this adverse occurrence.

In a study by (Teh & Ling, 2013), the predominant involvements among hospitalized lupus patients in Sarawak General Hospital, Malaysia, were hematologic (73.3 percent), renal (70.9 percent), and mucocutaneous (70.9 percent) (67.3 percent). According to the study, 26 people died (10.4 percent), with the leading reasons being infection and flare (50 percent), infection alone (19 percent), flare alone (19 percent), and others (12 percent). The presence of infection and flare of illness (hazard ratio (HR) 5.56) as well as high damage indices at the time of admission were independent predictors of death in our sample of SLE patients. Infection and flare were the leading reasons of mortality in Asian SLE patients hospitalized. According to the findings, the presence of infection with flare and high damage indices at the time of admission were independent prognostic factors.

According to a multivariate study on characteristics related with inpatient mortality, patients aged 65-84 and above 85 (OR 1.8 (95 percent CI 1.4-2.4)P.0001) had a higher probability of death than those hospitalized between the ages of 18 and 44. Patients with Medical aid (OR 1.4 (95 percent CI 1.2-1.7)P.0001), private insurance (OR 1.6 (95 percent CI 1.5-1.9)P.0001), and self-pay (OR 2.6 (95 percent CI 2.1-3.1)P.0001) had greater rates of inpatient mortality than Medicare enrollees. Admission during the weekend (OR 1.1 (95 percent CI 1.0-1.2) P = 0.0298), hospitalization involving critical care unit stay (OR 2.934 (95 percent CI 2.509-3.429) P.0001), acute kidney injury (OR 2.209 (95 percent CI 2.002-2.436) P.0001), acute respiratory failure (OR 5.544 (95 percent CI 5.01-6.136) P.0001) (Sarvepalli et al., 2018). Sarvepalli and colleagues (2018) further found that, male patients stayed 0.58 days (0.08; P =.0001) longer than females. Patients in zip codes where the median income was between the 75th and 100th percentile stayed 0.29 days (0.13) longer than those in zip codes where the median income was between the 0th and 25th percentile. Patients with a personal history of alcohol misuse lasted 0.98 days (0.14) longer (P.0001). Patients admitted to metropolitan hospitals, big hospitals, or teaching hospitals

remained 1.04 days (0.12; P.0001), 1.03 days (0.14; P.0001), and 0.94 days (0.1; P.0001) longer, respectively, than those admitted to non-metropolitan hospitals, small hospitals, or non-teaching hospitals. Having an elective hospitalization increased LOS by 2 days (0.13, P.0001). An ICU stay and severe renal damage worsen the hospital stay.

Advanced infections and patient-level factors such as male gender and older age contributed to higher mortality risk. Such factors include any complications encountered during patient admission (Merath et al., 2020). Diabetes mellitus increases the risk of all-cause mortality in breast, prostate and colon cancer survivors and therefore greater emphasis should be placed on diabetes management in patients with diabetes. The risk of in-hospital mortality associated with certain infections is relatively higher in patients with certain comorbidities such as pulmonary embolism, respiratory failure, renal failure and diabetes compared with those without specific comorbidities. The rate of postoperative complications increased according to preoperative risk scores in elderly hip fracture patients. Hip fractures in elderly patients have a higher proportion of patients with respiratory distress and a higher risk of postoperative in-hospital mortality. (Groff et al., 2020; Ma et al., 2017).

Certain diagnoses appear to increase mortality in patients admitted to the ward. Sepsis is the leading cause of pregnancy-related death on the ward and the prevalence of sepsis increases during pregnancy (Kendle et al., 2019). Associated solid tumors or comorbidities (eg congestive heart failure chronic lung disease coagulopathy liver disease lymphoma fluid and electrolyte disturbances metastatic cancer coronary artery disease pulmonary embolism) may increase the risk of renal failure and metastases as well as risk of death compared to hospitalized patients without comorbidity (Tsai et al., 2013). Dysnatremia is associated with poor outcomes; persistent hospital-acquired hypernatremia is a strong risk factor for in-hospital mortality and elderly patients with baseline C-reactive protein more than 75mg/dl at 7-14 days together with hospital complications are associated with in-hospital mortality in patients with acute chronic obstructive pulmonary disease (COPD) requiring admission to the intensive care unit (ICU) admission (Lu et al., 2021; Tsai et al., 2013).

Non-AIDS deaths increased significantly in the ART era and are now the most common cause of hospital death. Non-HIV infections are the leading cause of cardiovascular disease, liver disease and malignant death. High CD4 cell counts and hepatic and cardiovascular complications were

most strongly associated with non-AIDS mortality. Targeted interventions for AIDS-related diseases are needed to reduce in-hospital mortality among HIV-infected patients (Cowell et al., 2015). In-hospital mortality rate was found to be 4 times higher among patients with metastatic cancer (2.1% vs. 0.5%; P = < 0.0001). According to a study by (Majdinasab et al., 2021a), after correcting for covariates, dyspnea at rest/moderate exertion (OR 5.7/2.4; 95 percent CI 2.7/1.6 to 11.9/3.7; P 0.0001) was revealed to be the most significant predictor of in hospital mortality in stage IV cancer patients (OR 5.7/2.4; 95 percent CI 2.7/1.6 to 11.9/3.7; P 0.0001). Majdinasab et al (2021) concludes that therefore that aggressive treatment in advanced cancer patients contributes to alarmingly high in-hospital mortality. Improved, deliberate communication of palliative care options with patients is exceedingly conducive to enhancing end-of-life cancer care.

2.3.2 Diagnosis process and patient care on all-cause in-patient mortality

The diagnostic process is a complex transformational process that begins with the patient's individual disease history and ends with a definitive outcome. A patient begins a complex process of consulting a doctor about his symptoms who can label his disease classification and prescribe a specific treatment and place him in a diagnostic category and such processes. The result is important for effective treatment of the patient and physician. The diagnostic procedure must be accurate to avoid misdiagnosis. Patients with pulmonary intra-abdominal urinary tract and central nervous system infections are initially diagnosed with infection elsewhere and this misdiagnosis contributes to 15% of hospital deaths. Misdiagnosed or misdiagnosed patients had significantly higher in-hospital mortality than correctly diagnosed patients and misdiagnosed patients had a higher mortality rate (Abe et al., 2020; Baerheim, 2001).

Receiving prescribed drugs and immunizations was linked with decreased 30-day and 1-year risk-adjusted mortality in heart failure patients and receiving care processes that evaluate patient counseling or record documenting was not associated with decreased mortality (Wu et al., 2014). The investigation of nursing diagnoses, outcomes, and treatments in critically ill patients revealed a high level of engagement in response to a wide range of patient demands. The maximum number of nursing diagnoses that can be used to predict patient outcomes (Castellan et al., 2016)

In advanced cancer patients, aggressive therapy adds to shockingly high in-hospital mortality. Improved, intentional communication of palliative care alternatives with patients is extremely beneficial to improving end-of-life cancer care (Majdinasab et al., 2021b).

Nursing diagnoses were discovered to predict patient outcomes (quality of life, death) as well as organizational outcomes (duration of hospital stay, hospital expenses, quantity of nursing care, discharge dispositions) and diagnoses-based patient care plans enhanced sleep quality, quality of life, and glycemic control. Furthermore, nursing diagnoses enhanced forecasts of patient outcomes when combined with information from disease-based categorization systems (e.g., diagnosis-related groups) (Sanson et al., 2017). Patient mortality is caused by a lapse in decision-making and clinical decision-making failures most typically arise around the choice to operate, with additional discussion of potentially challenging situations necessary (Davis et al., 2019).

Medical malpractice is when a patient is misdiagnosed. A medical error is any preventable event that causes or results in the inappropriate use of drugs or harm to a patient. Such incidents may relate to professional practice health product procedures and systems including prescription drug order communication drug labeling packaging labeling formulation dispensing monitoring and dispensing instructions for use. A medical error can also be defined as an unintentional action that fails to achieve an intended result or does not perform a planned procedure as intended (execution error) and can result from using the wrong plan to achieve the goal (planning error) or deviation. from a care process that may or may not harm the patient. The fatality of errors is not measured and prevention is discussed in limited confidential forums such as: a hospitals internal root cause analysis committee or ward morbidity and mortality meeting and these forums examine only a fraction of the adverse events identified and lessons learned does not spread outside the hospital (Makary & Daniel, 2016; Phillips et al., 2001).

While diagnosis process can be accurate, inpatient mortality can also arise from errors in the patient care process. The most common type of error in patient care is administering an improper dose, which accounted for 41 percent of all medication error types, with 36 percent receiving an overdose and the second most prevalent type of error was administering the incorrect drug to a patient (Phillips et al., 2001). Phillips confirmed 73 deaths related to the accidental administration of drugs such as heparin furosemide or injections of potassium chloride instead of sodium chloride to eight patients. Errors in patient care can also be affected by the staff of each

hospital. Despite the relatively small difference in rationing rates between hospitals as a whole patients admitted to institutions with lower rationing rates had a lower risk of in-hospital death than patients in comparable institutions and patients in hospitals with the highest rationing scores. not necessarily die. Schubert concluded that this reflects the quality of health care with which nurses are assigned (Schubert et al., 2012). Early in-hospital mortality is associated with more severe conditions such as septic shock the main contributors to the lack of improved outcomes may be health care provider and system factors rather than lack of diagnostic and treatment resources (Kershaw et al., 2019). For this reason, Kershaw concluded that, low-cost intervention to improve knowledge skills and communication with a focus on provider education and process improvement may be key to reducing early in-hospital mortality and improving hospital admission outcomes in this setting.

2.3.3 Trends of all cause in-patient mortality

Hospital care is a valuable and vital resource for meeting healthcare needs. Death is the core business of a hospital so it is important to understand changes in that core business. These different trends help us understand the underlying causes of death. The leading causes of death in hospitals in Tanzania are respiratory diseases malaria anemia HIV/AIDS and cardiovascular diseases. The mortality rate of children under the age of 5 is rising. These mortality trends lag behind countries achieving global and national sustainable health development goals. Unlike most countries in developed sub-Saharan Africa hospital mortality due to elective and emergency admissions has fallen for 17 consecutive years in England and Scotland (Aragón & Chalkley, 2018; Mboera et al., 2018). In a study in Nigerian hospital, from 2007 to 2019, the average age at maternal death was 30.8 5.9 years, with women who attended antenatal care clinic accounting for 88.8 percent of fatalities. The leading causes of direct maternal mortality were hypertension (27.0 percent), sepsis (20.6%), and hemorrhage (18.7%), while the leading indirect causes of maternal mortality were anaemia in pregnancy (3.2 percent), human immunodeficiency virus (3.2 percent), and sickle cell disease (2.4 percent). MMR increased statistically significantly by around 3.4 percent each year from 2211 per 100,000 live births in 2007 to 3555.6 per 100,000 live births in 2019 (APC: +3.4 percent, P-value 0.001) (Olamijulo et al., 2021).

New diseases and epidemics play an important role in hospital mortality trends. Changes in hospital mortality during the Covid-19 outbreak are difficult to interpret because waves of SARS-CoV-2 infection have occurred in different countries at different times and with different

population patterns and comorbid conditions. For this reason, there is an urgent need to identify, share and implement best practices for hospice care to prevent the resurgence of hospital mortality (Roth et al., 2021). Over a seven-year period, the majority (57.7 percent) of the 1127 hospital fatalities were among newborns. Congenital abnormalities (22.2 percent), prenatal illnesses (18.1 percent), cardiovascular problems (14.9 percent), and neoplasms were the most common causes of mortality (12.4 percent). The majority of deaths (85.7 percent) happened in an intensive care unit (ICU), with a notable increase throughout the years (80.1 percent in 1997 to 90.6 percent in 2004). The proportion of in-hospital admissions among the ICU population increased noticeably (14.8 percent in 1998 to 24.8 percent in 2004). Infants with congenital malformations and perinatal illnesses were more likely to die in an ICU (OR 2.42, 95 percent CI 1.65 to 3.55), whereas older children with cancer outside the ICU were less likely to die (OR 6.5, 95 percent CI 4.4 to 9.6). The average length of stay for children was 13 days (Ramnarayan et al., 2007).

