CLINICAL OUTCOMES OF CRITICALLY ILL COVID-19 PATIENTS ADMITTED TO CRITICAL CARE UNIT AT KENYATTA NATIONAL HOSPITAL

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A Research Project submitted in partial fulfillment of the requirements for the award of the Degree of Master of Nursing (Critical care) of the University of Nairobi.

OCTOBER, 2021

DECLARATION

I, Jackline Akinyi, declare that this research report is my original work and has not been presented for a degree in any other university.

Signature  _____ Date _____23rd November, 2021_____

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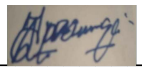
APPROVAL

Supervisors: This research report has been submitted for review with our approval as University supervisors:

1. Signature  Date _____23rd November, 2021____

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ABBREVIATIONS AND ACRONYMS

AKI	acute kidney injury
ARDS	acute respiratory distress syndrome
CCU	critical care unit
CKD	chronic kidney disease
COPD	chronic obstructive pulmonary disease
COVID-19	corona virus disease 2019
DONS	Department of Nursing School
DRC	Democratic Republic of Congo
ECMO	extracorporeal membrane oxygenation
FiO_2	fraction of inspired oxygen
IMV	invasive mechanical ventilation
KNH	Kenyatta National Hospital
MV	mechanical ventilation
PaO_2	partial pressure of oxygen
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
SCD	sickle cell disease
TB	tuberculosis
WHO	World Health Organization

OPERATIONAL DEFINITIONS OF TERMS

Clinical outcomes: the effect of managing covid -19 patients in critical care unit from 1st April 2020 to 30th April 2021 at Kenyatta National Hospital. In this study, the researcher will determine the survival status of the study participants in the critical care unit, and complications related to COVID-19.

Clinical: related to the management of COVID-19 patients in the critical care unit at Kenyatta National Hospital.

Comorbidity -a disease or medical condition that is simultaneously present with another or others in a patient. Also known as pre-existing conditions.

Complications: a disease that COVID-19 patient will get as a result of the severity of the infection or its association.

Coronavirus disease 2019: It is a transmittable disease that is caused by a novel coronavirus.

Critical care unit: a set up designated for severely sick COVID-19 patients. It commonly known as intensive care unit.

Critical care-the specialized care of patients whose conditions are life-threatening and require comprehensive care and constant monitoring, usually in critical care unit.

Critically ill: being in a serious state from covid -19 disease.

Length of stay-a period of time the patient spends in the unit.

Mortality rate-the relative frequency of deaths among COVID-19 patients in critical care unit from 1st April 2020 to 30th April 2021.

Mortality-the state or condition of being subject to die.

Outcome-the situation that exists at the end.

Survival status: this involved the mortality rate, AND the length of stay in the CCU.

ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is caused by Severe Acute Respiratory Syndrome Coronavirus 2. It was first identified in humans on 19th December, 2019, in Wuhan city in China and declared a global health concern on 30th January, 2020.

Broad objective: To establish the clinical outcomes of critically ill COVID-19 patients admitted to critical care unit at Kenyatta National Hospital (KNH) from 1st April 2020 to 30th April 2021.

Methodology: Design and study population- Descriptive, retrospective cohort study of critically ill COVID-19 patients admitted to CCU at KNH from 1st April 2020 to 30th April 2021. **Data collection**- Medical records of COVID 19 patients admitted to the CCU were reviewed. **Ethics**- Approval granted by the Ethics Review Committee of University of Nairobi and Kenyatta National Hospital.

Results: Sixty-five patients who were admitted to the IDU CCU with COVID -19 during the study period of April 2020 to April 2021were evaluated. Males were 55.4%. The mean age of the patients was 38.14 years. Eighty percent of the patients had one or more comorbid conditions. The most common comorbidity was diabetes mellitus (29.2%), then hypertension (24.6%). The median length of stay in the CCU was 5 days. The mortality rate was 24.6%. Patients who developed complications were 32.3%. The most common complication was acute kidney injury (18.5%), followed by liver injury (13.8%). Out of the 16 patients who died 62.5% had one or more complications related to COVID 19.

Conclusion: Mortality rate was 24.6%, less than previous findings. Mortality rate was high among those who developed complications. Most of the patients (80%) had comorbidities.

Recommendations: AKI is the most common complication among critically ill COVID-19 patients that people should be on the lookout for in CCU.

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CHAPTER ONE: INTRODUCTION

1.1 Background to the study

Coronavirus disease 2019 (COVID-19) is a transmittable infection that is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). (WHO, 2021) COVID -19 was first identified in humans on 19th December, 2019, in Wuhan city in China. The disease was declared a global health concern on 30th January, 2020. (Sohrabi et al., 2020) On 11th of March 2020, it was further termed a public health emergency. (Sohrabi et al., 2020; WHO, 2020a)

As by 3rd April, 2021, the world had a record of 130,944,305 cases, 2,852,929 deaths, and 105,426,787 recovered cases. The active cases were 22,664,589. (Coronavirus Update (Live), 2021). Regionally, Europe was the most hit with a total of 40,239,535 case. Total deaths were 923 905, and total recovered were 28 399 346. North America had a total of 36,137,870 cases, of whom 7,479,300 were active cases. Total deaths were 824 086, and total recovered 27 834 484. Asia had a total of 29 109 353 cases, 2 210 434 were active. The total number of deaths was 432 696 and those who recovered were 26 466 223. South America had a total of 21 509 405 cases. The active cases were 1 804 337. There were 563 287 deaths in total and 19 141 781 recovered cases. Africa had a total of 4 295 698 case, 331 577 were active e cases. In Kenya, there were 136, 893 recorded cases, 41,277 were active case and 2,186 had died, while a total of 93,430 had recovered. (Coronavirus Update (Live), 2021)

Measures were put in place by the Ministry of Health to prevent the spread of COVID-19 infection among which were cessation of movement by people, closure of schools, churches, restaurants, bars, 7:00pm to 5:00am curfew, handwashing with soap and water or sanitizing, keeping social distance of at least 1.5 meters, public vehicles carrying half the capacity of

passengers, employees working at home where possible. (Battle, 2020; Eastone Owino, 2020). Despite all the measures put in place to prevent the spread of COVID-19 infection in Kenya, the number of cases has been increasing owing to movement of people within the counties, nonadherence to the measures to prevent infection spread and poor hygiene status. (Battle, 2020; Eastone Owino, 2020)

Effect of COVID-19 infection has been largely felt by people worldwide. There has been difficulty in seeking health care, leading to increase in mortality and morbidity, loss of employments leading to poverty, difficulties in transport, closure of businesses, poor food security leading to malnutrition, domestic violence and depression. (Battle, 2020) Kenya has been more vulnerable because of congestion of people in slums like Kibera, unavailability of clean water, poor waste disposal, weak health system, unemployment of majority of the people, and poor food security. (Battle, 2020; Eastone Owino, 2020) In Kenya, there are few hospitals with few health care workers and less medications and equipment. The increase in the number of patients with COVID-19 infection has put a strain on health care provision, with health care workers getting infected and some dying. (Battle, 2020)

1.2 Problem Statement

COVID-19 is a highly evolving disease that is affecting people worldwide and rendering many critically ill, thus warranting admission to critical care units. (Xu et al., 2020) The rate at which the critically ill patients are dying is reported to be going up. (Xu et al., 2020) COVID-19 pandemic has put the healthcare systems, especially in developing countries, under a huge strain. The number of those who are critically ill and need critical care far outweigh the available resources in these countries. Kenya as a country has 537 critical care beds across all public and private hospitals. (Barasa et al., 2020) These are not enough to provide for care to the increasing number of COVID-19 patients who require critical care. The stuffing in these

facilities is also limited, making the provision of critical care even to be suboptimal. (Barasa et al., 2020) With suboptimal care due to inadequate resources and personnel, the clinical outcomes of those who get hospitalized to the critical care units becomes less favourable.