A study by (Jatwani et al., 2021) on trends in hospitalizations and inpatient mortality from acute myocardial infarction among patients with psoriatic arthritis discovered that overall rates of mortality in acute myocardial infarctions with underlying psoriatic arthritis are lower compared to those without psoriatic arthritis and that a decrease in cardiovascular mortality from acute myocardial infarction in psoriatic arthritis resects that even though psoriatic arthritis is associated with an increased. Other studies such as (Bath et al., 2020) it was discovered that the frequency of VE rose with a decrease in overall mortality over time and overall hospital stay has dropped, while the expense of care has increased. Bath (2020) further indicates that with the exception of burst thoracoabdominal aortic aneurysm, open surgical mortality for VE has also reduced generally, indicating perioperative treatment improvements. Endovascular use for VE has expanded dramatically; it is linked with decreased mortality for most VE, while there is an increase in inpatient mortality after endovascular repair of rTAA. Bath (2020) concludes that such observations might be attributed to a greater use of endovascular repair for patients who were previously ineligible for surgery due to high risk.

Patients with AF with a subsequent diagnosis of IDA had greater morbidity, complications, LOS, and hospitalization costs than patients treated for AF without IDA and there was no difference in in-hospital mortality between the two groups. The study notes that furthermore, in both AF with and without IDA, adjusted mortality and adjusted LOS reduced over time.(Minhas et al., 2022).

In a separate study by (Mehta et al., 2019), except for specific high-risk patients, it was shown that inpatient VTE rates continue to climb even five years after the surgeon general's call to action and that more research is needed to reduce VTE in patients, particularly those who are thought to be at reduced risk of VTE. In another study by (Kaewput et al., 2021) on in-hospital mortality in patients with hepatorenal syndrome, the total hospital mortality rate was 32% and the hospital mortality fell from 44 percent in 2005 to 24 percent in 2014 (P 0.001), although rates of liver transplantation (P = 0.02), renal replacement treatment (P 0.001), duration of hospital stay (P 0.001), and hospitalization cost (P 0.001) increased. Multivariable analysis revealed that older age, alcohol use, coagulopathy, neurological disorder, and need for mechanical ventilation predicted higher hospital mortality, whereas liver transplantation, transjugular intrahepatic portosystemic shunt, and abdominal paracentesis predicted lower hospital mortality.

In a study by (Burke et al., 2021) on Incidence of HIV-positive admission and inpatient mortality in Malawi (2012-2019), women aged 25 to 34 saw the biggest absolute decreases (2264 fewer HIV-positive admissions, 95 percent CI 2002-2526). People living HIV (PLH) in-hospital mortality was 23.5 percent, with no significant change over time in any age-sex group and no connection with ART usage at admission. Burke (2021) states that rates of admission for adult PWH have declined significantly, most likely due to significant gains in community HIV diagnosis, treatment, and care. Despite gains in ART coverage, HIV-positive in-hospital fatalities remain unacceptably high and therefore the study concludes that in order to minimize inpatient fatalities among PWH, a comprehensive research and implementation program is urgently required.

In another study on trends in mortality among patients with pancreatic malignancy by (Dahiya et al., 2022), the overall number of pancreatic cancer hospitalizations increased from 37,123 in 2008 to 37,635 in 2017 (p 0.0001), although per million US population decreased from 122 in 2008 to 116 in 2017. The 65-79 age group had the greatest rate of hospitalization, rising from 41.6 percent in 2008 to 45.9 percent in 2017 (p 0.0001). In 2008, there was a minor female predominance (51.9 vs 48.1 percent, p 0.0001); however, in 2017, there was a slight male predominance (50.9 vs 49.1 percent, p 0.0001). The bulk of the study population was white. Furthermore, in 2017, emergent/urgent hospitalizations were somewhat more common than elective hospitalizations (50.7 vs 49.3 percent, p 0.0001). the study concludes that from 8.4 days in 2008, the average length of stay (LOS) has declined.

In a study by (Talbert et al., 2023) on trends in inpatient and post-discharge mortality among young infants admitted to Kilifi County Hospital, Kenya the study found that 208/3625 (5.7%) young babies died one year after discharge, with a rate of 64.3 (95 percent CI 56.2 to 73.7) per 1000 infant-years. Within one month of release, 49 percent of post-discharge fatalities occurred, and 49 percent of post-discharge deaths happened at home. Low entrance weight was linked to both inpatient and post-discharge fatalities. The study concludes that inpatient death was linked to clinical indicators of illness severity, but post-discharge mortality was linked to duration of stay, departure against medical advice, and transfer to a specialized hospital. Admission with indications of both diarrhea and severe pneumonia or severe pneumonia alone had a greater risk of both inpatient and post-discharge death in the Kilifi context than admission for diarrhea alone. There was no statistically significant difference in inpatient or post-discharge mortality between children hospitalized with diarrhea alone and those admitted with other diseases excluding severe pneumonia. HIV, a small mid-upper arm circumference (MUAC), and bacteremia were all linked to inpatient and post-discharge death. Circulatory impairment, sepsis, and abnormal electrolytes were linked to inpatient death but not to post-discharge mortality. Prior hospitalization and lower chest wall indrawing were shown to be linked with post-discharge mortality but not with inpatient mortality. Age, stunting, and chronic or bloody diarrhea had no effect on death before or after discharge.(Talbert et al., 2019). The study conclude that young infants accounted for an increasing proportion of pediatric admissions and their overall mortality remains high. Post-discharge mortality accounts for a lower proportion of deaths but mortality rate is higher than among children aged 2-59 months

2.3.4 Institutional factors associated with in-patient mortality

The nurse-to-patient ratio in a particular hospital can affect the hospitals mortality rate. Staff shortages have a major negative impact on maternal and patient care outcomes in low-income countries. System failures and inadequate management of human resources are the main causes of the health supply gap that need to be addressed through a deliberate strategy to support the health care workforce to match supply and demand and minimize bottlenecks in health services. need of Field work. Improving the quality of hospital care in this regard (Bradley et al., 2015; Driscoll et al., 2018). Changes in postoperative mortality rates are associated with changes in nursing staffing levels as lower levels mean higher mortality rates as well as the need for care and this is an important indicator of patient mortality (Ball et al., 2018a). Collaboration between

doctors and nurses' influences patient mortality. There was a correlation between mortality and the reported adequacy of the nurse-physician relationship with settings having the lowest mortality rates and the best nurse-physician communication. Collaboration between doctors and nurses is therefore associated with reduced patient mortality (Abe et al., 2019).

In critically sick patients with sepsis, ICU admission/discharge time and weekend hospitalization were not independent risk factors for hospital death. The patient-nurse ratio upon admission, which influences compliance, was found to be a predictor of hospital survival. The major risk factor for in-hospital mortality was an unstable status upon discharge from the ICU. These discoveries might have an impact on how septic patients are managed (X. Zhou et al., 2023). In a separate study, nighttime admission for conditions such as type A acute aortic dissection was linked to an increased risk of in-hospital mortality; thus, health care systems should focus on managing the increased risk of in-hospital mortality among patients admitted at night, regardless of the cause (Y. Zhou et al., 2020).

In terms of admissions the day of the week affects how quickly patients are admitted. Whether urgent or non-urgent weekend admissions were consistently associated with poorer patient outcomes. This has prompted funders and policymakers to initiate health care system reforms assuming that reduced service delivery would carry a higher risk of adverse outcomes on weekends and that more consistent hospitalizations throughout the week would reduce or eliminate disparities. Nighttime ICU discharge is associated with increased risk of in-hospital death but weekend ICU discharge is not (Chowdhury et al., 2018; Han et al., 2018a). Higher-than-expected mortality rates imply inadequate treatment or neglect and systems should be implemented to ensure that they learn and extrapolate risk factors through an in-depth review of care provided to patients prior to their deaths, that they reduce and eventually eliminate relative mortality through improved practices, and that they improve care and safety for the entire organization. Mortality evaluations can give insight into the quality of treatment that dying patients get (Bhattacharya & Makin, 2023).

The type of hospital whether private or public affects patient admission outcomes. Patients in private hospitals experience constant hospitalization and death rates. Differences in results may be related to reinvestment not being used for patient care that would otherwise be used as private hospital profits. Availability of specialized services for specific patients such as pregnant women

may also contribute to overall patient care outcomes. Complications during pregnancy and delivery and postnatal complications contribute to maternal mortality both in and out of hospital. Most can be prevented or treated. Antenatal and routine care and delivery care under the supervision of trained staff in a health facility is associated with better maternal health. Evidence-based interventions to improve health care should focus on maternal education women empowerment increasing access to health care and closing the gap between rural and urban areas (Doctor et al., 2018; Tanuseputro et al., 2015).

A one-patient increase in a nurse's workload raised the risk of an inpatient dying within 30 days of admission by 7% while every 10% increase in bachelor's degree nurses decreased this likelihood by 7%. These associations imply that patients in hospitals where 60% of nurses have bachelor's degrees and nurses care for an average of six patients have a nearly 30% lower mortality rate than patients in hospitals where 30% of nurses have bachelor's degrees and nurses care for an average of eight patients (Aiken et al., 2014). Factors such as referred women in labor from primary health facilities and births managed by medical interns was associated with maternal mortality in hospitals and maternal healthcare providers in these hospitals require training on the management of a birthing emergency (Tiruneh et al., 2022). Stillbirth and newborn death auditing improves facility structures, care systems, and neonatal health outcomes. To improve the audit process, enablers must be improved and obstacles identified at both the health provider and institution levels. Stillbirth and newborn death auditing improves facility structures, care systems, and neonatal health outcomes. To improve the audit process, enablers must be improved and obstacles identified at both the health provider and institution levels (Gondwe et al., 2021).

Admission to the pediatric intensive care units between 06:00 and 09:59 on weekdays and between 06:00 and 17:59 on weekends were independently associated with PICU death when compared to admission during weekday afternoons. Handoffs of care, rounds, resource availability delays, or unrecognized patient deterioration prior to transfer are all potential contributing factors that merit further investigation (McCrory et al., 2017). In another study by (Williams et al., 2020), there were no significant changes in the risks of death between admissions during the day and those during the night, or between admissions during normal hours and those during off-hours. The data, however, is of poor quality, necessitating bigger prospective investigations.

In a study by (Xu et al., 2021), the most common reasons for admission were peritonitis and cardiovascular problems. 1447 (25%) of the 5810 patients released from the hospital were readmitted within 30 days, and 124 (2%) died. There were no changes in readmission risk between dialysis methods. There was frequently discordance between the reason of hospitalization and readmission, and we discovered a consistent pattern of readmission ascribed to infection complications and their interaction with cardiovascular illnesses. Xu (2021) concludes the high incidence of hospitalization in dialysis patients raises the possibility of lengthier hospitalizations for dialysis patients, and cardiovascular events and infections are identified as consequences that may benefit from better post-discharge surveillance.