In a multicenter cohort study, KNH was among the study sites and it was established that critical care admission rate of COVID-19 patients was 11%. (Ombajo et al., 2020) The data obtained was generally for all COVID-19 patients, including those who were not admitted to CCU. Therefore, this study is meant to establish the clinical outcomes of critically in patients who were admitted at our local set up, KNH CCU. KNH has an isolation critical care unit where COVID-19 patients get admitted, and admissions have been happening ever since the disease outbreak. The researcher therefore determined the clinical outcome of all study participants who were admitted from 1st April 2020 to 30th April 2021.

1.3 Study justification

Policy making and allocation of resources towards fighting the COVID-19 pandemic requires data on how the situation is on the ground, including the number of COVID-19 patients that require critical care. There is a paucity of research in our local set up on the number of COVID-19 patients who end up requiring critical care. This study aimed at filling that gap by looking at the clinical outcomes of COVID-19 patients who got admitted to critical care units. This information will be useful to the policy makers and stakeholders in healthcare for planning and allocation of the available resources towards mitigation of the effects of COVID-19 pandemic on the health of Kenyans. The study is to be conducted at Kenyatta National Hospital because, it being at the apex of our referral system, it has a fair representation of patients from all over the whole country and hence the results are easily generalizable.

1.4 Significance of the study

The study was aimed at creating insight concerning the clinical outcomes of the COVID-19 patients who got admitted to CCU in Kenya. The findings of this study are meant to be used by the health care stakeholders in allocation of resources towards critical care of COVID-19 patients in CCU. This will also advise on strategies to identify and protect those who have increased risk of dying from COVID-19 severity.

1.5 Research Questions

1. What is the survival status of critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021?
2. What are the complications of COVID-19 infection in critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021?
3. What are the comorbidities of critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021?

1.6 Objectives

1.6.1 Broad objective

To describe the clinical outcomes of critically ill patients admitted with COVID -19 disease at KNH CCU from 1st April 2020 to 30th April 2021.

1.6.2 Specific objectives:

1. To describe the survival status of critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021.
2. To determine the complications of COVID-19 infection in critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021.

3. To establish the comorbidities of critically ill COVID-19 patients admitted to critical care unit (CCU) at KNH from 1st April 2020 to 30th April 2021.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter will look at literatures on survival status, complications related COVID-19 disease, and comorbidities in critically ill patients in critical care units. Theoretical framework and conceptual framework will also be dealt with in this chapter.

2.2 Clinical outcomes

2.2.1 Survival status

Chang et al did a systematic review and meta-analysis of covid -19 in CCU and mechanically ventilated patients (12,437 participants) and determined that CCU mortality was associated with age older than 60 years at an odds ratio of 3.7 and male gender with OR 1.37. (Chang et al., 2021) They further determined the combined CCU mortality rate from 20 studies involving to be 28.3%. (Chang et al., 2021, p. 19) Another study conducted in Northeast Ohio, involving 495 patients admitted to CCU with severe COVID-19 disease, elicited that the mean age was 67.3 years, majority of them were males accounting for 58.4%. (Fadel et al., 2020) In Kenya, a multi-center cohort study was conducted on 787 COVID-19 patients in 6 hospitals, and the main aim of the study was to establish epidemiology and clinical characteristics of all COVID-19 patients in the 6 hospitals and not strictly CCU patients. (Ombajo et al., 2020) It was established that the median age of the patients was 43 years with majority(58%) being 40 years and above.(Ombajo et al., 2020) In Congo, it was noted that males formed almost two-thirds of the population at 64%. (Ombajo et al., 2020). Patients who were above 60 years of age and those of male gender were determined to be likely to die of COVID-19. (Ombajo et al., 2020)

Spain recorded a mortality rate of 32.6% in a recent systematic review and meta-analysis, in which the majority(80%) of death arose from people older than 80 years. (Rodríguez et al., 2021) For comparison, the regional CCU mortality rates were as follows: United Kingdom had

the highest mortality rate of 33%, followed by United States of America with 29%, Italy 26%, China with 24%, Spain with 23%, France with 15%, and finally Mexico with 2%. (Chang et al., 2021). On the contrary, a study done in New Jersey established a higher mortality rate of 69% among COVID-19 patients in CCU. (Cedano et al., 2021) Notably, Wang et al established a mortality rate of less than quarter among 36 study participants in China. (Wang et al., 2020) In another study in China, Yang et al determined that, the patients who died were averagely greater than 64 years in age and more than half (53%) had comorbid. (Yang et al., 2020)

A case series conducted in western Asia determined the mortality rate to 19% which was lower than what had been established in other studies. (Khamis et al., 2020) On the contrary, Kenya had higher mortality rate, whereby roughly half (51%) of the study participants admitted to CCU died, similar to the findings in China.(Ombajo et al., 2020; Yang et al., 2020) In Democratic republic of Congo, mortality rate was determined to be equal mong males and females. (Nachega et al., 2020)

Studies established that the average number of days a patient took in the CCU was approximately 7 days. (Chang et al., 2021; Fadel et al., 2020; Yang et al., 2020) Oliveira et al had different findings which established that the average number of days that COVID-19 patients took in the CCU was 14 days for those who survived and 9.5 days for those who died. (Oliveira et al., 2021) In Kenya, the CCU length of stay was at a mean of 6 days and the days from CCU admission to death was recorded at a mean of 16 days. (Ombajo et al., 2020)

2.2.2 COVID-19 complications

Chang et al (2020) determined that acute respiratory distress syndrome (ARDS, 84%) was the most common complication. This was in keeping with other studies that arrived at the same

conclusion. (Abate et al., 2020; Wang et al., 2020; Yang et al., 2020) Chang et al (2020) also established that acute kidney injury (AKI) was becoming rampant (32%) in relation to COVID-19. Wang et al also established that as much as ARDS was the most prevalent, patients had a tendency of developing arrythmia, shock, and even acute cardiac injury. (Wang et al., 2020) Interestingly, most (67%) of the patients who died developed complication among which were, in addition to ARDS and AKI (29%), liver complications (29%), cardiac complications (23%), with a minority (2%) developing pneumothorax. (Yang et al., 2020)