Complications of childbirth that account for major causes of death include birth asphyxia and meconium aspiration syndrome as well as preterm and suspected infection. In addition, intrapartum hypoxia, preterm and its consequences, and assumed infection are important causes of mortality among children. The study further notes that severe hypoxia and hypothermia at the time of admission are other factors that must be considered. Strategies to detect at-risk fetuses during labor, such as enhanced fetal heart rate monitoring combined with prompt therapies, as well as the implementation of WHO measures for preterm babies, may minimize mortality in this low-resource scenario (Moshiro et al., 2019). In another study by (Subedi et al., 2022), ten women (6.9%) had not sought even a single prenatal care visit, whereas 32 (22.9%) had come for antenatal care one to three times. In 114 instances (78.6 percent), at least one cause of death was determined, whereas 31 cases (21.4 percent) remained unclear. The cause of death was not determined in 14 (50 percent) of the 28 cases of macerated stillbirths, but premature labor was related to the cause of death in four (14.3 percent). Intrapartum hypoxia was recognized as the cause of death in 20 (37.7 percent) of the fresh stillbirths, premature labor in nine (17 percent), and undetermined in 15 (28.3 percent). Prematurity was identified as the cause of death in 32 (50 percent) of the 64 early neonatal fatalities, with birth asphyxia accounting for the remaining instances. The study concluded that prematurity was found as the leading cause of early neonatal fatalities, while preterm labor was recognized as the leading cause of perinatal deaths overall and that perinatal fatalities should be researched in order to determine the specific cause of death, which may be used to design preventative initiatives.

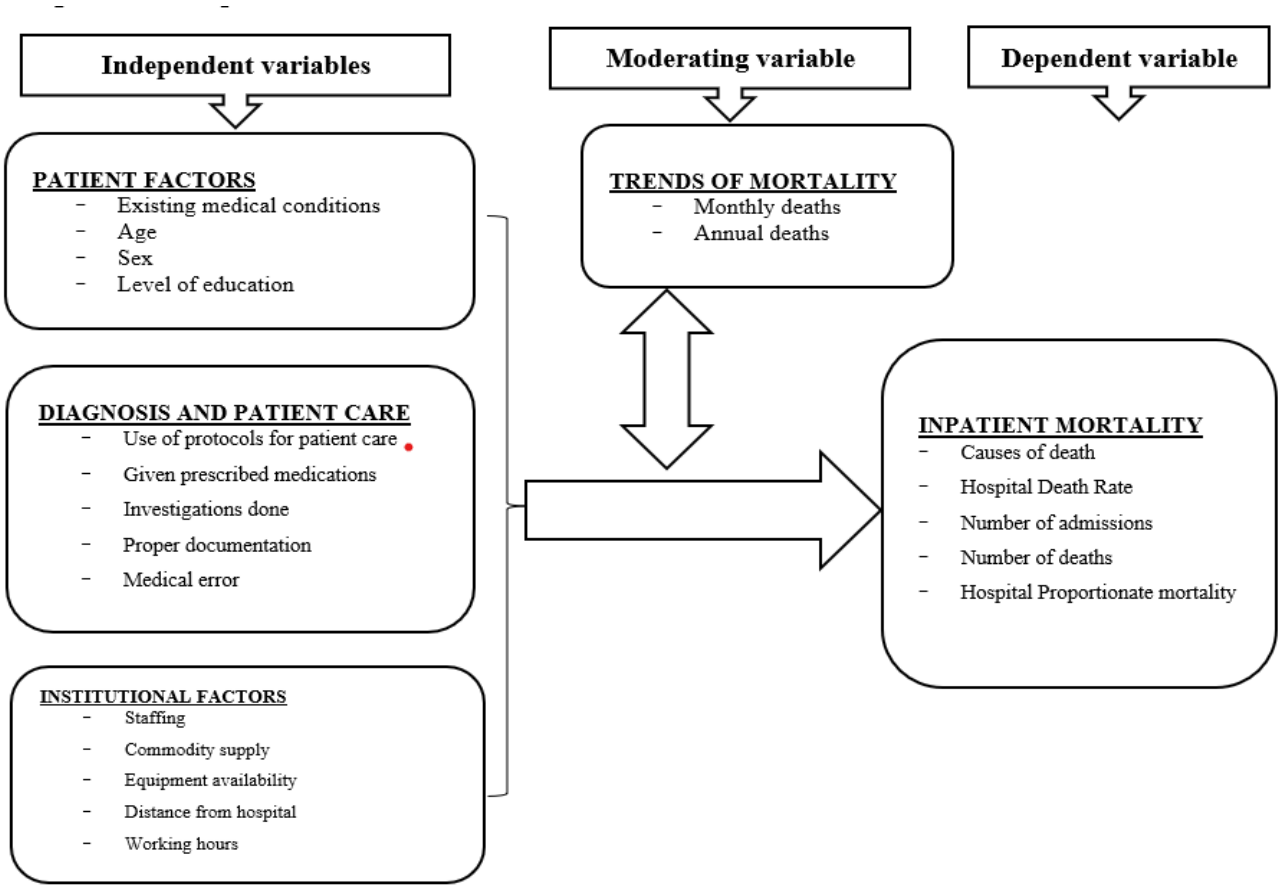
2.4 Theoretical Literature Review

This study was based on (Barnes-Josiah et al., 1998), "three delays" model which explain that mortality is due to delays in deciding to seek appropriate medical help, reaching an appropriate facility; and receiving adequate care when a facility is reached. Long delays in accessing healthcare for pneumonia in young children have been identified as the initial decision by healthcare professionals to seek healthcare and the healthcare system to provide it. Most of the mothers died in the facility and the rest died at home after receiving care in the facility. More than half of all women who die in health care settings experience one or more types of delay. Long waits before treatment in healthcare facilities long delays in hospitalizations Lack of drugs Lack of and incompetence of technicians are some of the main causes of type 3 delays (Mgawadere et al., 2017; Pajuelo et al., 2018). Mortality reductions could be achieved through better logistics infrastructure and training of healthcare providers as a way to reduce the three delays that Barnes suggests (Egbe et al., 2019).

2.5 Conceptual Framework

The dependent variable of the study is patient mortality measured by causes of death (nominal), all-cause mortality rate, case fatality rate, and proportionate mortality. The independent variables included diagnosis and patient care, patient factors, and institutional factors. Diagnosis and patient care were measured by health care workers' adherence to protocols for patient care, the process of diagnosis of the patient, the specific diagnoses, whether infectious or noninfectious, the investigations requested, and the time at which the patient was admitted. Patient factors were measured by the comorbidities, age, sex, and level of education of the patient. Institutional factors were measured by staff-patient ratio, oxygen availability in the ward, and the number of staff trained on basic life support.

Figure 1: Conceptual framework



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3.0 CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter will discuss research philosophy research design study site targets and study group sampling and sampling procedures validity and reliability of research instruments ethical considerations of research instrument data collection methods and data analysis.

3.2 Research Approach

This study utilized quantitative methods and primary and secondary data sources to achieve the research objectives.

3.3 Research design

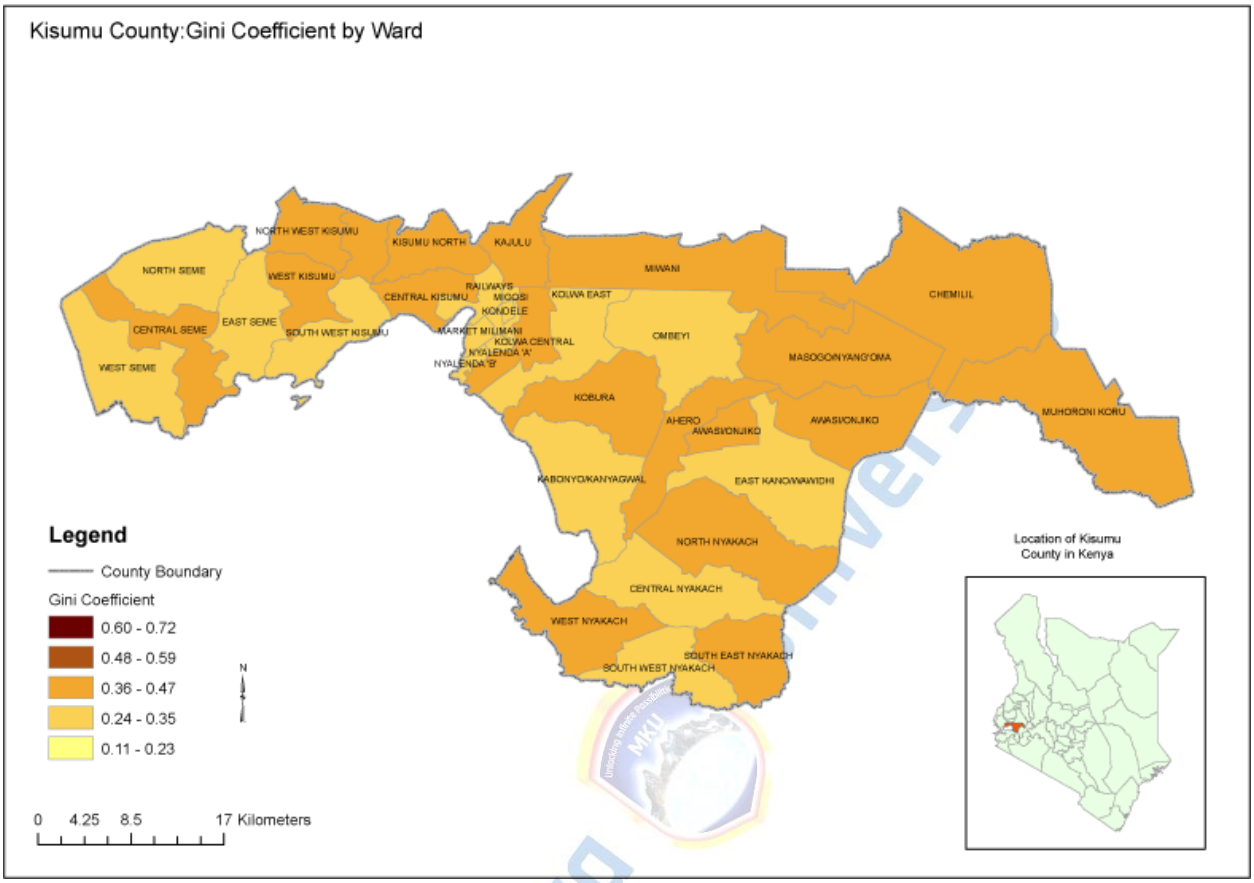
This study was a cross sectional retrospective study design that involved review of records of patients who died between 2018 January 1 and 2019 December 31, at Level Four Kisumu County hospital. This design was used because the data on patients who died during the study period could only be collected in health records department. Patient file review focused on the

number of deaths during the study period. The collected information was segregated in terms of age, sex, length of stay and diagnosis at death certification. Demographic data including location of the patient was characterized as to whether the patient was a referral to hospital or not.

3.4 Location of the study

Kisumu County is among the 47 counties in Kenya located between 33° 20E and 35° 20E and latitude 0°20S and 0°50S and bounded by Homa Bay County to the south Nandi County to the northeast Kericho County to the east Vihiga County to the northwest and Siaya County to the west. The district covers a total area of 20095 km2 and another 567 km2 is covered by water. According to the 2019 national census Kisumu County has a population of 1155574 with a population density of 550 people per capita. Population by gender is 556942 males and 594609 females' sex 23 (Kenya Population and Housing Census 2019). Kisumu County Hospital is a public health center capable of providing comprehensive medical and surgical services and has a capacity of 180 beds. This hospital was chosen because it is located within Kisumu central business district and every Friday, it had been observed by the researcher that traffic builds up to collect dead bodies which is very different from other hospitals within the county.

Figure 2:Map of Kisumu



3.5 Target population

The target population in this study included records of all patients who died while receiving treatment at Kisumu County Level four hospital between January 1 2018 12 AM and December 2019 11:59PM. For the health workers, the target population was key informants who were the heads of departments working at Kisumu Level four County Hospital.