A systematic review and meta-analysis of COVID-19 CCU and mechanically ventilated patients determined that acute kidney injury and acute respiratory distress syndrome that arose because of COVID-19 were associated with CCU mortality with an OR of 12.47 and 6.52 respectively.(Chang et al., 2021). On the contrary, in Central Florida, it was determined that those patients who died developed either heart failure, or chronic kidney disease or dementia. (Oliveira et al., 2021)

2.3 Comorbidities

Chang et al established hypertension as the leading pre-existing condition in slightly more than half (51%,) of the participants, followed by obesity (35%), and diabetes(30%). (Chang et al., 2021) Similarly, research conducted in Canada established that most of the patients (73.5%), had at least one comorbidity of whom majority (46.2%) had hypertension, followed by dyslipidaemia (36.8%) and diabetes mellitus (30.8%). (Mitra et al., 2020) In addition, a study in North New Jersey established that other than hypertension and diabetes being the most common comorbidities, obesity(44%),chronic kidney disease(19%), coronary artery disease(11%), chronic obstructive pulmonary disease(COPD, 9%), asthma(6%) and end-stage renal disease(3%) were also considered common among COVID-19 patients admitted to CCU.

(Cedano et al., 2021) Abate et al established a different finding stating that among 24 983, almost 60% had pre-existing medical conditions, cardiovascular conditions (55%) leading, followed by hypertension (38%) and diabetes (31%). (Abate et al., 2020)

In Wuhan, China, majority of the patients had at least one underlying medical condition whereby almost half (43.9%) had hypertension, 18.4% had diabetes mellitus, 14.6% had chronic cardiac disease, 5.5% had chronic pulmonary disease, 5.4% had cerebrovascular disease, 8.4% had chronic hepatic disease, 5.4% had malignancy. (Xu et al., 2020) Similarly, research conducted among CCU COVID-19 patients in Central Florida established that hypertension was the leading comorbid in majority (64%) of the patients, then diabetes in 41% and coronary artery disease in 16% of the patients. (Oliveira et al., 2021) On the contrary, a research done in Northeast Ohio determined that diabetes was the most underlying medical condition at 35.8%, followed by severe sepsis/septic shock. (Fadel et al., 2020)

In a cohort study done in Congo, 75% (3) of the children who were admitted to the CCU with COVID-19 died. (Nachega et al., 2020) It was evident that one of those who died had two comorbidities while the rest had none. (Nachega et al., 2020) Mortality in the CCU was also associated with age above 60 years and comorbidities. (Nachega et al., 2020) Generally, they also established that the mortality rate among COVID-19 patients in CCU was nearly half(45%) , which was similar to what had been reported in South Africa. (Nachega et al., 2020) In keeping with researches done elsewhere, it also established that hypertension and diabetes mellitus as underlying conditions led to poor outcomes among patients with severe covid -19 in the CCU. (Nachega et al., 2020)

2.4 Theoretical framework

The concepts of Roy's adaptation model were used to guide the study. It was developed in the year 1976 by Sister Callista Roy. (V.baisa, 2014) Callista Roy viewed a person as an open system that is interacting with the environment. (Badr Naga & al-atiyyat, 2013) In a review of the theory, it was stated that a person responds to the external or internal stimuli through coping mechanisms, that is the regulator and cognator. (Badr Naga & al-atiyyat, 2013) The theory has four modes of adaptation which are physiological modes, self-concept modes, role function modes and interdependence modes. This research is set out to assess the association between the adaptive behaviours and the stimuli. Focal stimulus in this study is patient diagnosed with COVID-19 infection, contextual stimuli are sociodemographic data, and residual stimuli are the comorbidities that might affect the coping mechanisms and thus the clinical outcomes. The main goal of this research is to enhance adaptation by removing, altering or changing relevant focal, contextual or residual stimuli. (Badr Naga & al-atiyyat, 2013)

2.5 Conceptual framework

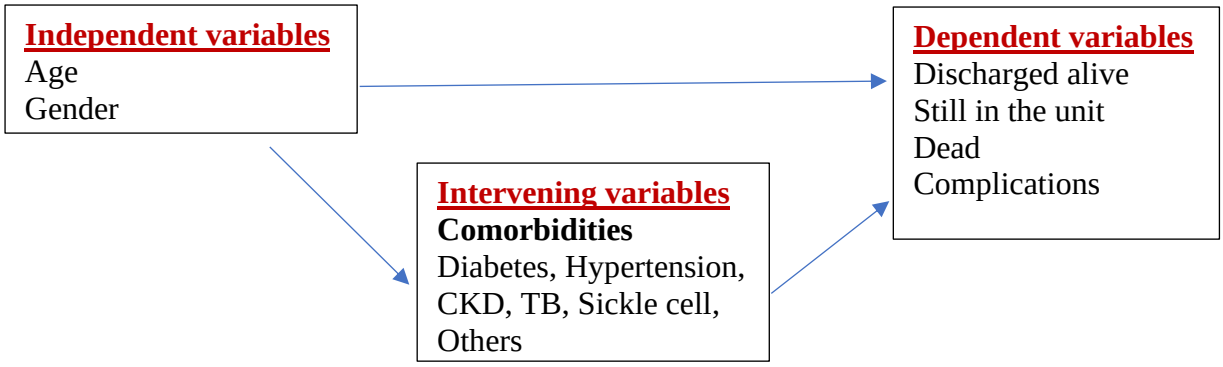


Figure 1: Conceptual framework

The researcher assessed whether the independent variables, age and gender, had any direct association with the dependent variables. For instance, the impact of age and gender on the period the patient took in the CCU before being discharged to home, or transferred to other facilities, or die, or develop complications.

Moreover, the researcher determined whether there was any association between the intervening variables, comorbidities, and the independent variables that might have contributed to the outcomes. Study participants with any pre-existing condition were assessed to establish whether those conditions had any input on the length the participant took in the unit, the rate of survival, the complications and the mortality rates.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter will include research design, study variables, study location, study population which will include inclusion and exclusion criteria, sample size, sampling procedure, research tool, data management, delimitation, limitations, confidentiality, expected use of the results, and ethical consideration.

3.2 Study design

The study employed descriptive, retrospective cohort study design to review medical files of all covid -19 patients admitted to the Kenyatta National Hospital (KNH) critical care unit from 1st April 2020 to 30th April 2021. This was retrospective in the essence that the researcher was going back in time, and therefore relied on information in the medical records. It was also a cohort study because the study participants had the same exposure of having been admitted to the CCU with COVID-19 infection. (Polit & Beck, 2010). The study described clinical outcomes including survival, complication, mortality, and the comorbidities associated with COVID-19.(Polit & Beck, 2010).

3.3 Study variables

1. Independent variables were ages in years and gender.
2. Intervening variables were comorbidities. The association between comorbidity and dependent variable were established.
3. Dependent variables were the clinical outcomes. The clinical outcomes were the survival status and COVID-19 complications.

3.4 Study Location

Kenyatta National Hospital is a level 6 referral facility in Nairobi County that serves Kenya and its neighbouring countries. It was established in **1901 and** became a State Corporation in **1987**. It occupies 45.7 hectares of land, and within the KNH complex are College of Health Sciences (University of Nairobi); the Kenya Medical Training College; Kenya Medical Research Institute and National Laboratory Service. KNH has 50 wards, 22 out-patient clinics, 24 theatres (16 specialized) and Accident & Emergency Department.(Kenyatta National Hospital, 2017)

Among the services offered in KNH are intensive care services. There is one main CCU and 11 speciality CCUs. The main CCU has 21 bed capacity, medical CCU has 8 bed capacity, paediatric CCU has 5 bed capacity, cardiac CCU has 4 bed capacity, accident and emergency CCU has 4 bed capacity, gynaecology CCU has 2 bed capacity, neonatal CCU has 10 bed capacity, neurology CCU has 5 bed capacity, surgical CCU has 5 bed capacity, infectious disease (IDU) unit CCU has 7 bed capacity. COVID-19 patients get admitted to the infectious disease unit (IDU) CCU.

3.5 Study population

All COVID-19 patients who were admitted to the CCU at KNH from 1st April 2020 to 30th April 2021 were recruited in the study, all dates inclusive.

3.5.1 Inclusion criteria

The inclusion criteria were all patients who tested positive for COVID -19 prior to admission to CCU from 1st April 2020 to 31st April 2021, all dates inclusive. This was established by checking in the files for the COVID-19 test results that were positive. The study was basically on patients whose indication for CCU admission was COVID-19.

3.5.2 Exclusion criteria

Patients who got COVID-19 while in CCU because of a different condition were excluded. This enabled the research to draw conclusion on the clinical outcomes of COVID-19 patients whose primary problem that led to CCU admission was COVID-19 severity.

3.6 Sample size

This being a descriptive, retrospective cohort study, there was no sample size calculation. The study included 65 patients who were admitted with COVID-19 to KNH CCU from 1st April 2020 to 31st April 2021 who met the inclusion criteria above. Twenty-six patients were excluded from the study.

3.7 Sampling procedure

The study used census method to include all the patients admitted with COVID-19 to CCU from 1st April 2020 to 31st April 2021.

3.7.1 Recruitment procedure

In-patient number, name, date of admission and discharge, discharge status of all patients were captured from Daily bed return file for infectious disease unit CCU at the information center registry. The in-patient numbers were then used to retrieve files from the records department. Patients who had a positive test result for COVID-19 were recruited into the study.

3.8 Research tool

Data was extracted from patients' medical records using data collection form specifically designed for this study by the investigator. (**Appendix I**)

3.8.1 Validity and Reliability of the instrument

The researcher did a pre-test of the data collection form on critically ill patients who were admitted to the CCU at KNH with COVID-19 in the month of March 2020.

3.9 Data collection procedure

Data collection started at the information center registry whereby in-patient number, name, date of admission and discharge, discharge status of all patients were captured from Daily bed return file for infectious disease unit CCU. A list of the in-patient numbers was then taken to records department to aid in files retrieval. The researcher then checked in the file for COVID-19 test results. The patients who had positive test results were included in the study. The researcher then went ahead to collect more data on age, sex, comorbidities, survival status, and COVID-19 related complications. This data was entered in the data collection form.

3.10 Data management

All the data collection forms were serialised. The collected data, excluding patient identifiers, were entered into Microsoft excel. This data was then reviewed by the investigator for completeness. Missing information was checked from the source of the data. Duplicate data was removed. The data collection forms were kept in a secured cabinet while the computer used for data entry was also secured with a password only accessible to the investigator.

3.11 Data analysis

The data in the excel was uploaded into SPSS and coded as per the data collection form.

3.11.1 Demographics

Categorical data (gender) was presented as percentages and counts, while continuous data (age) was presented as either median with interquartile range or mean with standard deviation depending on normality distribution.

3.11.2 Clinical outcomes and comorbidities

Survival, mortality and complications were summarized using frequencies and percentages.

Test of association between mortality and comorbidities and complications was done using Chi-square test. Comorbidities were analysed as frequencies and percentages. The analysis was done using SPSS version 26. The data was presented in form of tables, pie charts, bar graphs, and box plots.

3.12 Expected application of results

The results obtained from the study will guide the institution on resource allocation, and also ascertain the vigilance needed in terms of COVID -19 patient management in CCU. The results have pointed out areas that need further research.

3.13 Ethical consideration

Authorization to conduct the study was granted by the School of Nursing, University of Nairobi, KNH administration and Ethics committee of Kenyatta National Hospital. Approval was also granted by the Medical CCU in-charge. The approval letter was submitted to the health records department. Data collection forms were serialised. There were no identifiers of the patients. The information was stored in the computer with password only accessible by the investigator. The data collection forms were locked in a safe drawer only accessible to the researcher.

3.14 Study limitations

The study had a few limitations. Some files had missing information. This was mitigated by checking the daily bed return records. Some files could not be traced and thus not studied.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter will include study findings on demographic characteristics, comorbidities and clinical outcomes of critically ill COVID-19 patients.

4.2 Demographics

The study evaluated 65 out of 91 patients who were admitted to the IDU CCU during the study period of April 2020 to April 2021. Thirty-six (55.4%) of the patients were male while 29 (44.6%) were female. The mean age of the patients was 38.14 years (SD 22.7, 95% CI: 32.5-43.7). The youngest patient was 7 days old while the oldest was 81 years old. Table 1 below summarises these findings.

Table 1: Demographic characteristics

Variable	statistics
Male	36 (55.4%)
Female	29 (44.6%)
Age in years	Mean 38.1 (SD 22.7)

Of the 65 patients included in this study, 12 (18%) were children below 18 years of age while 53 (82%) were adults. This is depicted in the pie chart below (figure 2).