3.6 Sampling procedures and techniques

3.7 Sample size determination

Taro Yamane (1967) formula was used to calculate the sample size because the study involved a small sample (less than 10,000)

n = N/ 1+ N(e)2

In the formular above;

n is the required sample size from the population under study

N is the whole population that is under study (680)

e is the precision or sampling error (0.05)

Using Yamane formula, the sample size is 203

3.8 Sampling methods

Systematic sampling and stratified sampling methods were used into order to avoid bias. In systematic sampling, all files for deceased patients who died between January 1 2018 12: 00 AM and December 31, 2019 11:59 were determined by counting (N). Files were then allocated numbers and listed in order of death occurrence per month from January 2018 to December 2019 and this constituted the sampling frame. A total number of 680 deaths occurred between January 2018 and December 2019 based on the hospital records. The files were assigned serial numbers and segregated per department. After segregation per department, the files were serialized per month each year. The four departments included medical department, surgical department, pediatrics department and reproductive health department. By use of computer program, files serial numbers were picked randomly to arrive at the sample size of 203.

3.9 Research instruments

Data extraction form for key informant and patient data extraction form were used. The key informant data form had following subsections in tandem with the study objectives: (i) all-cause mortality (ii) institutional, (iii) patient factors and (iv) influence of diagnosis and patient care. Other parameters that included demographic information of the patient, date of admission, sex of the patient, date of death, diagnosis on admission, diagnosis at death time and address. Data extraction form were organized into sections in tandem with the study objectives' variables.

3.10 Validity and reliability

All instruments were reviewed by the researcher's supervisor against the objectives of the proposed study. Each section of the data form was evaluated to check relevancy with study objectives. The data form was pretested by giving to staffs at Level Four Kisumu County hospital to volunteer to fill. The information gathered was the evaluated to check the consistency of the information provided. The researcher used the Cronbach's alpha test of reliability and validity. On this test, scores of above 0.70 were acceptable.

3.11 Data collection methods and procedures

The researcher with the help of research assistants at the hospital records department collected mortality data at the hospital using the checklist and data record extraction forms. The researcher supervised the whole data collection process. In each file sampled, information on date of admission, sex of the patient, dead of death, diagnosis on admission, diagnosis at death time, address, other pre-existing medical condition collected and recorded. The data was then entered into SPSS and coded appropriately.

3.12 Data analysis techniques and procedures

Data analysis was done by SPSS for windows version 29. For data in objective one chi-square was used to check association between age, education level, gender, comorbidities, sepsis, hospital acquired infection and ward mortality. Data in objective three was analyzed by odds ratio to determine the risk of hospital death based on the presence or absence of doctor and nurse. Chi-square was used to check association of appropriateness of facility, delay of care and distance and mortality. Data in objective four was analyzed using ANOVA to determine variation in ward mortalities and data presented as line graphs. P value <0.05 was considered significant.

3.13 Ethical considerations.

A written consent form was obtained from key informant (Appendix I). The study was approved by the Mount Kenya University School of Graduate studies (appendix V) and ethical committee MKU/ISERC/2581 (appendix IV). The study was approved by National Commission for Science Technology and Innovation (NACOSTI) approval License number NACOSTI/P/23/23547 (Appendix VI). Authority to access data and conduct the study was obtained from Level four Kisumu County Hospital with approval letter ref number KDH/GEN/VOL. IV (74) letter (Appendix VI). All information obtained from the study pertaining to individual patients was not shared. No identifiers were captured during the study. Key informants were identified and the whole research process explained to them. Participation of key informant was based on voluntary informed consent.

4.0 CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

This section contains study findings, analysis and presentation on factors associated with all-cause-inpatient mortality at Kisumu County level four hospital Kenya between 2018 and 2019. It includes the response rate, demographic characteristics, and presentation of study findings categorized as all-cause-in hospital mortality, trends of hospital deaths, patient factors, institutional factors and diagnosis process.

4.2 Response rate

This was a retrospective study that involved 203 patients who died at Kisumu level four county hospital between January 2018 and December 2019 across all the wards. The study also targeted four key informants who are the heads of departments. All the data extraction forms were filled and all the four key informants filled the questionnaires thus the response rate was 100%. The table below gives a summary of response rate.

Table 1: Response rate

Sample size	**Return rate**	**Frequency**
Patients' records	203	100%
Key informants	4	100%
Total	**207**	**100%**

Source: field (2023)

4.3 Socio-demographic characteristics

Table 2: Age and sex of patients who died between 2018 and 2019 at KCH

		sex		Total
		Male	Female	
Age	Below 10 years	18	16	34
	10 - 35 years	32	28	60
	36 - 59 years	38	18	56
	> 60 years	22	31	53
Total		**110**	**93**	**203**

Majority of deaths occurred between the ages of 10 and 35, 60 (29.6%), followed by 56 (27.6%) patients between the ages of 36 and 59, 53 (26.1%) patients over 60, and 34 (16.7%) patients under the age of 10. **(Table 3).** Given that the majority belong to an age category where there is a higher risk for infectious diseases, the findings of the current study may indicate that infectious diseases play a role in hospital mortality. The current study's findings concur with those of Zarullia et al. (2021) and Roth et al. (2018) that patients between the ages of 15 and 40 frequently die at rates that are three times higher than average, although this excess mortality is not the primary factor contributing to the life expectancy disparity. However, it should be emphasized that studies were conducted in western nations, which may be confounded by racial factors, and they did not focus on age-specific causes of death (Zarullia et al., 2021). According to the current study, fewer deaths occured in younger adults, which is similar to study result by Zarullia et al. (2021). The current study discovered that 110 male deaths (54%) were higher than 93 female deaths (46%). **(Table 3).** These results concur with those of Al-Jarallah et al. (2022), who discovered that the male gender was a reliable predictor of in-hospital death. Although the current study concurs with Al-Jarallah et al. (2022), it should be kept in mind that the study only looked at 19 COVID patients who were hospitalized in Kuwaiti hospitals. This finding can be explained by the fact that men put off getting medical attention, and by the time they do, the condition may have advanced.

4.4 Trends and all-cause In-patient Mortality between January 2018 and December 2019

The total number of patients admitted in all the wards between January 2018 and December 2019 was 9661. Medical ward admitted majority 3904 (40.4%) of patients followed by 1477 (15.3%) in surgical ward, 2373 (24.6%) in pediatric ward and 1907 (19.7%) in obstetrics ward **(Table 4).** The overall hospital 2-year mortality was 7.08% (684 deaths) which is in contrast to a study by (Griffiths et al., 2019), who found hospital mortality to be 4.1% slightly lower that the current study. The findings may suggest that hospitals in developed countries may have a lower in-hospital mortality compared to Kenyan hospitals (developing countries). It should however, be kept in mind that (Griffiths et al., 2019) carried this study in a developed country which perhaps has better health systems as opposed to current study which was carried in resource limited settings. Another explanation for this result could be because the current study was conducted at a county hospital, which might have a smaller catchment area and a more constrained variety of services than in previous studies where the hospital's extensive range of services draws more admissions.

Of the recorded deaths, medical ward contributed most 79% (541), followed by pediatrics 68 (9.9%), surgical 66 (9.6%), and obstetrics and gynecology 9 (1.3%). Medical ward had the highest overall hospital mortality 541 (13.86%), followed by pediatrics 68 (9.9%), surgical ward 66 (4.47%) and gynecology 9 (1.4%) **(Table 4).** The current study findings agree with (Soffer et al., 2021) and (Kershaw et al., 2019) who found that general medical wards admit high risk patients and thus have the highest mortality. The results in the current study suggest that patients admitted in medical ward tend to be very sick at the time of admission. It should however be noted that other studies (Kershaw et al., 2019) focused on patients who died within 48 hours of admission.

Table 3: Overall trends of all-cause in-patient mortality rate per ward

Ward	Admission	Admission%	Deaths	Deaths proportion	Overall Hospital death rate (%)
Medical ward	3904	40.4%	541	79.1%	13.86%
Surgical Ward	1477	15.3%	66	9.6%	4.47%

Paediatrics ward	2373	24.6%	68	9.9%	2.87%
Obstetrics/Gyn	1907	19.7%	9	1.4%	0.47%
Total	**9661**	**100%**	**684**	**100%**	**7.08%**

4.4.1 Monthly Mortality Rates Per ward in 2018 and 2019

In 2019, medical ward had a mean monthly mortality of 17.25, followed by pediatric and surgery with mean monthly mortality of 2.33 and 1.67 respectively**. (Table 5).** Obstetrics and gynecology recorded the least mean monthly mortality of 0.08. This can be explained by various monitoring mechanisms that are in place related to maternal health which includes notification of maternal deaths.

Table 4: Mean Monthly mortality trends per Ward

Descriptive statistics									
		N	Mean	SD	SE	95% CI for Mean		Minimum	Maximum
						Lower	Upper		
Deaths in 2019	Medical Ward	12	17.25	16.821	4.856	6.56	27.94	0	46
	Pediatrics Ward	12	2.33	2.807	.810	.55	4.12	0	9
	Surgical Ward	12	1.67	2.535	.732	.06	3.28	0	8
	Obstetrics /Gynecology	12	.08	.289	.083	-.10	.27	0	1
	Total	**48**	**5.33**	**10.891**	**1.572**	**2.17**	**8.50**	**0**	**46**
Deaths in 2018	Medical Ward	12	27.83	15.514	4.479	17.98	37.69	0	57
	Pediatrics Ward	12	3.33	2.348	.678	1.84	4.83	0	7
	Surgical Ward	12	3.83	2.588	.747	2.19	5.48	0	8
	Obstetrics/Gynecology	12	.58	.515	.149	.26	.91	0	1
	Total	**48**	**8.90**	**13.524**	**1.952**	**4.97**	**12.82**	**0**	**57**

Compared to most deaths that occurred in 2018, medical ward had a mean monthly mortality of 27.83, followed by surgery 3.83 and pediatrics at 3.33. Obstetrics and gynecology recorded least monthly mortality in 2018. **(Table 5)**. There was significant difference between deaths in 2018 and 2019 at Kisumu County hospital. **(Table 6)**

Table 5: Ward mortality trends in 2018 and 2019

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
Deaths in 2019	Between Groups	2304.167	3	768.056	10.333	<.001
	Within Groups	3270.500	44	74.330		
	Total	5574.667	47			
Deaths in 2018	Between Groups	5811.563	3	1937.188	30.606	<.001
	Within Groups	2784.917	44	63.294		
	Total	8596.479	47			

There was significant variation in ward mortality in 2018 (p <0.001, F 30.606, CI 95%, df 3) and also in 2019 (p <0.001, F 10.33, CI 95%, df 3). **(Table 6).** The findings of the current study may suggest that there could have been undiagnosed virulent disease in the year 2018 that caused more deaths in medical ward as compared to 2019. It may also be interpreted to mean that 2019 was well staffed in than 2018.

4.4.2 Mortality trends in 2018

The mortality for medical, pediatrics, surgery and obstetrics/gynecology wards were compared monthly during the year 2018. **(Figure 3).** Generally, patients died in the wards throughout the year except in February. More deaths occurred in medical ward all through the year, with a spike in deaths between February and August 2018. The trends in ward mortality are relatively lower in the surgical and pediatric wards throughout the year, with a slight spike in the number of deaths in both wards during March and April 2018 and again between August and December of the same year. The Obstetrics and Gynecology Department recorded the lowest monthly mortality of all time, with deaths recorded between March and April, June and July, and October and December 2018. The current study results may suggest that more deaths occurred during the rainy season between March and July. The current findings agree with (Chowdhury et al., 2018; Maisa et al., 2021). A possible explanation could be that during this time, more respiratory diseases are reported and other weather-aggravated diseases such as asthma can worsen. It could also be explained that during this season, most patients were not able to get to the hospital in time due to transport challenges during the rainy season.