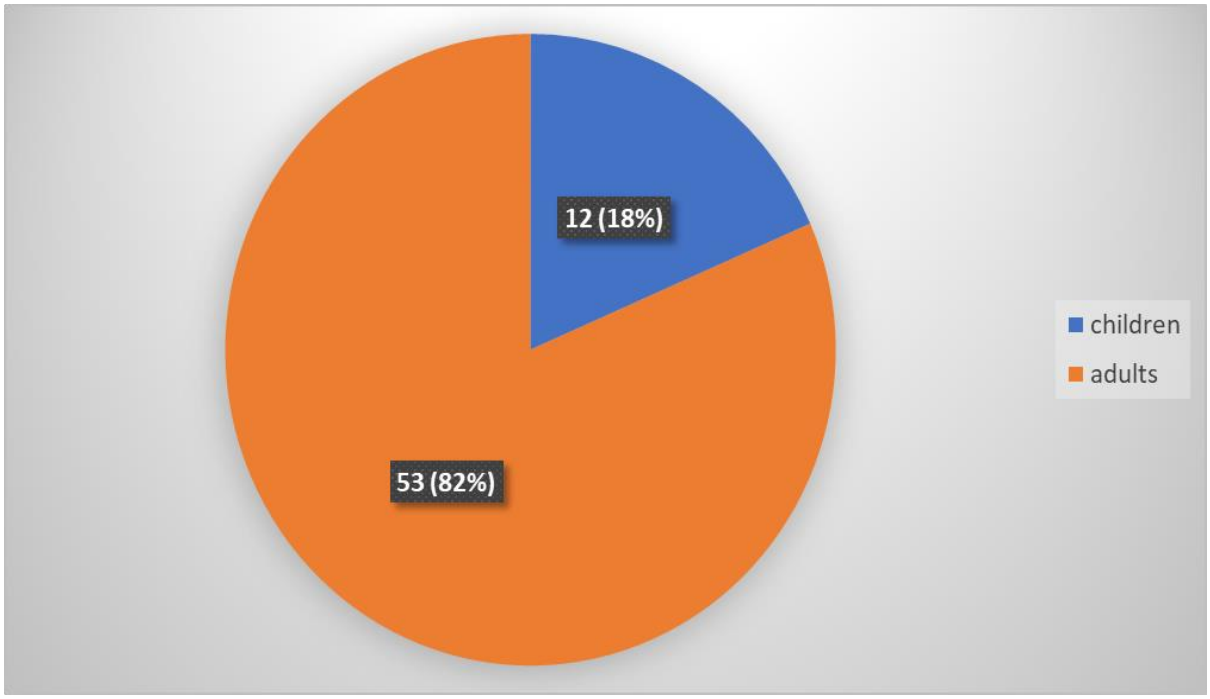


Figure 2: Pie chart comparing children vs adults

4.3 Comorbidities

Fifty-two (80%) patients had one or more comorbid conditions. Twenty-nine (55.8%) of these were males while 23 (44.2%) were females. The most common comorbidity was diabetes mellitus while the least common was tuberculosis (Figure 3 below). Other comorbidities included spinal muscular atrophy, head injury, lymphoma, meningitis, cancer of the lung, chronic lung disease, convulsive disorder, asthma, and cancer of the stomach.

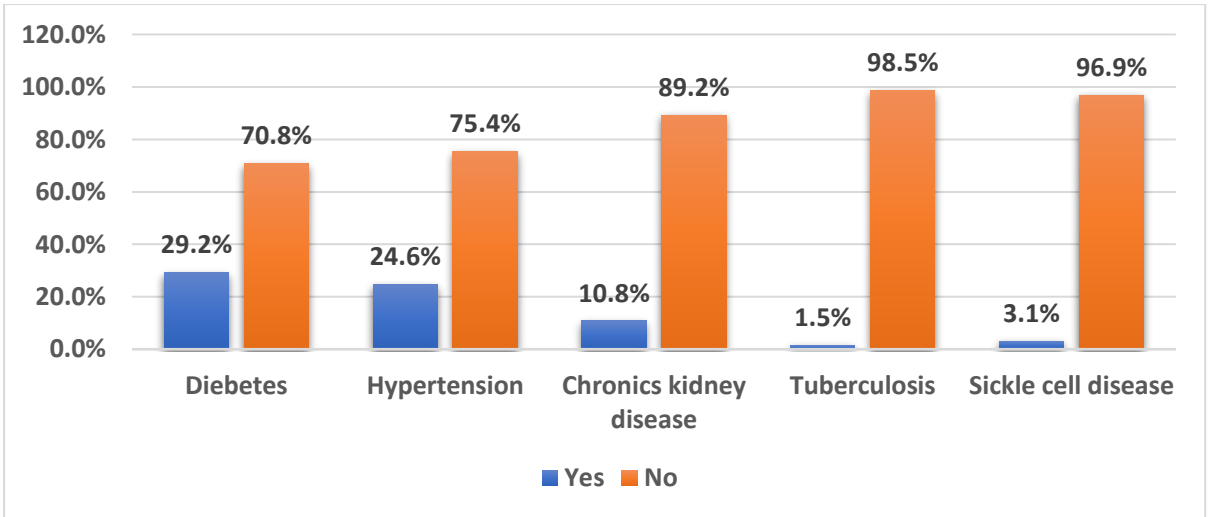


Figure 3: A bar graph showing Comorbidities

Table 2 below shows the comparison between gender and comorbidities

Table 2: Gender-Comorbidity crosstabulation

			Gender		
			Male	Female	Total
Comorbidity	Yes	Count	29	23	52
		% within comorbidities	55.8%	44.2%	100%
		% within gender	80.6%	79.3%	80%
	No	Count	7	6	13
		% within comorbidities	53.8%	46.2%	100%
		% within gender	19.4%	20.7%	20%
Total			36	29	65

Chi square statistics were used to examine association between these two categorical variables. There was insignificant relationship at 5% significance level between gender and comorbidities (x^2 = .016, df=1, p= 0.901).

The mean age of patients with comorbidities was 39.49 years (SD 24.3, 95% CI: 32.72-46.25). The mean age of those without comorbidities was 32.77 years (SD 14.3, 95% CI: 24.08-41.46)

The box plot below (Figure 4) shows the age relationship between comorbidities and age.

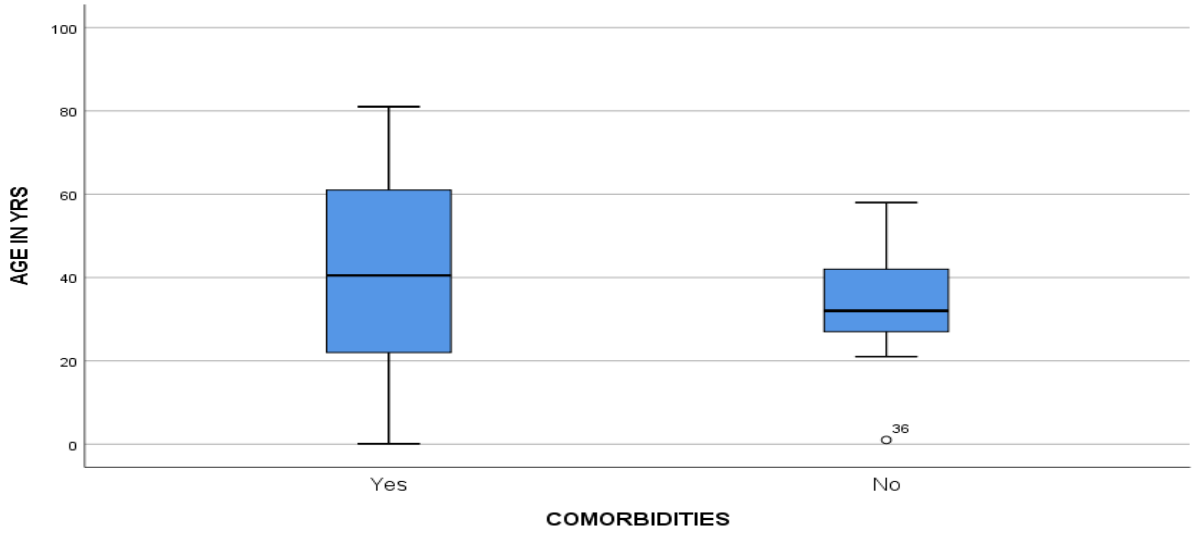


Figure 4: Box plot representing Comorbidities vs age

Eleven (91.7%) of the 12 children had comorbidities. Forty-one (77.3%) of the adult patients had comorbidities. The bar graph below (Figure 5) shows the overall rate of comorbidities in children and adults.

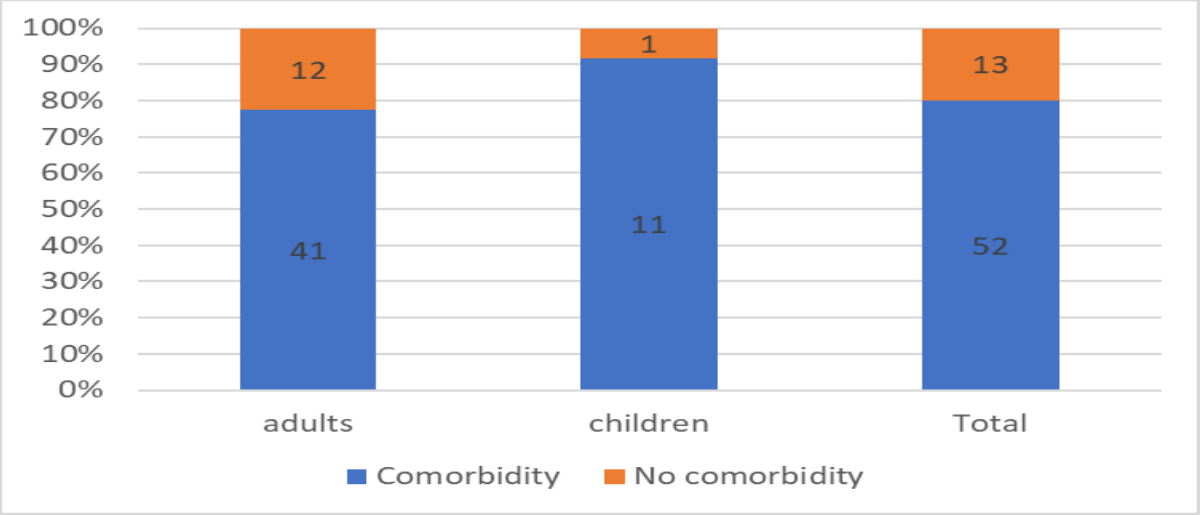
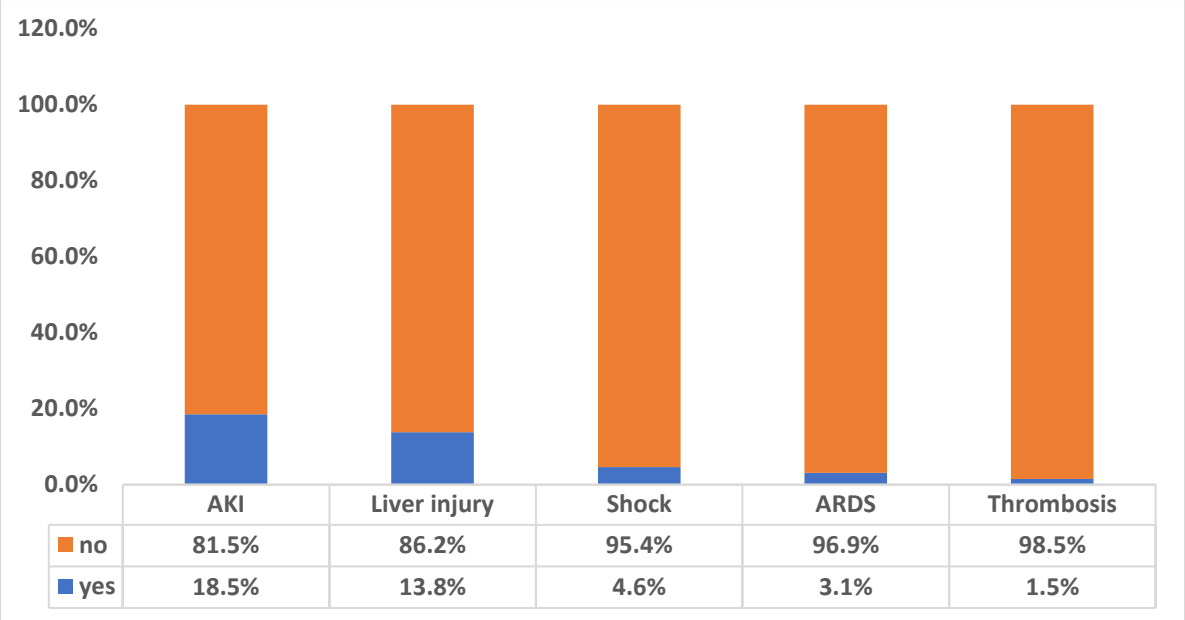


Figure 5: Bar graph representing Comorbidities in children and adults

4.4 Clinical outcomes

All the 65 patients who were studied had been discharged from the CCU by the time this study was being conducted. The median length of stay in the CCU was 5 days (IQR 2-10). Sixteen (24.6%) of the patients had died while 49 were discharged from the CCU alive. Of the 16 mortalities, 4 died after a few hours of admission, and 6 died after 1 day of admission, thus 62.5% of them died after 1 day and less in the CCU. Also, only one was a child. Twenty-one (32.3%) of the 65 patients developed complications during their stay in the CCU. The most common complication related to COVID 19 was acute kidney injury at 18.5% (12) followed by liver injury at 13.8% (9). Figure 6 below gives a list of the complications and their rates of occurrences.



	AKI	Liver injury	Shock	ARDS	Thrombosis
no	81.5%	86.2%	95.4%	96.9%	98.5%
yes	18.5%	13.8%	4.6%	3.1%	1.5%

Figure 6: Bar graph showing Complications

Of the 21 patients who developed complications related to COVID 19 while in ICU, 10 (47.6%) were males while 11 (52.4%) were females. Chi square statistics revealed insignificant relationship at 5% significance level between gender and complications (x2 = .757, df=1, p= 0.384). The mean age of those with complications was 47.81 years (SD 20.9, 95% CI: 38.28-57.34). This is represented in the plot box below (Figure 7).