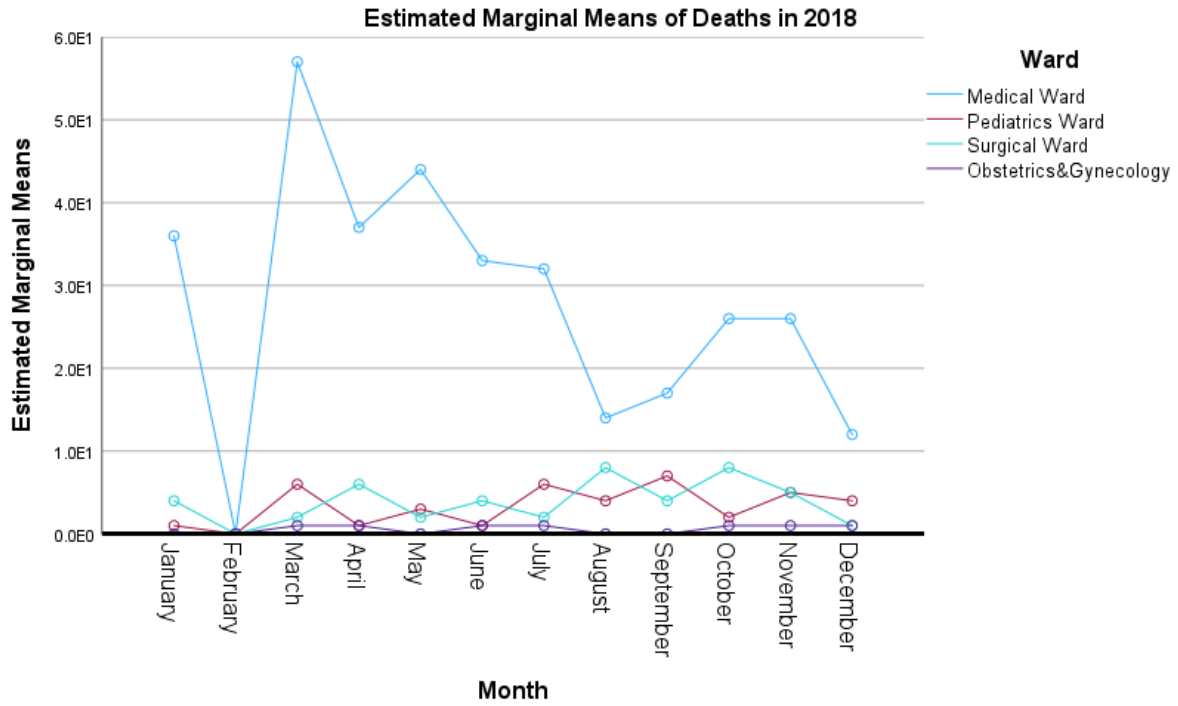


Figure 3: Mortality trends in 2018

4.4.3 Mortality trends in 2019

Deaths occurred throughout the year, with the medical ward recording the highest number of deaths compared to other wards, and January had a high number of deaths, which dropped in February, and there is a sharp rise in number of deaths in February, which drops in July, and then steadily rises before sloping in December 2019. The pediatric ward had the second highest number of deaths, which shows a steady rise from January, peaks in April before sloping down in July, and maintains the low death record before slightly rising again in November 2019 and falling again in December 2019. There was a drop in mortality in the surgical ward in January, which continued through February and April before steadily rising again to reach peak in August and September. **(Figure 4).** The findings of the current may as well suggest that there is increased number in deaths during the winter rainy season perhaps underscoring the role of weather in respiratory disease (Chowdhury et al., 2018; Maisa et al., 2021).

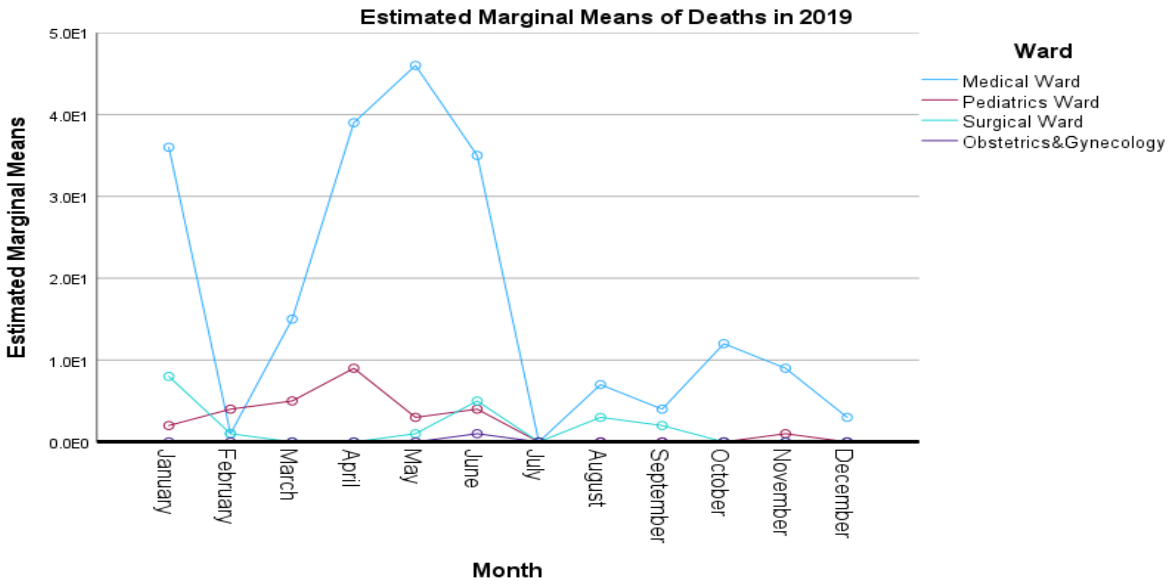


Figure 4: Mortality trends in 2019

4.4.4 Causes of Deaths

Majority of deaths occurred due to infections 86 (42.4%) and non-communicable 85 (41.9%). Injuries from trauma and accidents accounted for least causes of deaths at 2%. Other deaths 25 (12.3%) occurred due to other diseases. **(Table 5).** The current study findings contrast findings by (Roth et al., 2018) who reported that 73.4% of hospital death are due to non-communicable diseases while communicable and others accounted for 18.6%. The difference could be explained by the fact that Roth et al. (2018) carried out a global study involving several countries. Another possible explanation is that countries like New Zealand have better health care to deal with infections, unlike the findings in the current study. It can also be argued that perhaps life expectancy and lifestyle in western countries are risk factors as opposed to infections in sub-Saharan African countries like Kenya.

Infections caused more deaths among patients aged 10 and 59 years than in patients at extreme of ages (below 10 years and more than 60 years). **(Table 5)**. There was statistically significant variation in mortalities across ages in relation to causes of death (P=0.135). However, non-communicable diseases caused more deaths among the elderly (>60 years) than in any other age group (p=2.84) **(Table 7)**

Table 6: Distribution of deaths by age category based on non-communicable diseases

		Non-Communicable Diseases				Total
		Hypertension	Diabetes Mellitus	Cancer	Other	
Age	**Below 10 years**	0	0	0	9	**9**
	10 - 35 years	1	0	2	29	**32**
	36 - 59 years	2	1	2	20	**25**
	> 60 years	6	5	7	15	**33**
Total		**9**	**6**	**11**	**73**	**99**

In relation to age specific non-communicable diseases, hypertension, diabetes mellitus and cancer were more common among the elderly (>60 years) than in any other age group. Cancer was more prevalent followed by hypertension and diabetes mellitus. Other non-communicable diseases are listed in increasing frequency. **(Table 8).** The study found that cancer, hypertension and diabetes mellitus were the leading non communicable causes of deaths. Similar findings by (Nigri et al., 2022) reported that cardiovascular diseases and neoplasms are important causes of death among the aged hospitalized patients although there are other important non-communicable diseases observed such as severe anemia and heart failure.

Table 7: Other non-communicable diseases

NCD	Frequency	%
Severe anemia	**16**	21.9
Heart failure	10	13.7
Dehydration	5	6.8
Sickle cell disease	4	5.5
Stroke	4	5.5
Birth asphyxia	2	2.7
Malnutrition	2	2.7
Perforated PUD	2	2.7
RDS.	2	2.7
Appendicitis	1	1.4
Chronic kidney disease	1	1.4
Convulsive disorder	1	1.4
Hemorrhoids	1	1.4
Hepatic encephalopathy	1	1.4
Lymphoma	1	1.4
Severe burns	1	1.4

Shock	1	1.4
Others	18	24.7
	73	100

4.4.5 Deaths based on site of infection

Among patients who died due to infections, the current study found that the majority 50 (26.1%) had respiratory infections, 17 (8.4%) had CNS infections and 19 (9.4%) had other infections. The current study findings agree with Ball et al. (2018) and Dat et al. (2022), who found that respiratory infections were the leading cause of hospital mortality in 27.8% of cases. The results from the current study suggest that perhaps there are important risk factors for respiratory infections that need further research. Another possible explanation is that perhaps COVID-19 existed before the first case was discovered. While the current study findings agree with Ball et al. (2018) and Soffer et al. (2021), it should be kept in mind that these were large studies involving several hospitals.

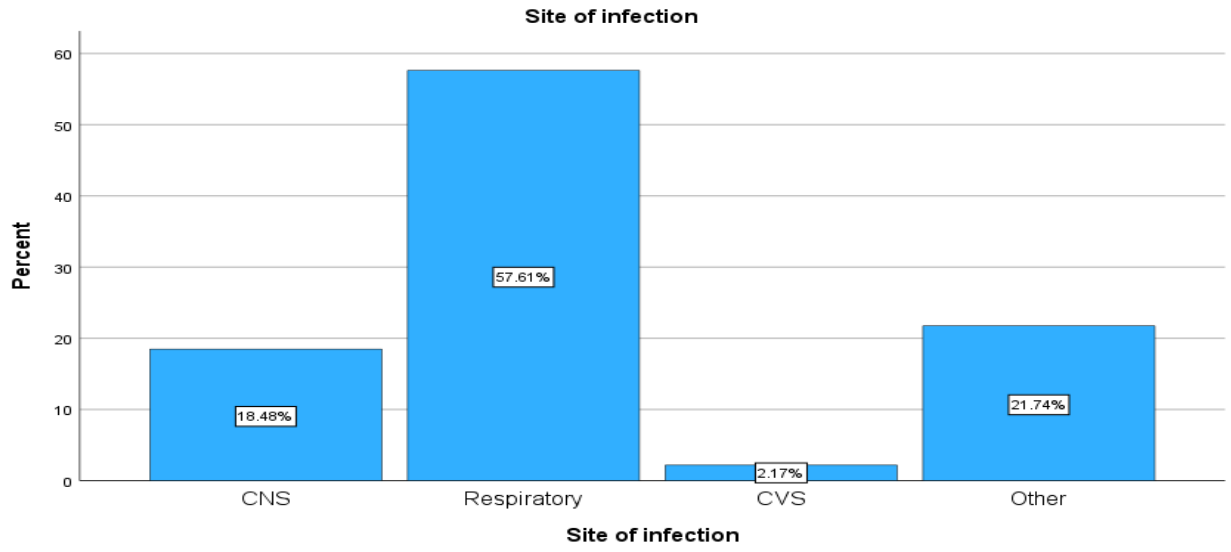


Figure 5: Site specific infection

4.4.6 Death category based on Specific Infection

The leading specific respiratory infection was pneumonia 22 (10.8%) and pulmonary tuberculosis 16 (7.9%). HIV/AIDs and Meningitis accounted for 9 (4.4%) and 14 (6.9%) of

deaths respectively during the study period. **(Table 9)**. The findings agree with (Ball et al., 2018b; Dat et al., 2022) who found that the most common diagnoses were diseases of the respiratory system like pneumonia. The current findings may suggest that perhaps there is significant air pollution that predisposes to respiratory diseases. It also suggests that more HIV testing is needed since it is a single most risk factor for pulmonary tuberculosis and pneumonia. Respiratory infections contributed to 56% of deaths. Pneumonia and pulmonary tuberculosis were the leading respiratory infections in the patients who died in 2018 and 2019. Similar findings by (Aragón & Chalkley, 2018b) and (Ogawa et al., 2021) indicated that the leading causes of death in hospitals include respiratory diseases such as pneumonia. Perhaps preventive interventions during rainy season could be justified.

Table 8: Specific infection

		HIV/AIDS	Tuberculosis	Pneumonia	Meningitis	Other	Total
Age	Below 10 years	0	2	8	3	6	19
	10 - 35 years	5	7	4	4	6	26
	36 - 59 years	4	4	2	6	10	26
	> 60 years	0	3	8	0	5	16
Total		**9**	**16**	**22**	**13**	**27**	**87**

The current study findings agree with (Griffiths et al., 2019) who found that pneumonia was the single most common diagnosis. Other infections are listed. (**Table 10)**

Table 9: Other infections

Infection	Frequency	%
Others	10	37.04
Severe malaria	4	14.81
Hepatitis	3	11.11
Septicemia	3	11.11
Encephalitis	2	7.41
Brain abscess	1	3.70
Cystitis	1	3.70
Esophageal candida	1	3.70
Gastritis	1	3.70
PJP	1	3.70
TOTAL	**27**	**100**

4.5 Patient Factors Associated with all-cause in-patient Mortality

Approximately111 (61% of patients) had a noninfectious comorbidity at the time of death. The majority of 21 patients who died (63.6%) had sepsis died due to focal infection. It was not possible to determine the presence of sepsis in 13 (6.4%) of the patients who died during the study period Age category, education level, presence of sepsis, hospital-acquired infection, and gender were not significantly associated with the cause of death. ($p>0.05$). Comorbidity was significantly associated with death of patients ($p<0.0001$). **(Table 11).**

Table 10: Patient factors associated with all-cause mortality

Variable	Total, N, %)	Cause of death				P value
		Infection	Injury	NCD	Other	
Age- Category(years)						
<10	34(16.8%)	18(52.9%)	2(5.9%)	9(26.5%)	5(14.7%)	0.231
11 to 35	59(29.2%)	27(45.8%)	0	24(40.7%)	8(13.6%)	
36 to 59	56(27.7%)	25(44.6%)	0	24(42.9%)	7(12.5%)	
>60	52(26.2%)	18(34%)	2(3.8%)	28(52.8%)	5(9.4%)	
Education Level						
Primary	76(37.4%)	30(39.5%)	3(3.9%)	37(48.7%)	6(7.9%)	0.16
Tertiary	45(22.2%)	21(46.7%)	0	20(44.4%)	4(8.9%)	
Don't know	82(40.4%)	38(46.3%)	1(1.2%)	28(34.1%)	15(18.3%)	
Gender						
Male	110(54.2%)	53(48.2%)	1(0.9%)	44(40%)	12(10.9%)	0.393
Female	93(45.8%)	36(38.7%)	3(3.2%)	41(44.1%)	13(14%)	
Comorbidity at time of death						
Infectious	71(39%)	58(81.7%)	0	13(18.3%)	0	**0.0001**
Non infectious	111(61%)	20(18%)	4(3.6%)	63(56.8%)	24(21.6%)	
Was there sepsis						
Yes	33(16.3%)	21(63.6%)	1(3%)	8(24.2%)	3(9.1%)	0.254
No	157(77.3%)	63(40.1%)	3(1.9%)	70(44.6%)	21(13.4%)	
Don't know	13(6.4%)	5(38.5%)	0	7(53.8%)	1(7.7%)	
Was there hospital acquired infection						
Yes	11(5.4%)	5(45.5%)	0	6(54.5%)	0	0.384
No	179(88.2%)	78(43.6%)	3(1.7%)	73(40.8%)	25(14%)	
Don't know	13(6.4%)	6(46.2%)	1(7.7%)	6(46.2%)	0	

4.6 Patient Care and diagnosis process on all-cause in-patient mortality

4.6.1 Use of protocol in patient care

Patient care, treatment, and diagnosis played a role in inpatient mortality (Robb et al., 2010). This has been demonstrated in the current study in which, just 50% of wards compared to 50% of the pediatrics and obstetrics departments. The study also found that while history-taking and patient examinations are occasionally done in the medical and surgical wards, they are regularly done in the pediatrics and obstetrics wards (50% wards). Perhaps this could explain the low mortality reported in these department. It should be kept in mind that hospital dynamics in 2018 and 2019 could be different and perhaps there in a need to carry out further studies to understand current staffing level. In the surgical and obstetrics and gynecology departments of the wards, investigations are performed often, whereas they are occasionally performed in the medical and pediatric departments (50%). 100% respondents said there was adequate, readily accessible documentation for patient care equipment, pharmaceuticals administered, admission note protocols, and progress notes and standard operating procedures. This is as summarized in the key informant responses **(Table 12)**

Table 11: Key informant responses in relation to patient care and diagnosis process

Response	Medical	Paediatrics	Surgical	Obs/Gyn
Protocol followed	No	Yes	No	Yes
History taken	sometime	Regularly	sometime	Regularly
Patient examination	Sometime	Regularly	Sometime	Regularly
Investigations done	Sometimes	Sometimes	Regularly	Regularly
Documented procedure	Sometimes	Regularly	Regularly	Regularly
Document admission	Yes	Yes	Yes	Yes
Document-medications	Yes	Yes	Yes	Yes
Progress notes written	Yes	Yes	Yes	Yes
Equipment available	Yes	Yes	Yes	Yes
SOPs available	Yes	Yes	Yes	Yes
Essential drugs	Sometime	Regularly	Regularly	Regularly
Necessary drugs availability	Sometime	Sometime	Sometime	Sometime
Mortality meetings	Sometime	Sometime	Regularly	Regularly

4.6.2 Quality of Care Received

The study also sought to find out the quality of care received. Majority 150 (73.9%) received care from the appropriate setting, 39 (19.2%) of patients who died had existing protocol for diagnosis and treatment followed and minority of the patients 3(1.5%) who died, had documentation of improvement/change in complains and laboratory parameters **(Table 13).** The current study findings agree with (Robb et al., 2010).

Table 12: Quality of care received

	Frequency	Percent	Valid Percent	Cumulative Percent
Received care from appropriate setting	150	73.9	78.1	78.1
Existing protocol for diagnosis & treatment followed	39	19.2	20.3	98.4
Documented improvement/change in complains/lab parameters	3	1.5	1.6	100.0
Total	192	94.6	100.0	

4.6.3 Patient care within the ward

In the majority (98.5%) of patients who died, there was no medical error and prescribed drugs were given. In about ninety-seven percent (196; 97%) of cases, requested investigations were done, and there was no misdiagnosis in 195 (96.1%) cases. Medical error and misdiagnosis were not significantly associated with the cause of death ($p>0.05$). The current study findings contradict Abe et al. (2020b); Makary & Daniel, (2016b) and Phillips et al., (2001b), who found that medical error contribute to significant hospital mortality. This finding could be explained by the fact that the studies done elsewhere were prospective and compared to current study which is retrospective the results can vary. **(Table 14).**

Table 13: Patient management factors associated with all-cause mortality

Variable	Total, N, %)	Cause of death				P value
		Infection	Injury	NCD	Other	
Was there medical error						
Yes	2(1%)	1(50%)	0	0	1(50%)	0.595
No	200(98.5%)	88(44%)	4(2%)	84(42%)	24(12%)	
Don't know	1(0.5%)	0	0	1(100%)	0	
Prescribed drugs given						

Yes	200(98.5%)	84(44%)	4(2%)	83(41.5%)	25(12.5%)	0.942
No	2(1%)	1(50%)	0	1(50%)	0	
Don't know	1(0.5%)	0	0	1(100%)	0	
Requested Investigations done						
Yes	196(97%)	87(44.4%)	4(2%)	81(41.3%)	24(12.2%)	0.712
No	3(1.5%)	2(66.7%)	0	1(33.3%)	0	
Don't know	3(1.5%)	0	0	2(66.7%)	1(33.3%)	
Was there misdiagnosis						
Yes	2(1%)	1(50%)	0	1(50%)	0	0.898
No	195(96.1%)	84(43.1%)	4(2.1%)	83(42.6%)	24(12.3%)	
Don't know	6(3%)	4(66.7%)	0	1(16.7%)	1(100%)	

4.7 Institutional factors associated with all-cause-inpatient mortality

The study sought to establish whether various institutional factors such as distance from the facility, presence of doctors and nurses, drugs availability and availability of hospital equipment were associated with in-patient mortality.

4.7.1 Staffing

At the time the majority of 116 (61.1%) patients died, a doctor was present and documented efforts made to resuscitate them. However, in 74 (38.4%) of the patients who died, there was no doctor to document any effort to save their lives. Nurses were present most of the time for 190 (93.6%) deaths and not present during 11 (5.4%) deaths that occurred at the Kisumu Level Four County Hospital. These findings agree with Driscoll et al. (2018) and Roth et al. (2021b). The absence of a doctor or nurse at any given time could be explained by a staff shortage that requires one medical staff member to work in all wards **(Table 15)**

Table 14: Doctor and presence in ward

Doctor present * Nurse present Crosstabulation

Count

		Nurse present		Total
		Yes	No	
Doctor present	Yes	116	9	125
	No	74	4	78
Total		**190**	**13**	**203**

There was a significant difference in the odds of a patient dying when a nurse and doctor were present compared to when they were not present (OR = 0.697, 95% CI: [0.207, 2.344]). This evidence suggests that the presence or absence of doctors and nurses' influences hospital mortality (Table 16). These results suggest that the presence of a doctor and nurse may be a protective factor against patients dying. These findings agree with Ball et al. (2018), Griffiths et al. (2019), and Roth et al. (2021b). The study found that there was a significant difference in the odds of a patient dying when a nurse and a doctor were all present (OR=0.697). the results of the current study also agree with (Tourangeau, 2006) who had similar findings that collaboration between doctors and nurses is associated with reduced patient mortality.

Table 15: Risk of death based in presence or absence of hospital staff

Risk of death Estimate			
	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Doctor present (Yes / No)	.697	.207	2.344
For cohort Nurse present = Yes	.978	.911	1.050
For cohort Nurse present = No	1.404	.448	4.405
N of Valid Cases	203		

4.7.2 Admission Related Factors associated with all-cause mortality

Majority of deaths, 174(85.7%) occurred from patients admitted as self-referral. Over half of deaths, 118(58.4%) occurred between 8am to 5pm and there was no delay in seeking care in over eighty percent 162(80.6%) of deaths. Majority of patients who died in the hospital were admitted in medical ward 155 (76.4%), followed by pediatrics 31 (15.3%), surgical 10 (4.9%). Obstetrics and gynecology ward had the least number of deaths 6 (3.0%). **(Table 17).** Appropriateness of facility, delay in seeking care, distance from facility, time, type and day of admission were not significantly associated with death of patient. ($p>0.05$). The ward in which a patient was admitted was significantly associated with all-cause mortality ($p<0.0001$). The current study findings agree with findings by (Han et al., 2018b) and (Roth et al., 2018). The current study findings may suggest that admission of most patients who died was between 8am – 5pm underscoring the need to reinforce human resource during this time by the hospital management. Most of patients died in medical ward perhaps there is need to rationalize staffs in medical ward.