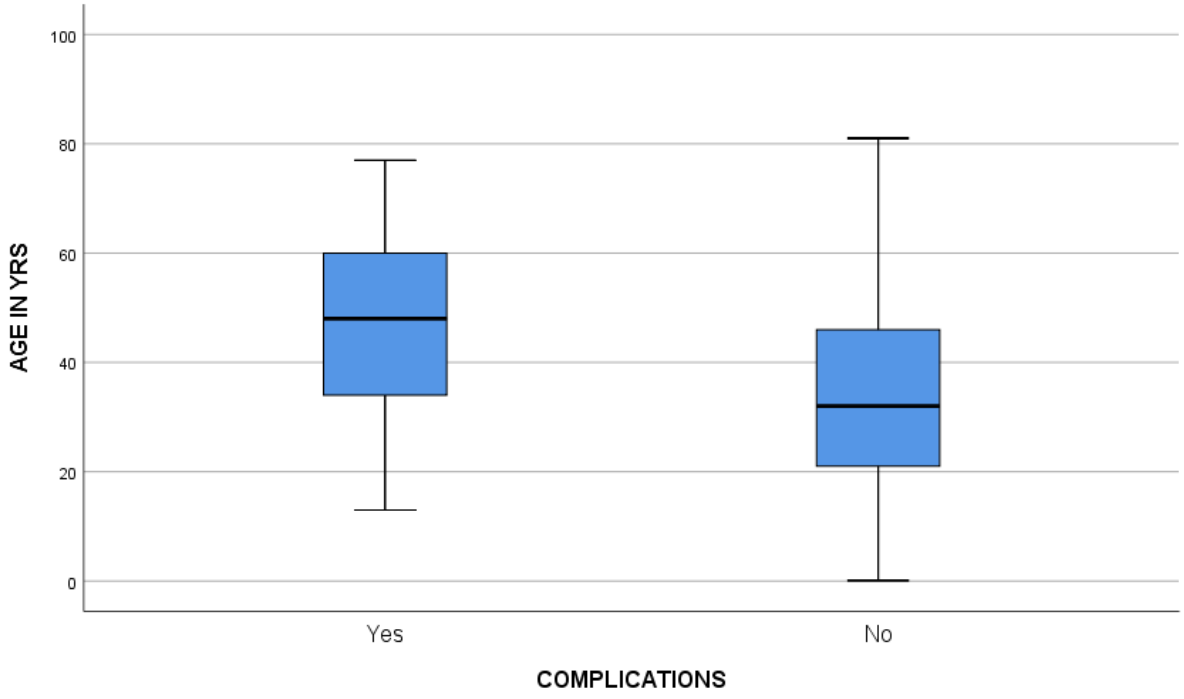


Figure 7: Box plot representing Complications vs age

Most of the patients who died were older with mean age of 50.34 years (SD 21.92, 95% CI:38.70-62.05). The youngest patient was 13 years while the oldest was 81 years old, however, there was no significant correlation between mortality and age.

Ten (62.5%) of the 16 patients who died had one or more complications related to COVID 19. Chi square test demonstrated a significant relationship between mortality and complications (x^2= 8.847, df=1, p=0.003).

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter will include discussion of the demographics, comorbidities, survival status and complications related to COVID-19 infection in critically ill patient. Conclusion and recommendations will also be covered here.

5.2 Demographic characteristics

The study determined that males were the majority (55.6%) which was agreeing with what was established in other studies. For instance, in studies done in North Ohio, Canada, Spain, China, and New Jersey it was established that males were more than half of the study participants. (Cedano et al., 2021; Fadel et al., 2020; Mitra et al., 2020; Yang et al., 2020) This could be attributed to the fact that mostly men are the ones who go out in search of jobs, travel in and out of the country and meet with friends at joints for drinks or to watch football, therefore get predisposed to COVID 19. The mean age of the patients admitted with COVID-19 was 38 years. This age was lower than what was determined in other studies. In studies done in USA, Congo, China among others, it was established that the mean age was above 60 years. (Chang et al., 2021; Fadel et al., 2020; Ombajo et al., 2020; Wang et al., 2020). In our set we have more of the younger population as opposed to developed countries that have the older population being the majority.

5.3 Clinical outcomes

The study established that the mortality rate was 24.6%. This was lower compared to what was established in other studies. Cedano et al determined that the overall mortality rate among the 132 patients admitted in ICU with coronavirus was almost 70%. He further established that

death in people aged 35 years to 49 years was 63% and those aged 50 years to 64 years was 62%. (Cedano et al., 2021). In a Meta- Analysis, it was determined that the mortality rate of critically ill COVID-19 patients was about 40% overall, of which China had the most mortality (42%), while USA recorded 36% mortality. (Abate et al., 2020). Previously, Kenya had recorded a mortality rate of over 50% among COVID-19 patients in CCU, in a study done on epidemiology and characteristics of coronavirus infected patients.(Ombajo et al., 2020). The probable reason for the lower mortality rate among critically ill COVID-19 patients in CCU could be because of the lessons learned on management of COVID-19 patients, from other countries that were previously hit by the pandemic; highly trained CCU health care providers, and better CCU supportive management.

This study established that most of the patients who died had a mean age of 50.34 years (SD 21.92, 95% CI:38.70-62.05). This was less than what was determined in most studies. In Asia, China and Spain, it was determined that mortality was high among patients who were 64 years and above. (Fadel et al., 2020; Rodríguez et al., 2021; Yang et al., 2020). Possible reasons for this finding could be that people at an average age of 50 years are still employed and therefore go out most of the time to work and mingle with others, thus contracting COVID-19. On top of that, lifestyle diseases become common in this age group, coupled with weakened immune system and the normal changes in the body physiology, putting them at an increased risk of dying.(Owusu et al., 2020).

Out of those who died, females were the majority (52.4%). This was contrary to other studies where males were majority of those who died. (Chang et al., 2021; Fadel et al., 2020; Wang et al., 2020). Most of the patients who died were older with mean age of 50.34 years (SD 21.92, 95% CI:38.70-62.05). This finding was in keeping with what was established in another study. (Abate et al., 2020). This can be attributed to the fact that physiologically as people age, the immune system is weakened, they become prone to death. The presences of one or more

complications were predictors of mortality (62.5%). This finding was in keeping with what was determined in another study. (Abate et al., 2020).

The median length of stay in the CCU was 5 days (IQR 2-10). This was agreeing with what Rees et al determined in China. They established that the length of stay in CCU ranged from 2 to 9 days. (Rees et al., 2020). However, this finding was lower than what was established in other studies. Olivera et al determined the number of days in CCU for those who were discharged alive to be 2 weeks and for those who died was about 10 days. (Oliveira et al., 2021). Kenya had previously recorded more than 2 weeks CCU length of stay among the patients who died from COVID-19. (Ombajo et al., 2020). The decrease in CCU length of stay in this study could be because patients were discharged from the CCU as soon as their signs and symptoms resolved and there was no waiting for the COVID 19 test results to be negative for the survivors. Moreover, there were better ways of handling COVID-19 patients that were adopted from other countries like China, therefore leading to shortened number of days in the CCU.

Twenty-one (32.3%) of the patients developed complications during their stay in the CCU. This was less than what was determined in other studies. Abate et al, in a Meta-Analysis determined that the rate of COVID-19 related complications was almost 70%. (Abate et al., 2020) The most common complication related to COVID 19 was acute kidney injury at 18.5%. This finding was agreeing with what Chang et al established in a systematic review that AKI was becoming rampant. (Chang et al., 2021) Patients who developed ARDS were few (3.1%) as opposed to what was determined in previous studies. In a systematic review, Chang et al established that ARDS was the most common complication (84%), which was in keeping with several other studies. (Abate et al., 2020; Chang et al., 2021; Wang et al., 2020; Yang et al.,

2020). The probable explanation for this finding could be because of the better support management strategies of COVID 19 cases that the country learned from other countries like China, USA, France that gave better outcomes.

5.4 Comorbidities

Fifty-two (80%) patients had one or more comorbid conditions. This finding was higher than what had been established in other studies. Research done in Canada on ICU admission rate and clinical outcomes of 24983 subjects established that about 75% patients had comorbidities; Abate et al also recorded about 60% patients with comorbidity in a Meta-Analysis. (Abate et al., 2020; Mitra et al., 2020). The most common comorbidity was diabetes mellitus (29.2%), followed by hypertension (24.6%) and chronic kidney disease (10.8%). This finding was in keeping with what was established in USA in a study done on 495 COVID 19 patients admitted in intensive care unit. Diabetes mellitus was the most common comorbid (35.8%). (Fadel et al., 2020). On the contrary, most of the other studies had hypertension as the most common comorbid with diabetes coming third in the list. In Canada, China, Congo, South Africa, hypertension was rampant in above 40% of the cases with comorbid. (Mitra et al., 2020; Nachega et al., 2020; Xu et al., 2020).

5.5 Conclusion

The mortality rate (24.6%) was less that what was previously determined in most studies. A few (32.3%) of the patients developed COVID 19 related complication and AKI was the most common. Most (62.5%) of the patients who died had COVID-19 related complications. Most (62.5%) of the patients who died spent 1 day and less in the CCU. Majority (80%) of the patients had comorbidities, diabetes mellitus being the most common.

5.6 Recommendations

AKI was established to be the most common comorbid. These calls for vigilance management of COVID-19 patients in the CCU in order to prevent AKI.

A multicenter study is recommended to give better results, since this study was single-centered.

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APPENDICES

Appendix 1: Data Collection Form

A. Demographic data

1. IP Number: _____
2. Name: _____
3. Gender (circle)
    1) Male
    2) Female
4. Date of birth dd/mm/yyyy
5. Age in years _____
6. Date of Admission dd/mm/yyyy

B. Comorbidities (circle)

7. Does the patient have comorbidities?
    1) Yes
    2) No
8. Diabetes
    1) Yes
    2) No
9. Hypertension
    1) Yes
    2) No
10. Chronic kidney disease
    1) Yes
    2) No
11. Tuberculosis
    1) Yes
    2) No
12. Sickle cell disease
    1) Yes
    2) No
13. Others(list)_____

C. Clinical Outcomes (circle)

14. Discharge status
    1) Discharged

2) Still in CCU

15. If discharged
    1) Alive
    2) Dead
16. Date of discharge dd/mm/yyyy
17. Length of stay in CCU in days _____

18. Did the patient develop complications related to the COVID-19 infection?

    1) Yes
    2) No
19. Acute Respiratory Distress Syndrome
    1) Yes
    2) No
20. Acute Kidney Injury
    1) Yes
    2) No
21. Thrombosis
    1) Yes
    2) No

22. Shock
    1) Yes
    2) No
23. Acute cardiac injury
    1) Yes
    2) no
24. Liver injury
    1) Yes
    2) No

Appendix 2: KNH-ERC approval

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020) 2726300 Ext 44355

KNH-UON ERC
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Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/321

14th September, 2021

APPROVED
1 SEP 2021
KNH/UoN-ERC
P. O. BOX 20723

Jackline Akinyi
Reg. No.H56/33973/ 2019
School of Nursing Sciences
College of Health Sciences
University of Nairobi

Dear Jackline

RESEARCH PROPOSAL: CLINICAL OUTCOMES OF CRITICALLY ILL COVID-19 PATIENTS ADMITTED TO CRITICAL CARE UNIT AT KENYATTA NATIONAL HOSPITAL (P337/05/2021)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH-UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 14th September 2021 – 13th September 2022.

This approval is subject to compliance with the following requirements:

i. Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
ii. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.
iii. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
v. Clearance for export of biological specimens must be obtained from KNH- UoNERC for each batch of shipment.
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.

Protect to discover

This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely,

PROF. M.L CHINDIA
SECRETARY, KNH- UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Senior Director, CS, KNH
The Chair, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Director, School of Nursing Sciences, UoN
Supervisors: Dr. James Mwaura, School of Nursing Sciences, UoN
Dr. Sabina Wakasiaka, School of Nursing Sciences, UoN

Appendix 3: Permit to collect data from medical files

KNH/R&P/FORM/(

KENYATTA NATIONAL HOSPITAL
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565
Research & Programs: Ext. 44705
Fax: 2725272
Email: knhresearch@gmail.com

Study Registration Certificate

1. Name of the Principal Investigator/Researcher
   JACKLINE AKINYI
2. Email address: jackline.akinyi87@gmail.com Tel No. 0704381648
3. Contact person (if different from PI).....
4. Email address: ..... Tel No. .....
5. Study Title
   CLINICAL OUTCOMES OF CRITICALLY ILL COVID-19 PATIENTS ADMITTED TO CRITICAL CARE UNIT AT KENYATTA NATIONAL HOSPITAL
6. Department where the study will be conducted CRITICAL CARE UNIT
   (Please attach copy of Abstract)
7. Endorsed by KNH Head of Department where study will be conducted.

   Name: D.K. Maeve Signature ..... Date 17/9/21
8. KNH UoN Ethics Research Committee approved study number P337/05/2021
   (Please attach copy of ERC approval)
9. I JACKLINE AKINYI commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Medical Research.

   Signature..... Date 16/09/2021
10. Study Registration number (Dept/Number/Year) CCM /151/202
    (To be completed by Medical Research Department)
11. Research and Program Stamp _____

All studies conducted at Kenyatta National Hospital **must** be registered with the Department of Medical Research and investigators **must commit** to share results with the hospital.

Appendix 4: Google map of Kenyatta National Hospital