Table 16: Admission related factors associated with all-cause mortality

Variable	Total, N, %)	Cause of death				P value
		Infection	Injury	NCD	Other	
Appropriateness of facility						
Yes	198(97.5%)	86(43.4%)	4(2%)	83(41.9%)	25(12.6%)	0.791
No	5(2.5%)	3(60%)	0	2(40%)	0	
Distance from facility						
<10 km	136(68%)	62(45.6%)	2(1.5%)	54(39.7%)	18(13.2%)	0.629
>10 km	64(32%)	25(39.1%)	2(3.1%)	30(46.9%)	7(10.9%)	
Time of admission						
Daytime	148(72.9%)	70(47.3%)	3(2%)	59(39.9%)	16(10.8%)	0.526
Night-time	47(23.2%)	15(31.9%)	1(2.1%)	22(46.8%)	9(19.1%)	
Week day	4(2%)	1(25%)	0	3(75%)	0	
Weekend	4(2%)	3(75%)	0	1(25%)	0	
Type of admission						
Referral from hospital	27(13.3%)	8(29.6%)	0	13(48.1%)	6(22.2%)	0.529
Self-referral	174(85.7%)	80(46%)	4(2.3%)	71(40.8%)	19(10.9%)	
Not known	2(1%)	1(50%)	0	1(50%)	0	
Day of admission						
Week day	138(68.3%)	63(45.7%)	4(2.9%)	50(36.2%)	21(15.2%)	0.175
Weekend	29(14.4%)	12(41.4%)	0	14(48.3%)	3(10.3%)	
Don't know	35(17.3%)	14(40%)	0	20(57.1%)	1(2.9%)	
Delay in care						
Yes	8(4%)	4(50%)	0	4(50%)	0	0.938
No	191(95%)	84(44%)	4(2.1%)	78(40.8%)	25(13.1%)	
Don't know	2(1%)	1(50%)	0	1(50%)	0	
Ward admitted						
Surgical	10(5%)	3(30%)	1(10%)	4(40%)	2(20%)	**0.0001**
Medical	155(76.7%)	70(45.2%)	2(1.3%)	70(45.2%)	13(8.4%)	
Pediatrics	31(15.3%)	16(51.6%)	1(3.2%)	9(29%)	5(16.1%)	
Obstetrics/Gynecology	6(3%)	0	0	1(16.7%)	5(83.3%)	

4.7.3 Unidentified site of infection

The study sought to establish whether there was unidentified site of infection among patients who died during the study period. Majority 187 (92.1%) did not have unidentified site of

infection and 2 (1%) had unidentified site of infection. **(Figure 6).** The current study findings agree with (Abe et al., 2019) and (Robb et al., 2010). The current findings may suggest that perhaps patients presenting with diseases in early stage are likely not to be diagnosed. It could also point to possibility that health care workers may not be exhaustive on physical evaluation of the patients.

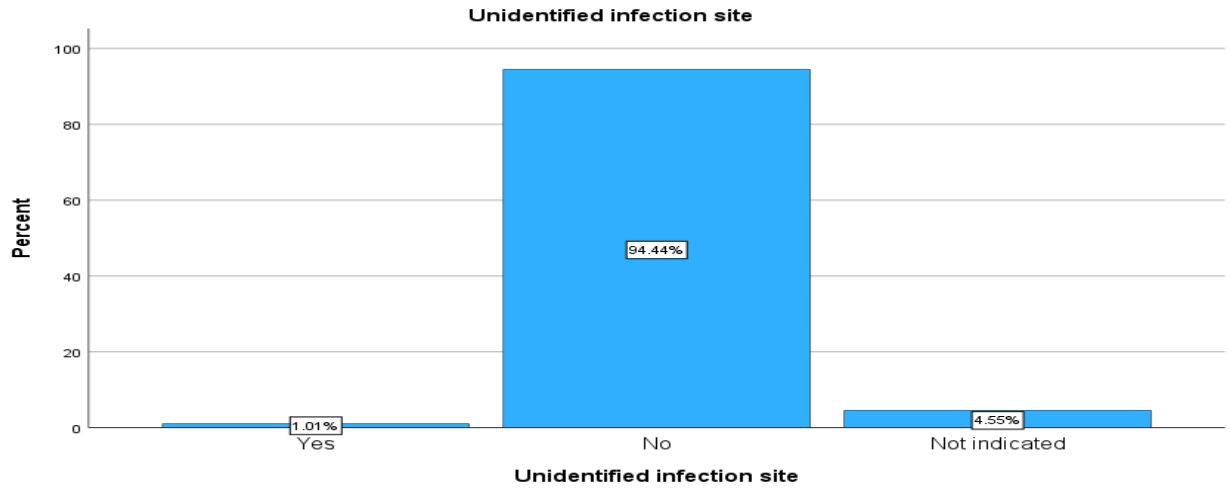


Figure 6: Unidentified site of infection

4.7.4 Maternal Antenatal clinic attendance

Of the patients who died in obstetrics and gynecology ward, only 1(0.5%) attended antenatal clinic. **(Figure 7)**. The findings of the current study agree with (Arefaynie et al., 2022) who found out that uptake of antenatal care service have remained improved but despite the mortality is in women who don't attend ANC.

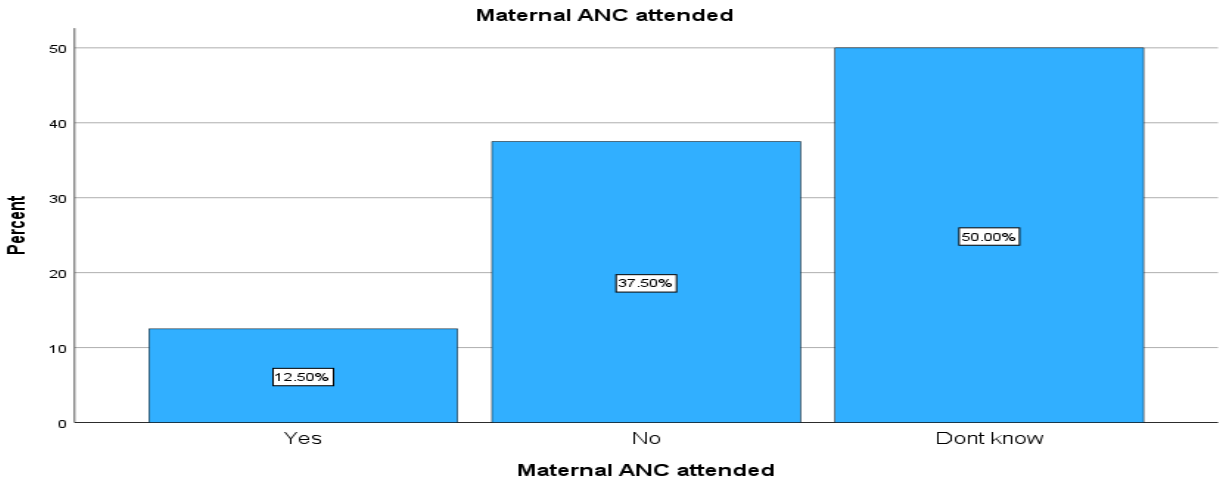


Figure 7: Maternal Antenatal Clinical attendance

5.0 CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The findings of this study suggest that 3% of deaths that occurred at Kisumu County level four hospital between 2018 and 2019 were avoidable. The purpose of the current study was to generate evidence that can be used by hospital management to reduce avoidable deaths and optimize resources in the hospital. This chapter covers summary of the results findings, conclusions, recommendations for practice and recommendations for further research.

5.2 Summary of the result findings

5.2.1 Trends of hospital deaths in 2018 and 2019

According to the current study, medical ward had the highest 2-year in-hospital mortality at 13.86% while obstetrics and gynecology (reproductive health) had the least mortality at 0.47%. The current study found that infections caused 42% of deaths in patients aged below 35 years while non communicable diseases caused 41% of hospital deaths in patients aged >60 years. Infections caused more deaths among patients aged 10 and 59 years than in patients at extreme of ages (below 10 years and more than 60 years). **(Table 5)**. There was statistically significant variation in mortalities across ages in relation to causes of death (p=0.135). However, non-communicable diseases caused more deaths among the elderly (>60 years) than in any other age group (p=2.84) **(Table 7)**

5.2.2 Institutional factors leading to hospital deaths

Majority of deaths, 174(85.7%) occurred from patients admitted as self-referral. Over half of deaths, 118(58.4%) occurred between 8am to 5pm and there was no delay in seeking care in over eighty percent 162(80.6%) of deaths. Majority of patients who died in the hospital were admitted in medical ward 155 (76.4%), followed by pediatrics 31 (15.3%), surgical 10 (4.9%). Obstetrics and gynecology ward had the least number of deaths 6 (3.0%). **(Table 17).** Appropriateness of facility, delay in seeking care, distance from facility, time, type and day of admission were not significantly associated with death of patient. ($p>0.05$). The ward in which a patient was admitted was significantly associated with all-cause mortality ($p<0.0001$). There was a significant difference in the odds of a patient dying when a nurse and doctor were present compared to when they were not present (OR = 0.697, 95% CI: [0.207, 2.344]). Appropriateness

of facility, delay in seeking care, distance from facility, time, type and day of admission were not significantly associated with death of patient. ($p>0.05$). The ward in which a patient was admitted was significantly associated with all-cause mortality ($p<0.0001$).

5.2.3 Patient related factors leading to hospital death in 2018 and 2019

Comorbidity was a significant factor associated with death among the patients who died in 2018 and 2019 ($p=<0.05$). In most of the deaths reaching up to 61%, the patients who died had a noninfectious comorbidity at the time of death. Approximately111 (61% of patients) had a noninfectious comorbidity at the time of death. The majority of 21 patients who died (63.6%) had sepsis died due to focal infection. It was not possible to determine the presence of sepsis in 13 (6.4%) of the patients who died during the study period. Age category, education level, presence of sepsis, hospital-acquired infection, and gender were not significantly associated with the cause of death. ($p>0.05$). **(Table 11).**

5.2.4 Patient care and management

In the majority (98.5%) of patients who died, there was no medical error and prescribed drugs were given. In about ninety-seven percent (196; 97%) of cases, requested investigations were done, and there was no misdiagnosis in 195 (96.1%) cases. Medical error and misdiagnosis were not significantly associated with the cause of death ($p>0.05$).

5.3 Conclusions

The study aimed to find out factors associated with all-cause inpatient mortality at Kisumu County level four hospital between 2018 and 2019. Based on the study findings, it can be concluded that more deaths occurred in medical ward from infectious diseases such as pneumonia and pulmonary TB among patients aged <35 years while non-communicable diseases such as cancer, hypertension and diabetes mellitus were important causes of death among the people aged >60 years. The results seem to suggest that more deaths occurred during rainy season between February and August. Patient factors such as age, sex and education level were not significantly associated with hospital mortality. Comorbidities particularly the non-infectious diseases were associated with more deaths. This research clearly illustrates that hospital deaths among aged people is due to noncommunicable disease and deaths among young populations is due to infectious diseases but also raises the question of the need to enhance nurse-doctor relationship to reduce avoidable deaths among patients admitted in hospitals.

5.4 Recommendations for practice

Based on the study findings and conclusions, the practitioners should:

a) Design prevention interventions for non-communicable diseases targeting the young people before reaching 60 years.
b) Advocate for immunization against respiratory infections during the rainy season between February and August each year.
c) Rationalize staffing in wards to improve patient care especially in medical ward.
d) Develop guidelines to guide clinical management of geriatric population admitted in hospitals with existing comorbidities

5.5 Recommendations for further research

This study was only conducted in one hospital and hence further research is needed to cover more hospitals before generalized conclusions can be drawn.

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APPENDIX I: CONSENT FORM

Serial number:_____

I am Vincent Musungu a student at Mount Kenya University pursuing master's degree in family health and I am doing a study on **FACTORS ASSOCIATED WITH ALL-CAUSE IN-PATIENT MORTALITY AT KISUMU COUNTY LEVEL FOUR HOSPITAL BETWEEN 2018 AND 2019**

All the information provided will not be shared except for purposes limited to the objectives of this study.

If you accept participating in the study, tick on 'accept' and append a signature in the space provide below.

I_____hereby consent/decline to consent to participate in the study

Signature…….

Date…….

APPENDIX II: PATIENT DATA EXTRACTION FORM

Ward|_____| **Serial No._____**

SECTION A: ALL-CAUSE IN-PATIENT MORTALITY

(1) Cause of death

a.|__|Infection→ Q2&3

b. |__| Injury/Trauma→Q4

c.|__| NCD→Q5

d. |__|Other

(2) If infection, which site?

a.|__| CNS

b. |__| Respiratory

c.|__| CVS

d. |__|Other

(3) Specific Infection at time of death

a.|__|HIV/AIDs

b. |__|Tuberculosis

c.|__|Pneumonia

d. |__|Meningitis

e.|__|Other (Specify: _____ Code |__|__|)

(4) If trauma, which site?

a.|__|Head

b. |__|Abdomen

c.|__|Chest

d. |__|Other (Specify: _____ Code |__|__|)

(5) If NCD, which NCD?

a.|__|Hypertension

b. |__|Diabetes mellitus

c.|__|Cancer

d. |__|Other (Specify: _____ Code |__|__|)

SECTION B: PATIENT FACTORS

(1) Age of the patient

a. |__| Below 10

b. |__|10-35

c. |__| 36-59

d. |__| > 60 years

(2) Sex

a. |__|Male

b. |__|Female

c. |__|Don't know

(3) What co-morbidities were present before or at time of death?

a. |__|Infectious

b. |__|Non infectious

(4) Education status

a. |__|Primary

b. |__|Tertiary

c. |__|Don't know

SECTION C: INSTITUTIONAL FACTORS

(1) Doctor present at time of death (either on duty or other measure)

a. |__|Yes

b. |__|No

c. |__|Don't know

(2) Nurse present at time of death (either on duty or other measure)

a. |__|Yes

b. |__|No

c. |__|Don't know

(3) Was there delay in receiving care

a. |__|Yes

b. |__|No

c. |__|Do not know

(4) Was it an avoidable death?

a. |__|Yes

b. |__|No

(5) Was the hospital appropriate facility for the patient?

a. |__|Yes

b. |__|No

(6) Was there long waiting hours before receiving treatment?

a. |__|Yes

b. |__|No

c. |__|Don't know

(7) Distance to a healthcare facility

a. |__|Near less than 10 km

b. |__|Far, 10 km and above

(8) Type of admission

a. |__|Elective

b. |__|Emergency

c. |__|Unknown

(9) Was there sepsis?

a. |__|Yes

b. |__|No

c. |__|Don't know

(10) Was there hospital acquired infection?

a. |__|Yes

b. |__|No

c. |__|Don't know

(11) Time of admission

a. |__|8pm – 5pm

b. |__|5pm – 7pm

c. |__|7pm – 7am

d. |__|Don't know

(12)Day of admission

a. |__| Weekday

b. |__|Weekend

c. |__|Don't know

SECTION D: DIAGNOSIS AND PATIENT CARE

(1) Was there any misdiagnosis?

a. |__|Yes

b. |__|No

c. |__|Not indicated

(2) Was there any medical error?

a. |__|Yes

b. |__|No

c. |__|Don't know

(3) Admission type

a. |___| Referral from another hospital

b. |___| Self-referral

c. |___| Not known

(4) Was there unidentified site of infection?

a. |__|Yes

b. |__|No

c. |__|Not indicated

(5) Quality of care received.

a. |__|Structure (received care from appropriate setting)

b. |__|Process (followed existing protocol for the diagnosis/treatment)

c. |__|outcome (documented improvement/change in complains/lab parameters)

(6) Was there delay in seeking care?

a. |__| Yes

b. |__| No

c. |__| Don’t know

(7) Which ward was the patient admitted to?

a. |__|Surgical,

b. |__|Medical,

c. |__|Pediatrics,

d. |__|Obstetrics/gynecology,

(8) Time of patient admission

a. |__|Daytime

b. |__|Night-time

c. |__|Weekday

d. |__|Weekend

(9) Season at admission

a. |__|Rainy

b. |__|Dry

c. |__|Don’t know

(10) Investigations requested was done

a. |__|Yes

b. |__|No

c. |__|Don’t know

(11) Patient was given drugs prescribed

a. |__|Yes

b. |__|No

c. |__|Don’t know

(12) If maternal death, did patient attend ANC (antenatal care clinic)

a. |__|Yes

b. |__|No

c. |__|Don’t know

APPENDIX III: KEY INFORMANT DATA FORM

WARD|_____| **Serial No._____**

SECTION A: ALL CAUSE IN-PATIENT MORTALITY

a. Number of patients admitted as from Jan 2018-December 31, 20 19 |____|
b. Total number deaths between Jan 2018-December 31, 2019 |____|
c. Total number of death/total number of patients admitted |____|
d. Number of deaths by sex distribution between January 1, 2018-December 31, 2019
    i. |___| Males
    ii. |___| Females
e. Mortality distribution by ward between January 1, 2018-December 31 2019
    i. |___| Medical
    ii. |___| Surgical
    iii. |___| Pediatrics
    iv. |___| Obstetrics/gynecology
f. Number of deaths by month

January 1, 2018 to December 31, 2018											
Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec
January 1, 2019 to December 31, 2019											
Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec

SECTION B: DIAGNOSIS AND PATIENT CARE FACTORS

1. Adherence to protocols for patient care
    a. |___|Yes
    b. |___|No
    c. |___|Don't know
2. Patient history taken in full
    a. |___|Regularly
    b. |___|Some time
    c. |___|Not at all
3. Patients examined as per guidelines by the qualified staff
    a. |___|Regularly
    b. |___|Some time
    c. |___|Not at all
4. Patient investigated as per request by doctor/clinician
    a. |___|Regularly
    b. |___|Some time
    c. |___|Not at all
5. Documentation of procedures
    a. |___|Regularly
    b. |___|Some time
    c. |___|Not at all
6. Documentation at admission
    a. |___|Yes
    b. |___|No
    c. |___|Don't know
7. documentation of Medications
    a. |___|Yes
    b. |___|No
    c. |___|Don't know
8. Progress notes documented
    a. |___|Yes

b. |___|No

c. |___|Don't know

9. Drugs given to the patient as prescribed

a. |___|Yes

b. |___|No

c. |___|Don't know

SECTION C: PATIENT FACTORS

1. To what extend does age of the patient affect treatment/care outcome

a. |___|Regularly

b. |___|Some time

c. |___|Not at all

2. To what extend does patient sex affect treatment/care outcome?

a. |___|Regularly

b. |___|Some time

c. |___|Not at all

3. To what extend does patient existing medical condition affect the treatment/care outcome?

a. |___|Regularly

b. |___|Some time

c. |___|Not at all

4. To what extend does patient level of education affect treatment/care outcome?

a. |___|Regularly

b. |___|Some time

c. |___|Not at all

SECTION D: INSTITUTIONAL FACTORS

1. Diagnostic equipment available

a. |___|Yes

b. |___|No

2. Staffing profile

a. |___| Medical Officers

b. |___| Clinical Officers

c. |___| Nursing Officers
d. |___| Nutrition Officers
e. |___| Laboratory Officers
f. |___| Physiotherapists

3. Availability of SOPS/guidelines in each ward/department
    a. |___|Yes
    b. |___|No
    c. |___|Don't know
4. Essential drugs available for patients
    a. |___|Most of the time
    b. |___|Some time
    c. |___|Not at all
5. Non-essential BUT necessary drugs available for the patients
    a. |___|Most of the time
    b. |___|Some time
    c. |___|Not at all
6. Mortality meetings held
    a. |___|Regularly
    b. |___| Some time
    c. |___|Not at all

APPENDIX IV: ETHICAL APPROVAL LETTER

Mount Kenya University

REF: **MKU/ISERC/2581**

Date: 24 January 2023

TO: **VINCENT MUSUNGU SECHERE**

REG: **MCM/2019/56898**

Dear Sir/Madam,

RE: FACTORS ASSOCIATED WITH ALL-CAUSE IN-PATIENT MORTALITY BETWEEN 2018 AND 2019 AT KISUMU COUNTY LEVEL FOUR HOSPITAL, KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1654.** The approval period is **24/01/2023 - 23/01/2024.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

Dr. Peter G. Kirira
Chairman, Mount Kenya University ISERC

APPENDIX V: INTRODUCTION LETTER

Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MCM/2019/56898

30th January, 2023

National Commission for Science Technology & Innovation (NACOSTI)
Off Waiyaki Way, Upper Kabete,
P.O Box 30623- 00100
NAIROBI, KENYA

Dear Sir/Madam,

RE: VINCENT MUSUNGU SECHERE – REGISTRATION NO. MCM/2019/56898

The purpose of this letter is to introduce the above named student who is pursuing **Master of Clinical Medicine** in the department of **Clinical Sciences** in the School of **Clinical Medicine**

The title of the research is ***"Factors Associated with All-Cause In-Patient Mortality Between 2018 and 2019 at Kisumu County Level Four Hospital, Kenya.***

It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **February, 2023 and April, 2023.**

Any assistance accorded to the student will be highly appreciated.

Thank you.

Mount Kenya University
P.O. Box 342-01000, THIKA
Office of the Director
Graduate Studies

Dr. Samuel M. Karenga, Ph.D
Director, Graduate Studies
Enc.

APPENDIX VI: KCH LETTER

REPUBLIC OF KENYA

COUNTY GOVERNMENT OF KISUMU

Telegrams: "DIST/HOSP"
Telephone: 254-057 2020171
Fax: 254-057-2024210
Email : medsuptkdh09

DEPARTMENT OF HEALTH

Kisumu County Referr
Hospital
P.O. Box 1818 - 40100
KISUMU

KDH/GEN/VOL IV (74) **DATE: 02/02/2023**

VINCENT MUSUNGU SECHERE

Dear Sir,

RE: PERMISSION TO COLLECT DATA

Following school and ethical approval of protocol titled 'factors associated with all cause in –patient mortality between 2018 and 2019 at Kisumu County Level Four Hospital, Kenya, you are hereby permitted to proceed with the activity at Kisumu County Referral Hospital.

Yours faithfully,

MAURICE OJOWI
TRAINING COORDINATOR
For; MEDICAL SUPERINTENDENT
KISUMU COUNTY REFERRAL HOSPITAL

APPENDIX VII: NACOSTI LICENSE

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 219234

Date of Issue: 01/March/2023

RESEARCH LICENSE

This is to Certify that Dr.. Vincent Musungu Sechere of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kisumu on the topic: FACTORS ASSOCIATED WITH ALL-CAUSE IN-PATIENT MORTALITY BETWEEN 2018 AND 2019 AT KISUMU COUNTY LEVEL FOUR HOSPITAL, KENYA for the period ending : 01/March/2024.

License No: NACOSTI/P/23/23547

219234

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions