COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAMME

TIME TO RECOVERY AND ITS PREDICTORS AMONG ADULTS HOSPITALIZED WITH COVID-19 IN COVID-19 ISOLATION AND TREATMENT CENTER, ADDIS ABABA, ETHIOPIA, 2023

INVESTIGATOR: WORKU BALCHA (BSC IN NURSING)

A RESEARCH THESIS WAS SUBMITTED TO ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES, SCHOOL OF NURSING AND MIDWIFERY, NURSING DEPARTMENT; IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTERS OF SCIENCE DEGREE IN ADULT HEALTH NURSING

MAY, 2023

ADDIS ABABA, ETHIOPIA

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAMME

TIME TO RECOVERY AND ITS PREDICTORS AMONG ADULTS HOSPITALIZED WITH COVID-19 IN COVID-19 ISOLATION AND TREATMENT CENTER, ADDIS ABABA, ETHIOPIA, 2023

INVESTIGATOR: WORKU BALCHA (BSC IN NURSING)

ADVISOR: TEFERA MULUGETA (ASST. PROFESSOR)

CO-ADVISOR: MEKONEN ADIMASU (MSC IN PEDIATRICS)

MAY, 2023

ADDIS ABABA, ETHIOPIA

APPROVAL SHEET

ADDS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAM

I, the undersigned MSc student, declare that I have submitted my original work on a title" Time to recovery and its predictors among adults hospitalized with COVID-19 in COVID-19 isolation and treatment center, Addis Ababa, Ethiopia, 2023." for the examination.

Submitted by:

WORKU BALCHA _____ _____

Name of student Signature Date

This thesis work has been submitted for examination with my approval as an advisor.

Approved by:

TEFERA MULUGETA (Asst. professor) _____ _____

Name of Major Advisor Signature Date

MEKONEN ADIMASU (M.Sc. in pediatrics) _____

Name of Co-Advisor Signature Date

APPROVAL BY THE BOARD OF EXAMINATION

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAM

As members of the Board of Examination for the thesis evaluation, we have read and evaluated the thesis prepared by Worku Balcha entitled " Time to recovery and its predictors among adults hospitalized with COVID-19 in COVID-19 isolation and treatment center, Addis Ababa, Ethiopia, 2023." It is certified and accepted in its present form by the board of examination as satisfying the thesis requirement for the degree of masters in Adult health nursing.

Approved by:

Examiner:

Berhanu Wordofa **(**Associate Professor) _____ _____

Name Rank Signature Date

Department Head:

Girum Sebsibie (PhD, Assistant Professor) _____ _____

Name Rank Signature Date

ADVISORS

Tefera Mulugeta (Asst. Professor) Signature: _____ Date: _____

Mekonen Adimasu (M.Sc. in pediatrics) signature: _____ Date: _____

STATEMENT OF DECLARATION

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis.

This thesis is submitted in partial fulfillment of the requirement for a graduate degree from the Addis Ababa University at College of Health Sciences, School of Allied Health Sciences department of Nursing and Midwifery. The thesis is deposited in the Addis Ababa University Digital Library and is made available to local, national and international scientific community. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Brief quotations from this thesis may be used without special permission provided that accurate and complete acknowledgement of the source is made. Requests for permission for extended quotations from, or reproduction of, this thesis in whole or in part may be granted by the Head of the Department or all advisers of the theses when in his or her judgment the proposed use of the material is in the interest of scholarship and publication. In all other instances, however, permission must be obtained from the author of the thesis.

Student

Name: Worku Balcha (BSc Nursing) Signature: _____Date: _____

Research Advisors:

Tefera Mulugeta (Asst. professor) _____ _____

Signature Date

Mekonen Adimasu (M.Sc. in pediatrics) _____ _____

Signature Date

ACKNOWLEDGMENT

Firstly, I would like to express my heart-felt gratitude to Arsi University, which sponsored me to join in this master program.

Secondly, I gratefully acknowledge to Addis Ababa University, college of health sciences, school of nursing and midwifery and department of nursing for giving me the chance and necessary support to do this research thesis.

Thirdly, I would like to express my deepest appreciation and special admiration to my advisors Tefera Mulugeta (Assistant professor, PHD fellow) and Mekonnen Adimasu (Msc in pediatrics) for their guidance and constructive comments, which have been very helpful to improve the whole research thesis. Their tolerance and understanding helped me to withstand the hard times and all the difficulties.

Lastly, but not the least I would like to extent my heart full thanks to Field Hospital and Eka Kotebe General Hospital managers, all staffs, card room officer and data collectors for their cooperation during data collection. In addition, I also thank my friends and I would like to thank them for helping me with their comments, discussions, and encouragement.

TABLE OF CONTENTS

Contents Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYM'S AND ABBREVIATIONS

AHR ----------Adjusted Hazard Ratio

ARD**S**----------Acute Respiratory Distress Syndrome

AKI ----------Acute Kidney Injury

CPHM----------Cox Proportional Hazard Model

CI----------Confidence Intervals

CHD ----------Coronary Heart Disease

COVID-19----------Corona Virus Disease 2019

CDC----------Centers for Disease Control and Prevention

CKD---------- Chronic Kidney Disease

COPD----------Chronic Obstructive Pulmonary Disease

HIV ----------Human Immuno-Deficiency Virus

HR----------Hazard Ratio

ICU----------Intensive Care Unit

IQR----------Inter Quartile Range

MOH----------Ministry of Health

MERS-CoV----------Middle East Respiratory Syndrome Coronavirus

RNA---------- Ribonucleic Acid

rRT-PCR----------Real-Time Reverse Transcription-Polymerase Chain Reaction

SARS-CoV----------Severe Acute Respiratory Syndrome Coronavirus

US----------United State

WHO----------World Health Organization

ABSTRACT

Background: The duration of viral shedding in COVID-19 patients may be influenced by a number of variables. In order to create preventive strategies and enhance treatment possibilities, it is crucial to understand the typical duration of recovery and its predictors. Despite the available interventions to tackle COVID 19, there is little information on time to recovery and its predictors among adult COVID 19 in Ethiopia.

Objective: The purpose of this study was to assess time to recovery and its predictors among adults hospitalized with COVID -19 in COVID -19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.

Methods: A quantitative institutional-based retrospective cohort study was conducted among adult patients admitted with COVID-19 from March 18, 2020 up to March 18, 2022 G.C. in Addis Ababa, Ethiopia. A total sample size of 295 were proportionally allocated to each selected hospital and systematic random sampling method was used. Epidata version 4.6 was used for data entry, and STATA version 14 for analysis. A Kaplan–Meier curve was used to estimate survival time and the Cox regression model was fitted to identify independent predictors.

Results: The majority of the age group 108(36.61%) was lie between 26-44 years old. At the end of follow up, 265 observations were developed an event (recovered) with median time to recovery of 14 days with IQR of 11-22 days. Being older age (aHR = 0.54, 95% CI; 0.35,0.84), presence of comorbidity (aHR = 0. 66, 95% CI; 0.45 ,0.97), presence of symptom (aHR= 0.56,95% CI;0.42,0.73), ≤ 93% O_2 saturation (aHR= 0.52, 95%CI; 0.38,0.70), case severity (aHR=0.03, 95%CI; 0.02,0.04), ICU admission (aHR=0.27, 95% CI; 0.19, 0.36) and oxygen use (aHR=0.48, 95%CI; 0.34, 0.67) were found to have statistically significant association with delayed recovery time.

Conclusion and recommendations: In general, this study found a relatively short median recovery time to the local finding. Older age, comorbidity, symptom presence, < 93% O2 saturation, severe stage of Covid-19, ICU admission and use of oxygen therapy were all significant predictors of delayed recovery time. The findings highlight the importance of giving a priority, attention and monitoring of COVID-19 patients with these elements.

Keywords: COVID-19, time to recovery, predictors, incidence rate, Addis Ababa, Ethiopia

CHAPTER ONE: INTRODUCTION

1.1. Background

SARS-CoV-2 has been affecting the global population for more than a year as a new global threat. Despite the huge efforts to eradicate this virus, numerous problems remain, such as diverse viral presentations, temporal immunity in affected individuals and variable data on viral shedding(1). Novel Corona virus is a new type of corona virus that emerged in December 2019 in Wuhan, China. Its genome is made up of a single strand of ribonucleic acid (2).

Large numbers of tests were performed to determine the causative agent, excluding other etiological agents that could produce similar symptoms, such as the severe acute respiratory syndrome corona virus (SARS-CoV) and middle east respiratory syndrome corona virus (MERS-CoV). Finally, the investigators came to the conclusion that the cause of a novel corona virus designated as severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The World Health Organization (WHO) proclaimed the corona virus disease 2019 (COVID-19) as pandemic on March 11th noting that a significant increase in the number of infected people(3).

The two most common routes of virus transmission have been recognized as physical contact and respiratory routes. Poor hand hygiene, overcrowding, and close physical contact, such as hand shaking, all contribute to the virus's rapid transmission in a short period of time(4).

Centers for Disease Control and Prevention (CDC) recommends two consecutive negative results of SARS-CoV-2 by Real-time Reverse Transcriptase Polymerase Chain Reaction (rRT-PCR) in 24 hours to conclude a patient’s recovery from COVID-19(5)

According to WHO recommendations, COVID-19 infection is detected by real-time reverse transcription polymerase chain reaction when SARS-CoV-2 RNA is present in a respiratory sample. According to estimates, individuals with moderate infections would need two weeks to recover, while those with major infections would need three to six weeks(6). The average time to recover from the disease lasts 5 to 36 days in Indian states(7). The average recovery period from COVID-19 more than 14 days for certain countries and less than 14 days for others, depending on the patient and the setting(8).

In hospitalized patients, the presence of risk factors such as advanced age, hypertension, diabetes mellitus, high D-dimer levels, male gender, dyspnea, presence of fever, severe hypoxia, and organ failure has significantly association with a longer recovery period(9).

Knowing the factors that influence the duration of viral ribonucleic acid (RNA) shedding, or the time it takes for patients with COVID-19 to go from infection to viral RNA-negative conversion, is critical for developing prevention strategies and optimizing treatment options(10).

There is currently little information available about the recovery period from COVID-19 and its predictors in Ethiopia and the research area. So, in order to develop the most effective treatments and preventative strategies, evidence demonstrating the length of recovery from COVID-19 in various contexts and circumstances is required. This study aimed to determine the average length of recovery from SARS-CoV-2 infection and its determinants in COVID-19 patients.

1.2. Statement of problem

COVID-19 has spread practically everywhere in the world, with over 37 million confirmed cases and over 1 million deaths documented through October, 2020(11).

The WHO claimed that there were 135,057,587 confirmed cases over the world. Only 3,171,006 instances, or 2% of all cases, were found in Africa. Only 3% (79,545) of the total cumulative deaths reported worldwide have been recorded on the continent. On the same day, a total of 227,255 confirmed cases and 3146 death were reported in Ethiopia(12).

The outcome of disease varies from uneventful recovery to multi-organ dysfunction (13). The effects of COVID-19 could be devastating for the economy. Due to duration of stay and resource intensity, hospitals lose thousands of dollars for every Covid-19 patient on average(14). Other than infection control and supportive care, there is no specific treatment for Covid-19. In addition to case fatality, Prolonged hospitalization is a well-known indicator of the severity of the disease(15). In COVID-19 patients, the median period of viral shedding is 12–42 days, with the maximum duration being 45 days. Older age, a time gap between sickness start and hospital admission, diarrhea, corticosteroid medication, and lopinavir/ritonavir use are all linked to a longer duration of viral RNA shedding in COVID-19 patients(10).

Age over 65, hypertension (which affects up to 40% of patients), diabetes, obesity, cardiovascular disease, and lung disease are all indicated to be potential risk factors for a prolonged recovery from COVID-19(16).The existence of clinical manifestation during admission is also linked to a delayed recovery from COVID-19(17).

There is evidence that the consequences of the aforementioned factors vary from location to location, indicating that there is still no well-established fact about the disease. Additionally, the underlying population demographics, lifestyle, economic situation, healthcare system, and endemic disease patterns in our nation and Africa are different from those in other regions of the world, making it difficult to predict and draw broad conclusions based on others' settings (19).

To combat the Covid-19 threat, the Ethiopian government has implemented a number of public health measures, such as increasing awareness, closing schools, limiting public gatherings and movement, and setting up and equipping treatment facilities to handle Covid-19 patients and isolate contacts with confirmed cases(11).

Despite the measures outlined above, the unexpectedly quick development of the Covid-19 pandemic in Ethiopia is overwhelming medical facilities, such as hospitals and critical care units

(ICUs), significantly(14). According to the WHO, Ethiopia reported a total of 500,633 confirmed cases and 7,573 deaths as of March 12, 2023(18).

As study progresses more data on the clinical, epidemiologic, laboratory, and radiologic features of the disease are become available. The symptoms appear to differ from one place to another, as well as from one person to another, depending on sex, age, and other factors, demonstrating the significance of patients' background characteristics in the clinical presentation, severity, and outcome of the condition(19-21). The length of viral shedding could vary from person to person(20). I want to feel better. Many newly hospitalized patients ask these questions.

COVID 19 is a worldwide problem with high incidence that requires preventive measures due to altered quality of life of people. Recovery times at healthcare facilities are a good indicator of the quality of the healthcare services they provide.

The majority of investigations on the duration of SARS-COV-2 shedding in COVID-19 patients have come from China and Europe. In Africa, only a few studies have been undertaken. Despite the fact that various research on COVID 19 knowledge, practice, and attitude, prevalence, incidence, and associated factors have been undertaken, in Ethiopia, the time to recovery and its predictors from COVID 19 in adults hospitalized with COVID-19 have not been well explored in Ethiopia.

Understanding the factors that influence the length of a hospital stay can help COVID-19 patients and their families make informed decisions about how long they will be in the hospital. Also, to know the status of recovery time, to plan treatment course, resource utilization, to reduce its economic impact and to develop innovate alternative treatment plan.

As a result, time to recovery is a very important parameter for health care provider to estimate the prognosis, to know improvement and facilitate communication among physician to initiate further treatment.

In addition to this knowing time to recovery facilitates the initiation of personalized treatment, reduces unnecessary treatments, and more precise decision making for both clinicians and patients. Furthermore, other researchers have not looked into which characteristics have a detrimental or favorable impact on treatment outcome. This study will be interested in this area to fill this gap. Therefore, this study aimed to assess time to recovery and its predictors among adults hospitalized with COVID -19 in COVID -19 isolation and treatment center, Addis Ababa, Ethiopia.

1.3. Significance of the study

COVID 19 is the most challenging problem worldwide. Time to recovery from COVID 19 will have practical value for patients, providers, researchers and policy-makers in the Ministry of Health. This study will help to assess the progress, to know the status of recovery time and to plan treatment course.

The study will be an input to policy makers, program managers, health professionals to have evidence on median time to recovery of patients, to decide based on evidence about COVID 19 and to support the planning of systems for enhanced COVID 19 control and prevention program.

The research was helpful in discovering predictors that might result in a COVID 19 therapy outcome that is unsuccessful and a poor recovery, and help for healthcare providers in preparing for additional care to enhance early recovery.

This Study will promote nursing research, nursing education and clinical practice to provide evidence-based nursing care.

Finally, this paper might also will be benefit researchers by using this result as baseline data to conduct further prospective follow-up studies covering a wide area. Therefore, this study will be conducted to determine the time to recovery from COVID 19 and identify important predictors that could affect the recovery time.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction of COVID-19

Millions of lives have been lost as a result of the global Coronavirus Infectious Disease 2019 (COVID-19)(22). As of March 7, 2022, there were more over 447.8 million confirmed COVID-19 cases and about 6 million deaths worldwide(23). Understanding the disease's severity, determining risk factors, and assessing the quality of medical care can be improved by being aware of the COVID-19 fatality rate(24). There has now been a significant body of research on the acute clinical manifestation and prognosis of COVID-19 individuals. However, there is significant variation in the estimate of recovery time from COVID-19. Early in the pandemic, a systematic review reported that the average duration of recovery time was 19 days(25).

The author searched on PubMed, Google Scholar, and Web Science data bases for 60 articles. From those, 49 articles were selected (35 of which were retrospective cohort study designs, 3 systematic meta-analysis, 3 prospective cohort study designs, and 8 cross sectional study designs) taking into account similarity of objectives and study population to this study, and articles published within the last five years. Then the author reviewed and presented according to the five sections listed below.

2.2. Time to recovery

The average recovery period from COVID-19 is more over 14 days for certain nations and less than 14 days for others, depending on the patient and the environment(8). A retrospective cohort study conducted in Shenzhen, China show that average median time to recovery was 21 days(26). In which almost similar to study conducted among Wuhan, China, indicate that the median length of viral shedding in survivors was 20 days (27).

According to study done in the Singapore showed that Median duration of viral shedding from first to last positive nasopharyngeal swab collected as part of clinical care was 12 days (28).

In the same manner, a cross-sectional study carried out in Tehran found that the median duration to recovery was 13.5 days (9).

As retrospective cohort study was done in Qingdao, Shandong Province, China showed that median duration of viral negative conversion of SARS-CoV-2 RNA occurred 14 days from the first positive RT-PCR test(29).

Similar retrospectively study was performed in Jiangsu and Anhui, China A total of 280 eligible COVID-19 patients confirms that median duration of viral clearance was 11 days(30). In contrast According to study conducted In Indian states, the average period to recover from the disease is 25 days (5 to 36 days(7).The possible reason for the observed discrepancy between the studies might be variation in study setting and time.

According to the WHO, individuals with moderate infections should expect to recover in two weeks, while those with serious illnesses can expect to recover in three to six weeks(31).

In Ethiopia, at Eka Kotebe General Hospital showed that the median time for the virus to clear each participant's body was 19 days(21). This is approximately similar to the study conducted in Wollega University Referral Hospital COVID-19 treatment center reported that median time to recovery from COVID-19 was 18 days (32). In contrast an institution-based study was conducted at Amhara regional state COVID-19 treatment institutes, the results showed that the median recovery time for COVID-19, which is 11 days. The observed disagreement between the studies could be due to differences in the period and study setting. This variation in recovery time can also be explained by the time gap between the start and end of the follow-up(33).

2.3. Predictors of time to recovery from COVID 19

2.3.1. Sociodemographic characteristic

Some studies indicated that sex-related differences might be due to females being more immune-privileged than males that might be related to sex hormones with immune-enhancing effect like estrogen(34). A study conducted in Shenzhen, Wuhan and Zhejiang Province reported that males were more likely to have delayed viral clearance Duration/ time to recovery (26, 27, 35).

A retrospective cohort study conducted in Guangzhou and Qingdao showed that age older than 45 years was factors independently affecting negative conversion of SARS-CoV-2 RNA (10, 29). Similar to study conducted in Tehran gender and age older than 50 years were predictors of recovery time. Also study done in Israel reveals that, male and female patients aged >30 years had significantly longer recovery periods compared with younger patients (36). It might be due to older age causing numerous biological changes in the immune system, which increase susceptibility to infectious disease(9).

According to a study done in Ethiopia at the Eka Kotebe General Hospital, men recovered from SARS-CoV-2 infections 36% faster than women did (21). In contrast retrospective cohort study conducted in Wollega University referral hospital COVID-19 treatment center showed that there

were no difference in recovery rate of among male and female but Recovery rate of younger age groups (<=24) years was 1.59 times higher as compared to patients who were aged >=41years (32). As an institution-based study was carried out at Amhara regional state being older age one of the significant predictors of delayed recovery time(33).

2.3.2. Comorbid related factors

In a study conducted in Jiangsu and Anhui, China, comorbidity was strongly correlated with a longer recovery time from COVID-19(30). In similar manner retrospective, multicenter cohort research in Wuhan, China, found that patients had comorbidities, with hypertension being the most prevalent, followed by diabetes and coronary heart disease, which prolonged time to recovery from COVID-19(27).

As study conducted in Mexican Institute of Social Security showed that Chronic non-communicable diseases such type 2 diabetes Mellitus and arterial hypertension were associated with a poorer Prognosis or delay recovery from COVID-19(37).

Is similar way study conducted in Guangzhou showed that had at least one comorbidity, including hypertension, diabetes, cardiovascular disease, and malignancy which associated with prolonged viral shedding(10).

Another study done in Tongji ,Jin Yin-tan hospital and Wuhan Union hospital main district (all in Wuhan, China) showed that (CHD) was proven to be an independent risk factor for prolonged viral RNA shedding(38).

According to a study done in Tehran, diabetes mellitus and hypertension significantly slowed the COVID-19 recovery process(9). In similar manner study conducted in Italy indicate that chronic obstructive pulmonary disease, hypertension, chronic kidney disease and cancer were associated with delay recovery time from COVID 19(39). This comorbid condition is linked to a higher risk of poor functional status and adverse events in response to diagnostic and therapeutic procedures like multiple medications, which often leads to a delay in recovery.

The findings of a study conducted in Ethiopia at Eka Kotebe General Hospital showed that nearly half of those with comorbidities were known cancer and HIV patients on clinical follow up. Those with at least one comorbidity recovered 93% faster than those without any comorbidities(21). Parallel to this, a retrospective cohort research carried out in the COVID-19 treatment center at Wollega University referral hospital revealed that the presence of comorbidity reduced recovery rates by 44% when compared to patients who had not been admitted with comorbidities(32).

2.3.3. Clinical presentations and laboratory finding

A study done in Zhuhai, China showed that the most common symptoms on admission were fever, followed by dry cough, expectoration and sore throat. The duration of fever and oxygen saturation <80mm Hg on admission were Associated with the COVID-19 severity in the early stage and there is no correlation between the viral shedding and COVID-19 severity(40).

According to study conducted outside of Wuhan, China in adults with COVID-19 recovery period was shorter in asymptomatic patients compared with symptomatic patients(41).

According to Tehran research presence of fever, arterial O2 saturation < 93% and respiratory rate of ≥ 25 breaths/min were significantly associated with prolonged recovery time and in multivariate analysis, only dyspnea had a significant association with this variable. Patients who had gastrointestinal problems (including abdominal pain, diarrhea, anorexia and vomiting) experienced prolonged viral shedding(9).

As study conducted in Changsha, outside of Wuhan, china indicated that the highest temperature at admission, time from symptom onset to admission and hospital length of stay were risk factors for prolonged duration of viral shedding(41)

A retrospective cohort study conducted in (Qingdao, China) showed that chest tightness and headache were factors independently affecting negative conversion of SARS-CoV-2 RNA(29).

A study conducted in (Guangzhou, China) reported that time lag from illness onset to hospital admission, diarrhea and disease severity were significantly and independently associated with prolonged viral RNA shedding(10). According to multicenter retrospective study from Wuhan, China severely ill patients stay longer to recover from COVID-19(42).

Study conducted in Tongji ,Jin Yin-tan hospital and Wuhan Union hospital main district (all in Wuhan, China) showed that Patients with albumin ⩾35 g·L−1 had a shorter duration of viral RNA shedding Compared to those with albumin <35 g·L−1 and the median times were 18 days and 20 days, respectively(38).

From the study conducted in Ethiopia at Eka Kotebe General Hospital the risk of delayed recovery was not influenced by blood type and existence of signs and symptoms(21). In contrast as an institution-based retrospective cohort study was carried out at Amhara regional state presence of symptom at admission, showed a relatively delayed recovery time (33). In similar manner prospective cohort study conducted in Millennium Covid-19 Care Center moderate and severe COVID-19 severity score showed a relatively delayed recovery time(17).

According to retrospective cohort study conducted in Wollega University referral hospital COVID-19 treatment center Patients who were not detected with fever were at higher rate of recovery than patients who were showed fever on admission(32). This might be the case that COVID-19 patients with no symptoms are typically experiencing a mild stage of the disease, which causes a quick recovery.

2.3.4. Treatment Related factors

A Retrospectively study conducted in Jiangsu and Anhui, China reported that time from illness onset to antiviral treatment was the major risk factors for COVID-19 recovery(30). It is in line with research done in Tongji, Jin Yin-tan Hospital, and Wuhan Union Hospital Main District (all in Wuhan, China), which found that the first time of antiviral treatment and SARS-CoV-2 RNA shedding were independent factors(38). According to study conducted in (Guangzhou, China) Corticosteroid treatment, lopinavir/ritonavir use, ICU care, oxygen therapy and use of antibiotics were significantly and independently associated with prolonged viral RNA shedding(10). In contrast According to study conducted in Zhejiang Province, China Antiviral therapy and corticosteroid treatment were not independent factors for time to recovery from COVID-19. However, ICU care and Oxygen therapy was significantly associate with prolonged recovery time(35). According to study conducted in US patients hospitalized with COVID-19 those who receive remdesivir treatment within 2 days after hospitalization was shorter time to recovery from COVID-19 than those who didn't(43). In similar manner study conducted in Bangalore, India indicate that early remdesivir initiation was independent predictors of time to recovery from COVID-19(44). Various studies have been conducted around the world, nearly all outside of Africa, to understand the disease pattern and outcome, and evidence suggest that there is a variation from place to place. As my knowledge is concerned previous studies done related to predictors of time to recovery in Ethiopia were focused on sociodemographic and sign and symptoms variable only, they did not address important variables that were potential predictors for time to recovery from COVID-19 such as laboratory related (i.e., Albumin level), treatment related (i.e., antiviral, ICU care) and Covid-19 severity level. Additionally, pervious study was unable to included participants in younger adult and older adult age groups. Therefore, knowing the precise time of recovery and other factors linked to early or delayed recovery could help plan the course of therapy, determine the prognosis, and forecast the outcome. This study will be interested in this area to fill in the gaps in knowledge.

2.4. Conceptual frame work

A conceptual framework for evaluating time to recovery and its determinants among individuals hospitalized with COVID-19 was constructed from various literature(17, 21, 32, 33, 41). It includes characteristics pertaining to sociodemographic, co-morbidity, clinical and laboratory data, and treatment variables.

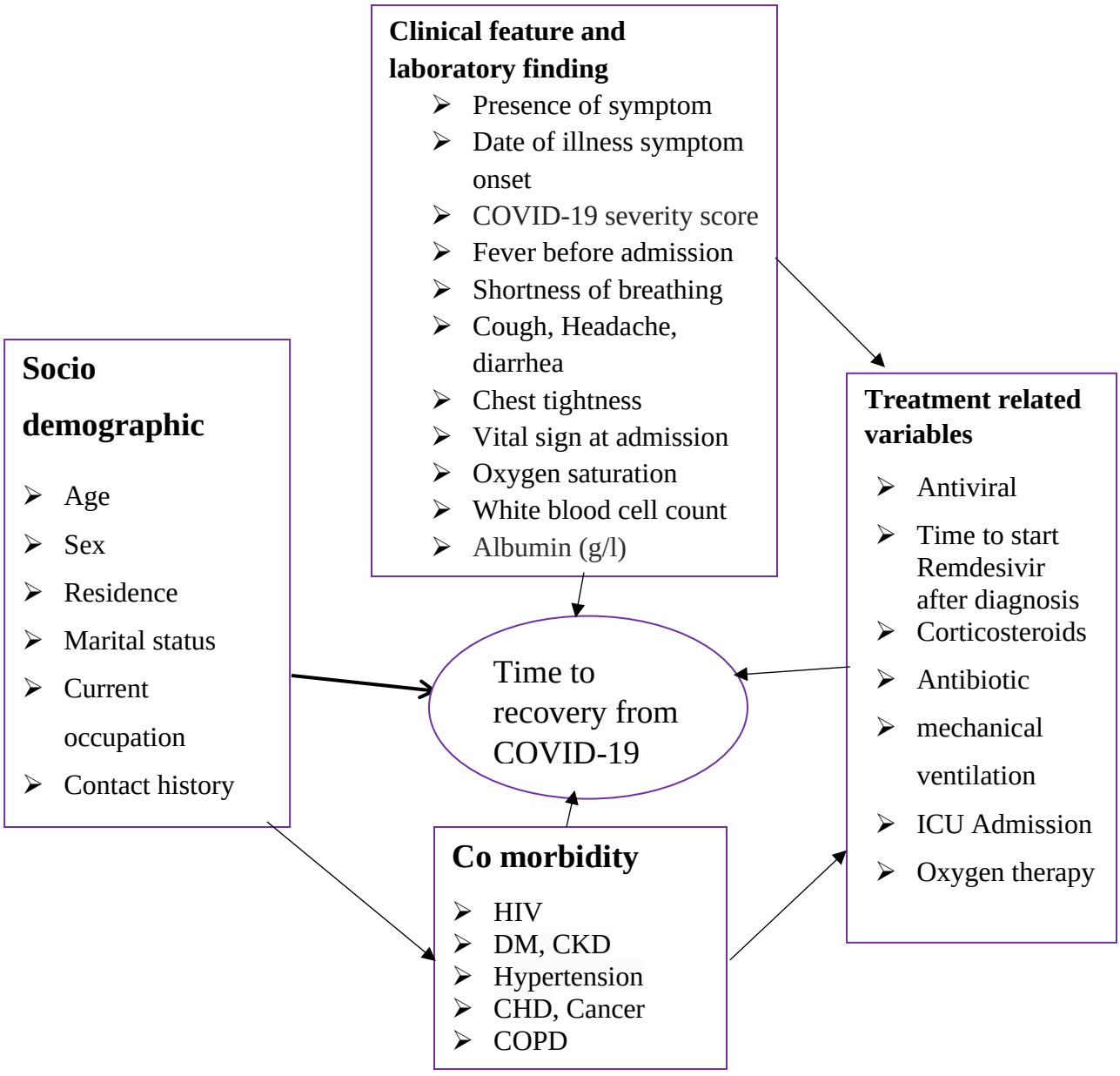

Figure 1: Conceptual framework for the assessment of time to recovery and its predictors among adults hospitalized with COVID-19 in selected COVID -19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.

CHAPTER THREE: OBJECTIVE

3.1. General objective

- The main objective of this study was to assess time to recovery and predictors among adults hospitalized with COVID-19 in COVID-19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.

3.2. Specific objectives

- To determine time to recovery among adults hospitalized with COVID-19 in COVID-19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.
- To identify predictors of recovery from COVID-19 among adults hospitalized with COVID-19 in COVID-19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.

CHAPTER FOUR: METHOD AND MATERIALS

4.1. Study area and period

The study was conducted in COVID-19 Isolation and Treatment Center Addis Ababa, the capital city of Ethiopia. Addis Ababa is founded in 1889 E.C and lies at an altitude of 2,300 meters above sea level. The estimated city population was 6.6 million inhabitants in 2016(45). Around four centers were found under the city administration for the treatment of COVID-19. These are Bole millennium, St. Peter hospital, Field hospital and Eka kotebe hospital. Among the COVID-19 isolation and treatment centers in Addis Ababa: Eka kotebe hospital and Field hospital were selected by lottery method. Eka Kotebe General hospital is located in the capital city of Ethiopia, Addis Ababa. The Center was the first hospital designated to manage positive COVID-19 cases in Ethiopia. It had a capacity of admitting 600 cases and capacity with 16 dedicated ICU. It has 25 Nurse, 10 laboratory, 15 midwifery, 8 pharmacy and 10 Doctor and total staff 68. Field hospital is located in Addis Ababa at Bole Bulbula in the capital city of Ethiopia. It had a capacity of admitting 200 cases. It has 10 Nurse, 11 midwifery, 2 laboratory, 2 pharmacy, 9 Doctor and total staff 34. The study was conducted from December 20, 2022-January 20, 2023 G.C. It was based on retrospective record reviewed from March 18, 2020 up to March 18, 2022 G.C.

4.2. Study design

A quantitative institutional-based retrospective cohort study was used

4.3. Population

4.3.1. Source population

- All medical record of adult COVID-19 patients hospitalized in COVID-19 Isolation and Treatment Centers Addis Ababa, Ethiopia.

4.3.2. Study population

All medical record of adult COVID-19 patients hospitalized in selected COVID-19 centers Addis Ababa, Ethiopia during the period of March 18, 2020 up to March 18, 2022 G.C.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion criteria

- All medical record of adult COVID-19 patients who were admitted to the selected COVID-19 isolation and treatment center Addis Ababa, Ethiopia during study period and whose chart was available at selected COVID-19 centers during the data collection period have participated in this study.

4.4.2. Exclusion criteria

- Patients with incomplete medical record card information, such as missing baseline data including the date of admission, the date of discharge and the status of the discharge, were excluded from the analysis.

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

For manual sample size calculation in a survival analysis, a single population proportion formula is as follows:

Sample size (n)=(E) / Pr(E). (**E)**= the number of events required to be observed,

Number of Event = $(z\alpha/_2+z1-\beta)^2 / \sigma^2 (ln\mathbf{HR})^2$

Z*α*/2 = standard normal percentile of confident coefficient,

Z1-*β* = standard normal percentile for the power to be achieved

***σ*2** = variance

lnHR = the natural logarithm of the hazard ratio.

Pr(E) = the probability that the event of interest (which is recovery in this context) will occur.

The sample size was calculated by using a sample size calculation for survival analysis in STATA version 14 statistical software. By taking (AHR = 0.56) from study done in Millennium COVID-19 care center the presence of symptom at presentation was found to have statistically significant association with recovery time(17). Log-rank test, Freedman method formula used as follow(46): By the following assumptions in to consideration: Probability of withdrawals 0.1, probability of recovery rate 0.5, alpha 0.05, and power of 80%. stpower log rank 0.5, hratio (0.56) power (0.8) wdprob (0.1). It became 268. By adding 10% for incomplete data 268+26.8= **nf=295**

4.5.2. Sampling technique

Among four COVID -19 isolation and treatment center in Addis Ababa: Eka Kotebe hospital and Field hospital were selected by lottery method. The samples size of 295 was proportionally allocated to size of currently on COVID-19 registered cases in each selected Hospital. For each hospital the proportionate number of study subjects were determined by using, n=nf/N *ni Where, ni= Number of COVID-19 in each hospital, nf= Total sample size, N= Total number of COVID-19 in both hospitals. A systematic random sampling technique was used. Sampling interval (K value) was calculated as N/nf=8500 /295 = 28.8 = 29. Then systematic sampling method (every 29^{th} registration after selecting 1^{st} sample by lottery method between 1^{st} and 29^{th} registration) were used to identify participant registration in each hospital by using COVID-19 case registration log book as a sample frame. The registrations were jumped to the next registration if they have outcome was drop out and incomplete data.

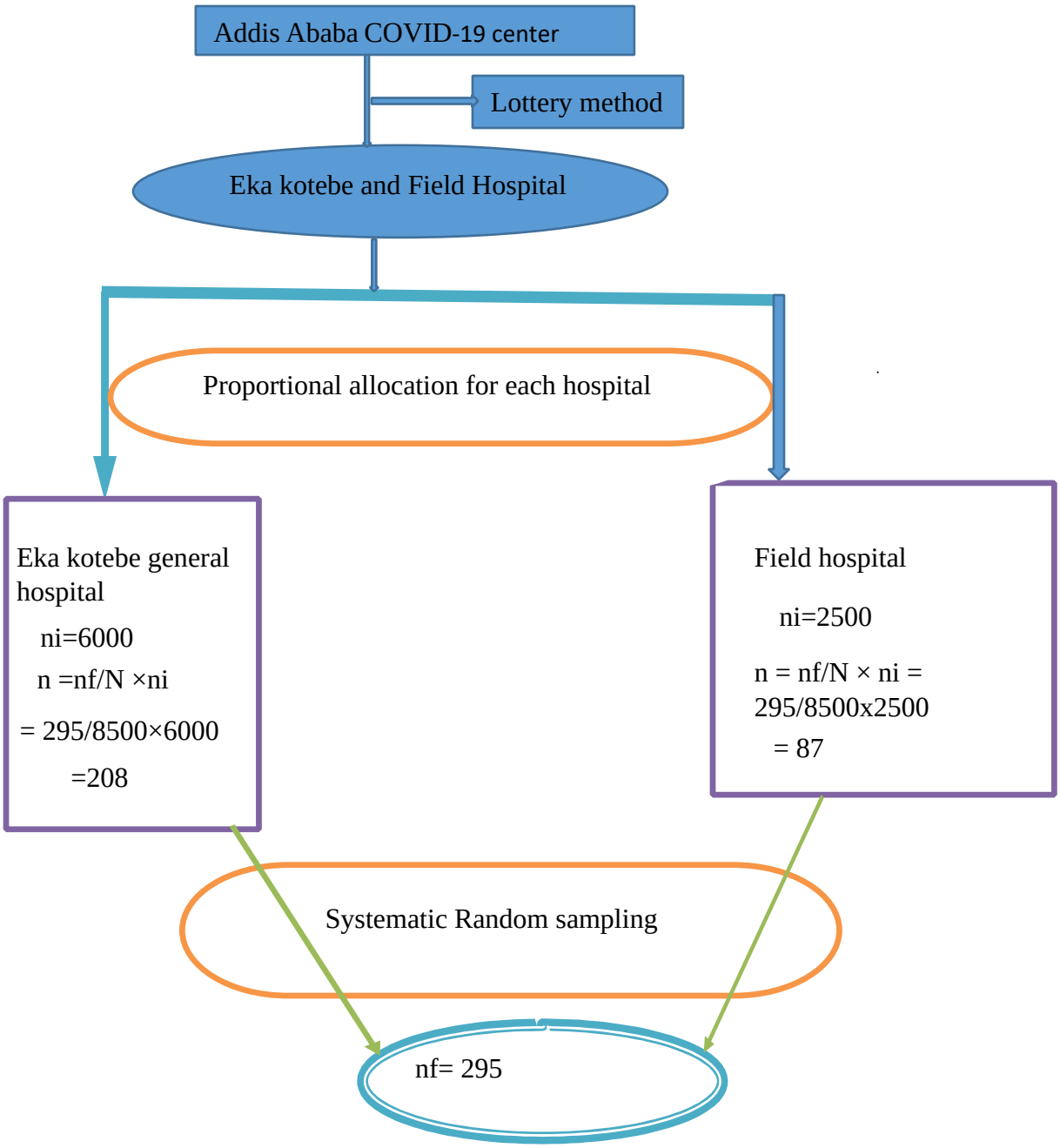

Figure 2 : Schematic presentation of the sampling procedure for the assessment of time to recovery and its predictors among adults hospitalized with COVID-19 in selected COVID -19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023

4.6. Study variable

4.6.1. Dependent variable

- time of recovery from COVID-19 (in days) (i.e., the event of interest is recovery and the response variable is time of recovery)

4.6.2. Independent variable

Socio demographic:

- sex, age, marital status, occupation, residence and contact history

Co morbidities

- Hypertension, diabetes mellitus, HIV, coronary heart disease, cancer, chronic obstructive pulmonary disease and chronic kidney disease

Clinical feature and laboratory variables

- Presence of symptom, Date of illness symptom onset, COVID-19 severity score
- fever before admission, cough, shortness of breathing, headache, chest tightness, diarrhea, vital sign at admission and oxygen saturation
- White blood cell, and Plasma protein(albumin)

Treatment related variable

- Antiviral, time to start remdesivir after diagnosis, corticosteroids, antibiotic, mechanical ventilation, ICU admission and oxygen therapy

4.7. Operational definitions

- **COVID-19 patients** are all individuals tested infected with SARS-CoV-2 by rRT-PCR.
- **Symptomatic patients** is defined as any SARS-CoV-2 positive individual by rRT-PCR with at least one sign or symptom for COVID-19 including but not limited to: cough, fever, headache, muscle pain and shortness of breath(21)
- **Age group;** Young adult (18-25 age), Adult (26-44 age), Middle-age (45-59 age), older adults (60 age and above)(47).
- **Comorbidity** (Yes/No) is co-existence of one or more diseases with Covid-19 cases "Yes" and, if not it will be considered as "No (32)".
- **Time of recovery** is defined as the number of days between the first rRT-PCR positive test for SARS-CoV-2 and two consecutive negative rRT-PCR test results in 24 hours(21).
- **Event**: recovery from COVID-19
- **Card with incomplete information**: Card which had no full information about diagnosis of COVID-19 and lacking baseline information such as date of admission, date of discharge and discharge status
- **Censored**: will be declared when the outcome of interest is not observed (not recovered from COVID-19), which included death, referred to other Health institution, patient registered on registration book as having COVID-19 but her/his card not found at card room, drop out of treatment and will be coded 0 if censored, 1 if recovered (32).

COVID-19 severity score classified as(48):

- **Mild Disease**: Characterized by fever, malaise, cough, upper respiratory symptoms, and/or less common features of COVID-19 (headache, loss of taste or smell etc.)
- **Moderate Disease**: Patients with lower respiratory symptom/s. They may have infiltrates on chest X-ray. Arterial O2 saturation >93%
- **Severe Disease**: These patients have developed complications. Hypoxia: Arterial O2 saturation ≤ 93% on atmospheric air or Respiratory rate >30 breaths/minutes

4.8. Data collection tool and procedures

4.8.1. Data collection tool

A structured data abstraction form was used. A data extraction tool was developed from different literatures (17, 21, 32, 33, 41) and prepared from COVID-19 patient medical cards and log-book that was currently used by the COVID-19 treatment center of the hospital. The checklist consists of socio demographic related variables (i.e., age, sex and occupation), co morbidity variables (Hypertension, Diabetes and Chronic heart disease), treatment related variables (Antiviral, ICU admission and oxygen therapy) and clinical and laboratory variables (symptom status at admission, vital sign, oxygen saturation and white blood cell count).

4.8.2. Data collection procedures

Information was collected from the registration book, and patient card. Data was extracted for one month by 4 trained BSc Nurses that working outside of treatment center using a data extraction sheet prepared in the English language after reviewing different literature. The Nurses working outside of COVID-19 center extracted the required data from patients' registration book and charts under supervision. The data extraction sheet cross checked with pre-established known source of study variables. Lists of charts of study participants during the study period was taken from the card room and Patients whose cards lacked basic information, such as the date of admission, the date of discharge, and the status of the discharge, were excluded from the analysis. Finally, charts which have baseline data was selected and variables was recorded.

4.9. Data quality assurances

To ensure quality of data at beginning, a data abstraction form was pre-tested on 5% of calculated sample size at St. Paul hospital COVID-19 center and necessary modifications was made based on gaps identified in the questionnaire such as excluding sociodemographic variables (such as economic status and religion) and including clinically relevant variables (such as vital signs at admission). Pre-teste was conducted one weeks before data collection. The pre-teste result was not included in the study. The abstraction format was checked to the hospital documentation system to ensure the agreement of the data abstraction format with the need for the study. Any error found during the process of checking was corrected and

modification was made into the final version of the data abstraction format. Training on record review was given to data collectors and supervisors for 01 days before the actual data collection task on the already existing records, half-day theoretical and half day practical training. Data quality was controlled by designing the proper data collection materials, through continues supervision. All completed data collection form was examined for completeness and consistency during data management, storage, cleaning and analysis. The data was entered and cleaned by the principal investigator before analysis. The principal investigator of the study controlled the overall activity.

4.10. Data processing and analysis

Data was entered into Epi-Data version 4.6 after checking for completeness, and then the data was cleaned and exported to STATA 14 statistical software for analysis. Descriptive analyses for continuous and categorical data describing the cohort characteristics were made. The results were presented by tables, texts and graphs based on the nature of the variable. Kaplan-Meier survival estimator and log-rank tests was used to estimate median recovery time during the treatment period and to compare time to recovery between groups, respectively. Predictors of time to recovery was identified using bivariable and multivariable Cox proportional hazard models (CPHM). All independent variables that had P value less than 0.25 in the bivariable model was considered candidate variables for the multivariable model. The output of the multivariable of CPHM was presented using adjusted hazard ratios (AHR) with the respective 95% confidence intervals (CI) and p-value less than 0.05 was used to declare presence of significant association between recovery and covariates. Among survival analysis model cox proportional hazard models was used. Schoenfeld residual analysis (global test) was used to show the Cox proportional hazard model assumption valid. To assess model adequacy for proportional hazard model, proportional hazard assumption was checked by global test, and overall model adequacy of proportional hazard model was assessed by using cox snell residual graph.

4.11. Ethical Considerations

Ethical approval was obtained from the institutional ethics research committee from Addis Ababa University College of Health Science following the approval by the institutional ethics research committee; official letter of co-operation was written to the concerned bodies by the college of health science about the purpose of the study to facilitate the support and commitment of responsible bodies. Permission to review charts was granted by medical director of each hospital after approval of institutional review board of each hospital. As the study was conducted through review of chart records, the individual patients were not subjected to any harm and personal identifiers were not used on data collection checklist and confidentiality was maintained.

4.12. Dissemination of the finding

The result of the study will be disseminated through writing a recommendation letter and submitting reports to Eka Kotebe General hospital, Field hospital and Addis Ababa University College of health science, department of nursing. Also, recommendation letter to the concerned bodies such as woreda health office, Ministry of health. This will be done through presenting of findings at appropriate seminars, workshop and conferences. Besides publication of the study finding on the reputable peer- reviewed local or international journal will be considered.

CHAPTER FIVE: RESULT

5.1. Socio-demographic characteristics of patients

The study included 295 patients, and all of their records fulfilled the inclusive criteria to respond to the check list, making the response rate 100%. Among all participants,170 (57.6%) were males; and 147 (49.83%) were married. The majority of the age group 108(36.61%) was lie between 26-44 years old. The patients ranged in age from 18 to 88 years. Regarding residence majority of them 203(68.81%) live in urban. The contact history for 36 (12.20%) patients was known. Around one-fourth 72 (24.41%) of patients were private employee (**Table 1**).

Table 1: Socio-Demographic characteristics of Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

Variable	**Category**	**Survival status**		**Total**
		Censored	**Recovered**	
		Frequency		**number (%)**
Age	18-25	5	55	60 (20.34)
	26-44	6	102	108 (36.61)
	45-59	6	57	63 (21.36)
	>=60	13	51	64 (21.69)
Sex	Male	19	151	170 (57.63)
	Female	11	114	125 (42.37)
Marital status	Single	3	70	73(24.75)
	Married	14	133	147(49.83)
	Separated	3	33	36(12.20)
	Divorced	3	16	19(6.44)
	Widowed	7	13	18(6.78)
Residence	Urban	23	180	203(68.81)
	Rural	7	85	92(31.19)

occupation				
	Gov't employee	3	66	69 (23.39)
	Private employee	13	59	72 (24.41)
	Farmer	2	24	26 (8.81)
	Merchant	4	36	40 (13.56)
	Daily laborer	1	9	10 (3.39)
	Driver	1	8	9 (3.05)
	House wife	2	13	15 (5.08)
	Students	2	32	34 (11.53)
	others	2	18	20 (6.78)
Contact history with confirmed case?	No	11	87	98 (33.22)
	Yes	5	31	36 (12.20)
	Unknown	14	147	161(54.58)

5.2. Clinical characteristics of patients

Around,124(42 %) of patients had at least one or more comorbidity. Among them 87(70.16%) was Hypertension and followed by diabetes mellitus 78(62.9%). Regarding vital sign at admission, a round 139(47.12%) of patient temperature was greater than 37.3 °C, more than two-third, 201(68.14%) of patient O2 saturation % was ≤ 93%, a round 127(43.05%) of patient respiratory rate was >=25 breath/minute and one-third, 93(31.53%) of patient pulse rate was >=101beats/minute. Regarding laboratory investigation about 78(26.44%) of patient white blood cell count was >=10000 cell/mm3 and 54(18.31%) of patient Albumin level was >55 g/L **(Table 2)**. More than half, 153(51.86 %) experienced symptoms at admission and the mean time of symptom onset to admission was 5 days. The commonest presenting symptom was cough 136(88.89%) followed by shortness of breathing 128(83.66%) and Headache 110(71.90%) **(Table 3**).

Table 2: Baseline clinical characteristics of Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

Variable	Category	Survival status		Total
		Censored frequency	Recovered	number (%)
Co-morbidity	No	10	161	171(57.97)
	Yes	20	104	124(42.03)
Maximum temperature on admission	<=37.3 ℃	17	139	156(52.88)
	>37.3 ℃	13	126	139(47.12)
O2 saturation % at admission	>93%	9	85	94(31.86)
	≤ 93%	21	180	201(68.14)
Respiratory rate at admission	>=25	14	113	127(43.05)
	<25	16	152	168(56.95)
Pulse rate at admission	60-100	19	183	202(68.47)
	>=101	11	82	93(31.53)
WBC count	<4000 cell/mm3	1	13	14(4.75)
	4000-9999 cell/mm3	8	73	81(27.46)
	>=10000 cell/mm3	10	68	78(26.44)
Albumin level	<35 g/L	0	14	14(4.75)
	35-55 g/L	3	31	34(11.53)
	>55 g/L	6	48	54(18.31)

Table 3: Symptom characteristics of Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

Symptom at admission	No	7	135	142(48.14)
	Yes	23	130	153(51.86)
Fever before admission	No	9	44	53(34.64)
	Yes	14	86	100(65.36)
Cough	No	1	16	17(11.11)
	Yes	22	114	136(88.89)
Shortness of breathing	No	4	21	25(16.34)
	Yes	19	109	128(83.66)
Headache	No	8	35	43(28.10)
	Yes	15	95	110(71.90)
Anorexia	No	20	83	103(67.32)
	Yes	3	47	50(32.68)
Chest tightness	No	14	106	120(78.43)
	Yes	9	24	33(21.57)
Sore throat	No	13	66	79(51.63)
	Yes	10	64	74(48.37)
Loss of taste	No	13	74	87(56.86)
	Yes	10	56	66(43.14)
Loss of smell	No	14	76	90(58.82)
	Yes	9	54	63(41.18)
Join pain	No	7	41	48(31.37)
	Yes	16	89	105(68.63)
Easy fatigue	No	8	46	54(35.29)
	Yes	15	84	99(64.71)
diarrhea	No	18	107	125(81.70)
	Yes	5	23	28(18.30)

At admission, most of the patients 116(39.32%) had moderate COVID-19 case and about 90 (30.51%) patients had severe COVID-19 case **(figure 3).**

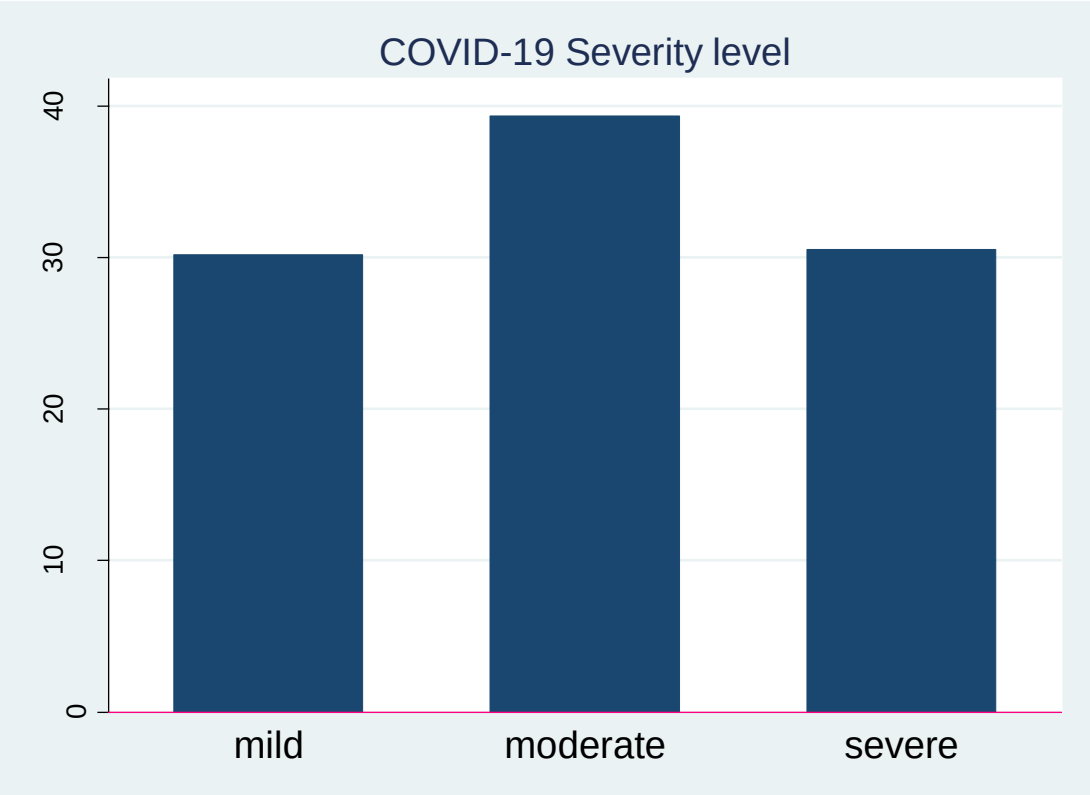

Figure 3: Percentage distribution of Severity levels among Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

5.3. Treatment related characteristics

Majority of the patients were treated 192(65.08%) with antibiotic and 102(34.58%) corticosteroids. About 81(27.46%) of them were treated with antiviral (ritonavir, lopinavir and remdesivir). The mean time to start remdesivir after diagnosis was 3.65 days. Nearly 241(82%) of the patients had received oxygen therapy. About 83(28.14%) were treated in the Intensive care unit (ICU) and 58(19.66%) were on mechanical ventilation (**Table 4)**.

Table 4: Treatment related characteristics of Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295)

Variable	Category	Survival status		Total
		Censored Frequency	Recovered	Number (%)
Antiviral	No	25	189	214(72.54)
	Yes	5	76	81(27.46)
Antibiotic	No	13	90	103(34.92)
	Yes	17	175	192(65.08)
Corticosteroid	No	23	170	193(65.42)
	Yes	7	95	102(34.58)
ICU Admission	No	21	191	212(71.86)
	Yes	9	74	83(28.14)
Mechanical ventilation	No	24	213	237(80.34)
	Yes	6	52	58(19.66)
Oxygen therapy	No	7	47	54(18.31)
	Yes	23	218	241(81.69)

5.4. Treatment outcome among patients admitted with COVID-19

At the end of follow up, 265 (89.83%) of the patients in the cohort were recovered from COVID 19 and recorded as an event. 30 (10.17%) observation was censored at the end of the follow-up time. 14 (4.7%) were died while they were on the treatment ,10 (3.3%) was transferred for further treatment and 6 (2%) drop out were while they were on the treatment **(fig-4).**

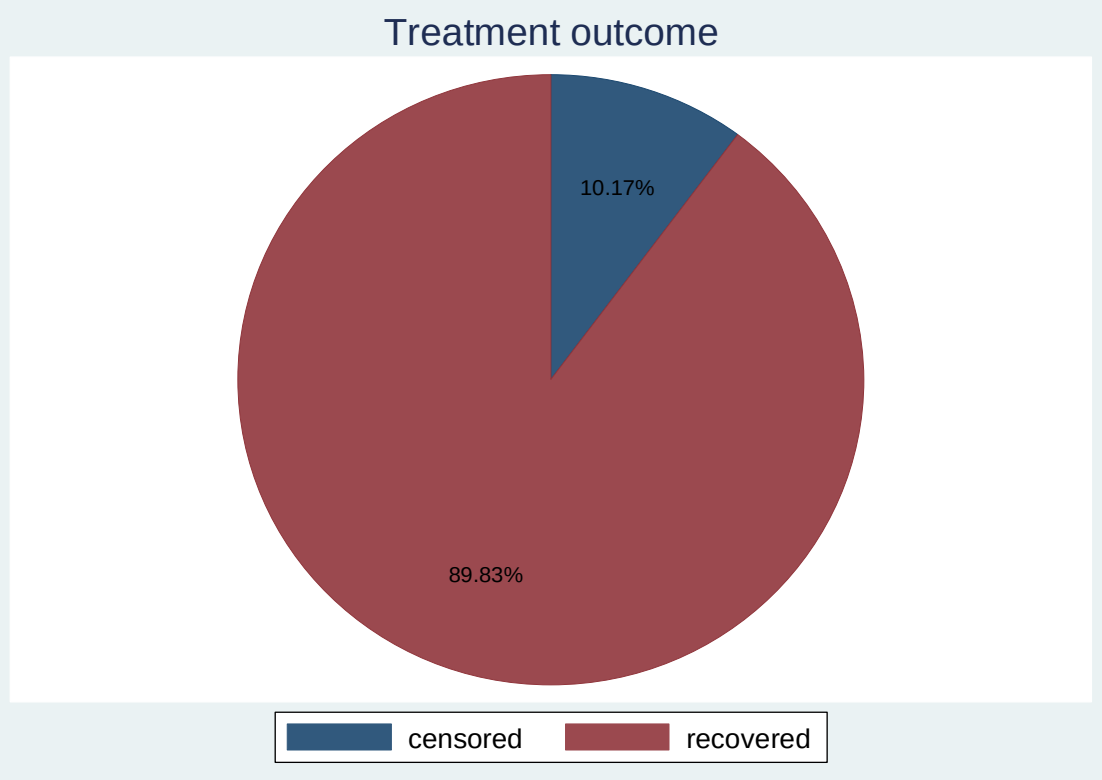

Figure 4: Treatment outcome among Covid-19 cases admitted in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

5.5. Recovery rate and median recovery time from COVID-19

At the end of follow up, 265 of them were developed an event (recovered) with median time to recovery of 14 days (IQR: 11-22). During follow-up time, a total of 5054 person-day risks were observed with a minimum and maximum follow-up time of 3 and 43 days, respectively. The overall incidence rate of recovery was of 5.2 per 100 (95% CI: 4.6, 5.9) person-days observations.

Kaplan-Meier estimation technique was used to see the estimate of survival time. The overall median recovery from COVID-19 in this study was 14 days, with (95%, CI:13-15). The overall Kaplan-Meier survivor function graph showed that over the first 20 days, the graphs significantly decreased, indicating that the majority of patients recovered from COVID-19 during this time **(Fig- 5**).

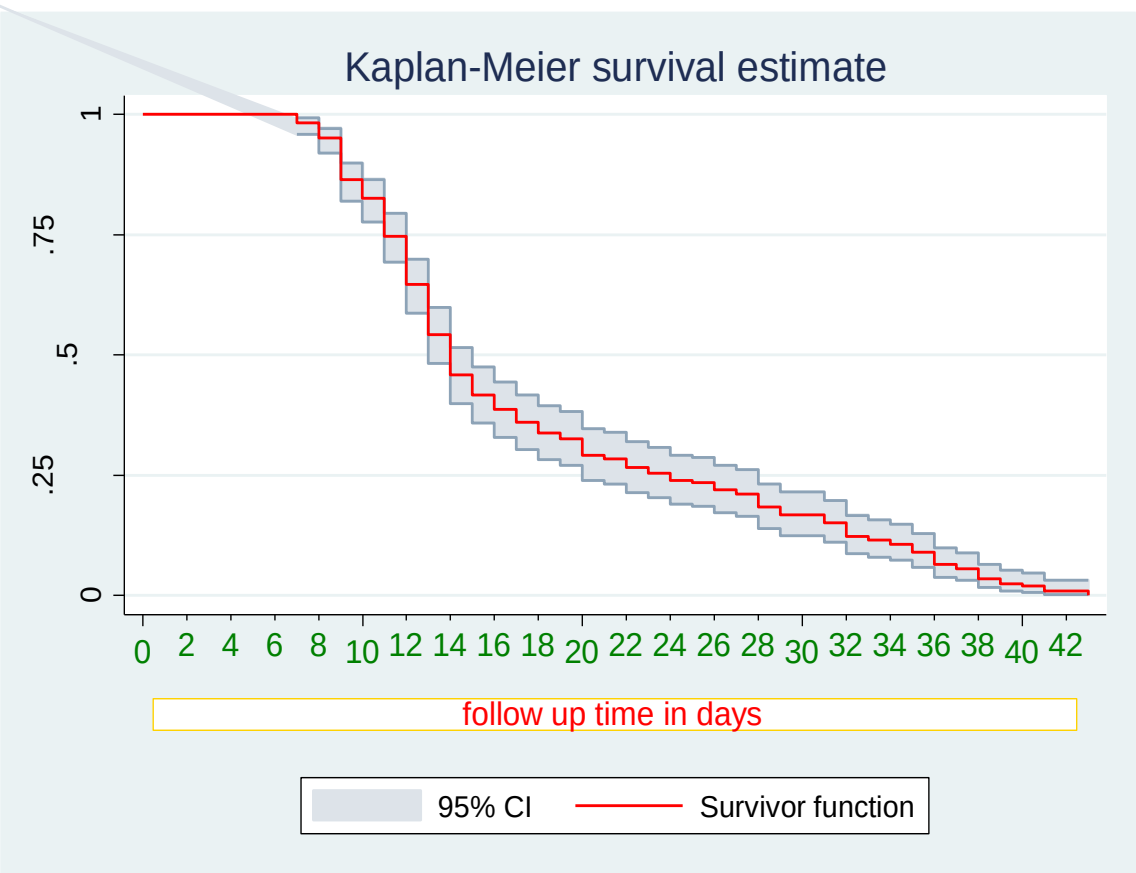

Figure 5: Overall median recovery time of the entire cohort patient's diagnosis with COVID-19 in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

5.6. Survival function among different groups of COVID -19 patients

Log-rank test was performed to test equality of survival curves for the presence of any significant differences in survival time among various levels of the categorical variables considered in the study. To show the significance of survival difference, log rank test was computed at 5% significance level. In this study, the test statistics showed that there is a significant difference in survival function for different categorical variables. Accordingly, the Kaplan-Meier analysis indicated significant evidence of differences in survival times. It was found that the median recovery time for those age >=60 had longer recovery time (22 days, 95%CI:14-28) than those age category 18-25 (13 days, 95%CI: 11-15) with P-value 0.0000**).** The median recovery time for those at least one or more Comorbidity had longer recovery time (16 days, 95%CI:14-19) than those without comorbidity (13 days, 95%CI:13-14) with P-value (0.0001). As test indicate that median recovery time for those severe case had longer recovery time (29 days, 95%CI: 28-32) with P-value (0.0000) than moderate and mild case (**fig 6-8**). The median recovery time for those who had symptom at admission had longer recovery time (17 days, 95%CI :15, 21) with P-value (0.0000) than who hadn't symptom. The median recovery time for those temperature >37.3 °C had longer recovery time (16 days,95%CI: 14, 20) with P-value 0.0006 than temperature <=37.3 °C. The median recovery time for those who mechanical ventilated had longer recovery time (26 days,95%CI: 25, 32) with P-value 0.0000 than who didn't mechanical ventilated. The median recovery time for those who admitted to ICU had longer recovery time (28 days,95%CI: 26, 32) with P-value 0.0000 than who didn't admitted to ICU. The median recovery time for those who use oxygen therapy had longer recovery time (15 days,95%CI: 14, 17) with P-value 0.0000 than who didn't use oxygen therapy. In similar manner there was significance difference in median recovery time of patients in relation to O2 saturation % at admission, WBC count, Albumin level, Antiviral and Antibiotic. However, from Kaplan Meier survival curve of individual covariates, there were no difference in median recovery time of among male and female with P-value=0.4583 (**fig-9**).

The Kaplan-Meier graph shows that median recovery time for those age >=60 was (22 days, 95%CI:14-28), which is higher than the median recovery time of age group 18-25, 26-44 and 45-59 this difference was significant with P-value (0.0000) (**fig-6**).

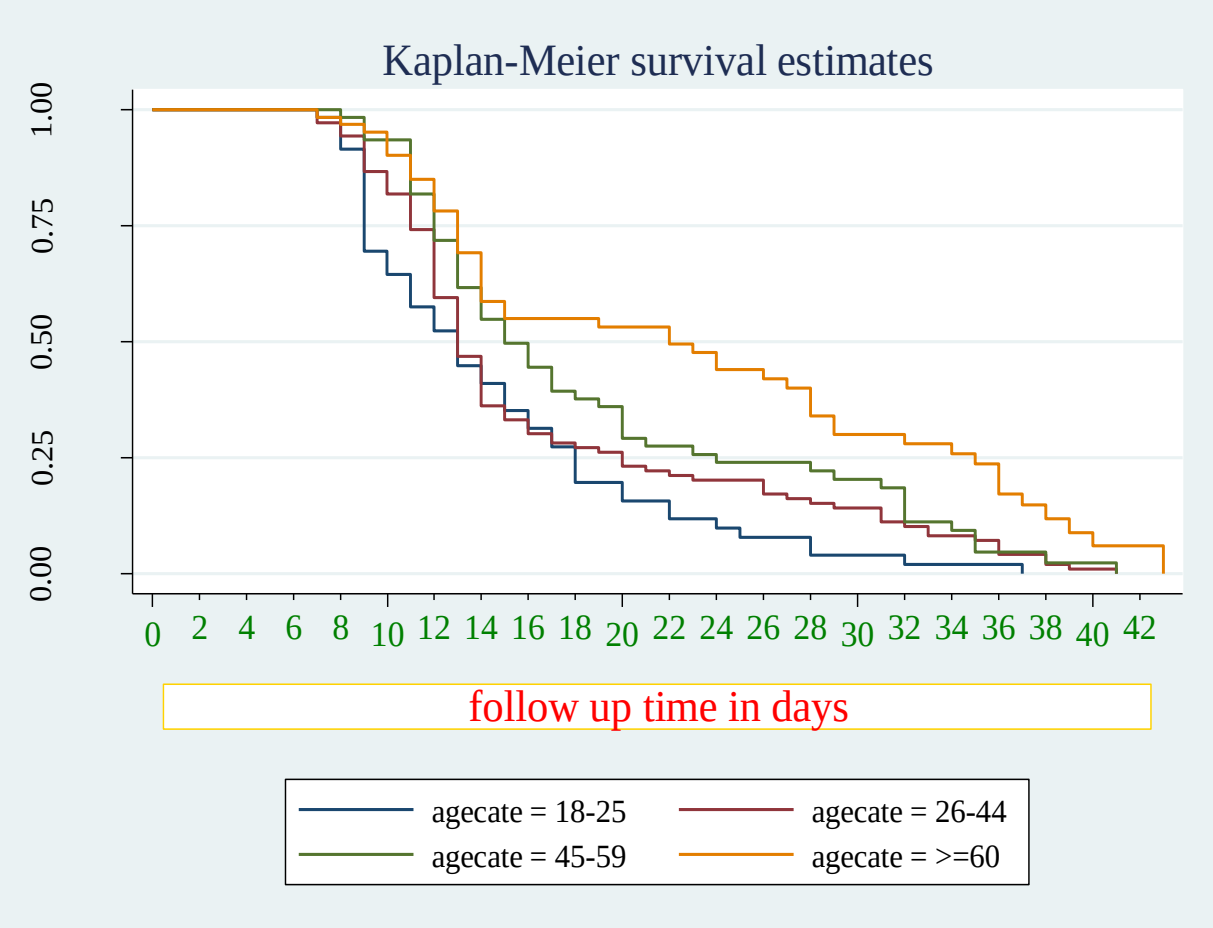

Figure 6: The Kaplan-Meier survival curves compare recovery time of COVID-19 patients with different age category in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

The Kaplan-Meier graph shows that median recovery time for those at least one or more Comorbidity was (16 days, 95%CI:14-19) which is higher than the median recovery time of those without comorbidity (13days, 95%CI:13-14) this difference was statistically significant with P-value (0.0001) (**fig-7**).

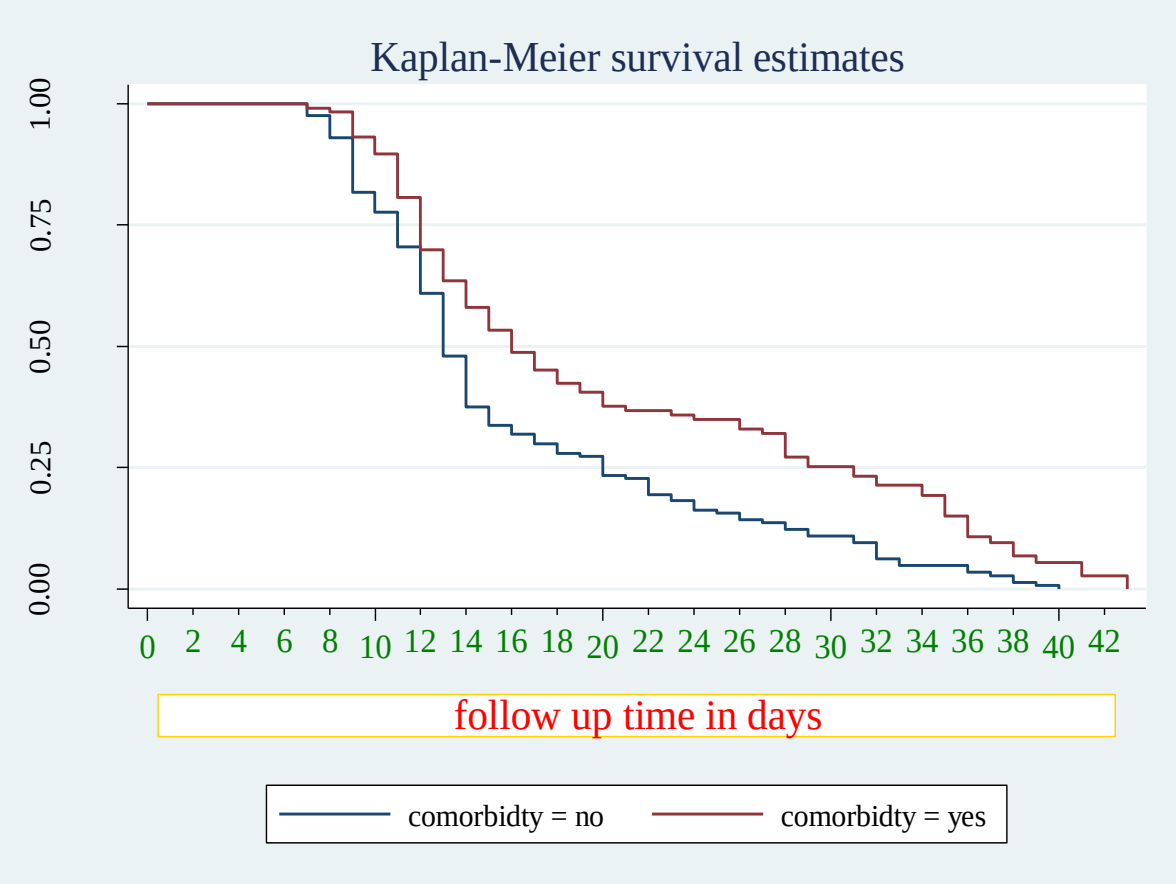

Figure 7: The Kaplan-Meier survival curves compare recovery time of COVID-19 patients with or without comorbidity in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

The Kaplan-Meier graph shows that median recovery time for those severe case was (29 days, 95%CI: (28, 32) which is higher than moderate and mild case with P-value (0.0000) **(fig-8).**

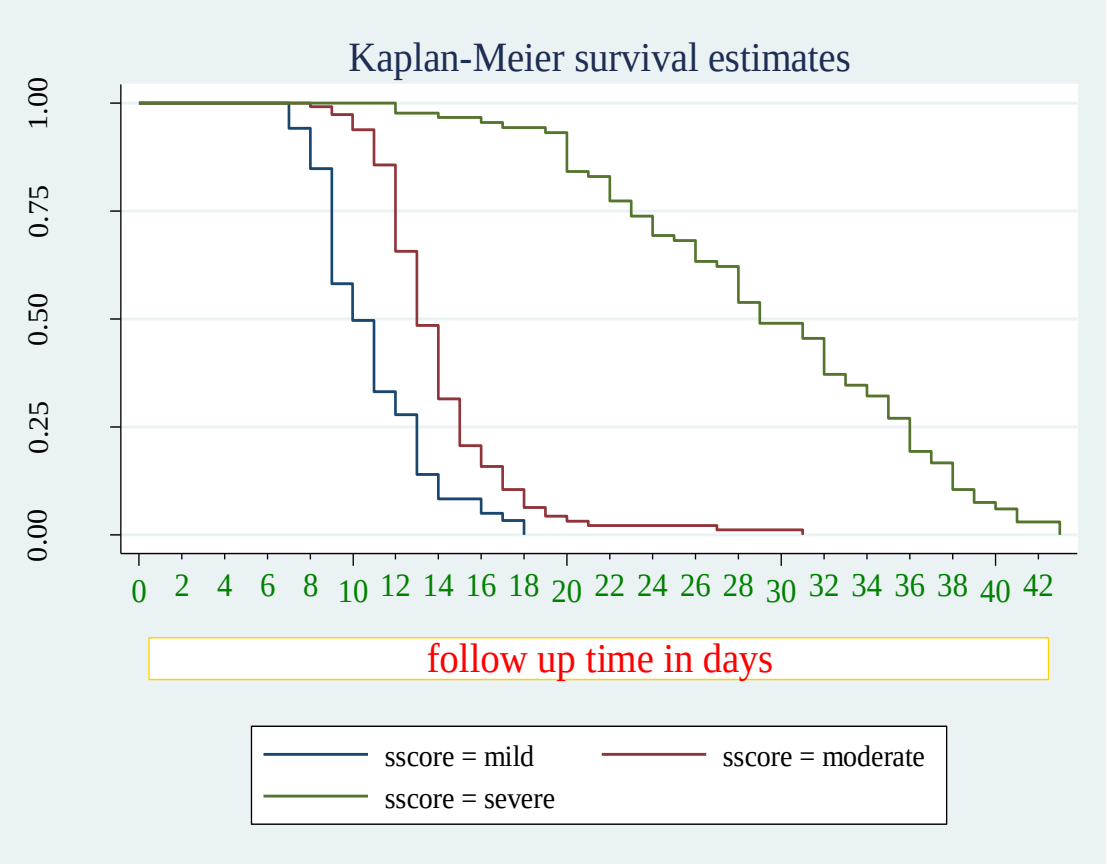

Figure 8: The Kaplan-Meier survival curves compare recovery time of COVID-19 patients with different COVID-19 severity level in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

The Kaplan-Meier graph shows that there was no difference in median recovery time of among male and female with P-value=0.2578 (**fig-9**).

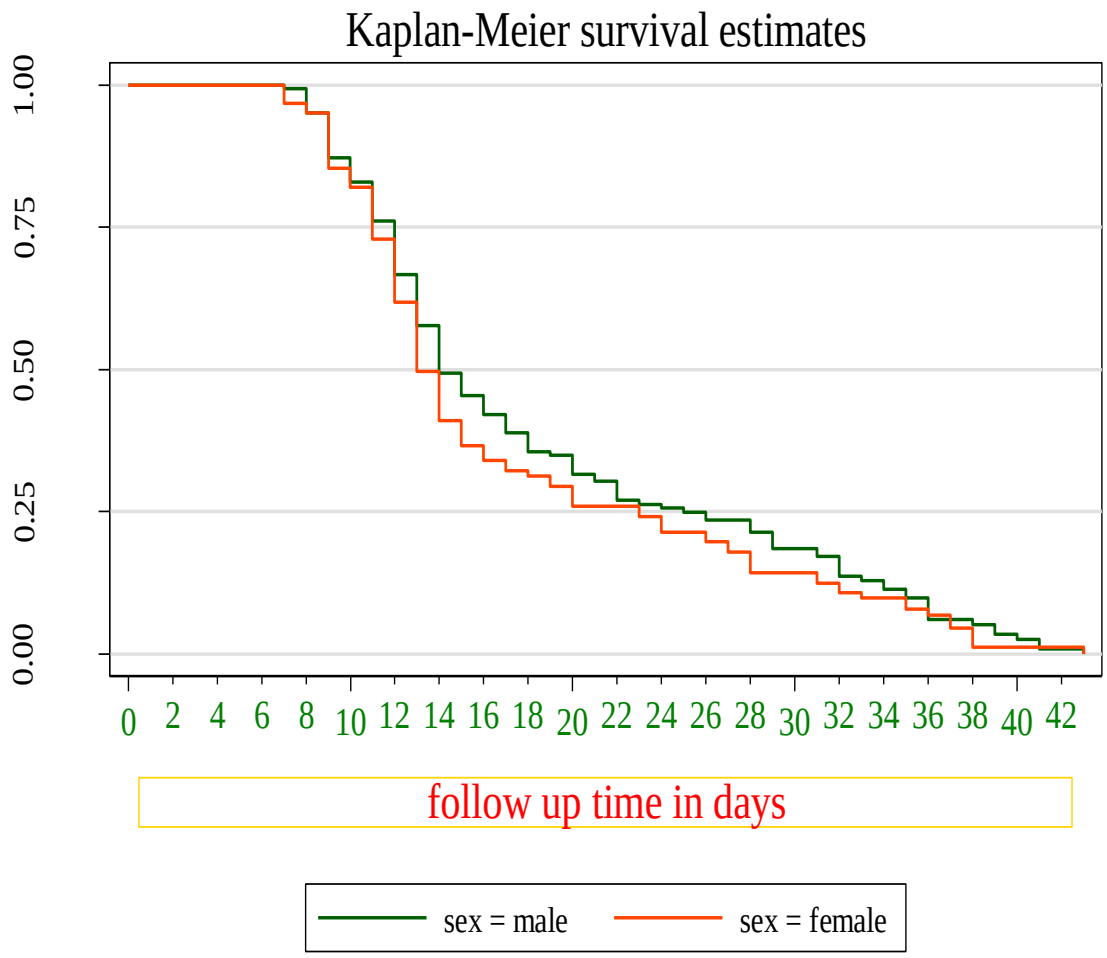

Figure 9: The Kaplan-Meier survival curves compare recovery time of COVID-19 patients between different sex in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

5.7. Predictors of recovery time from COVID-19

In bivariable cox regression analysis 15 variable were selected for multivariate Cox regression analysis. Covariates that had P- value ≤ 0.25 in bivariable cox regression analysis were selected for multivariable cox regression analysis. Age, comorbidity, presence of symptom at admission, vital sign at admission, O2 saturation % at admission, white blood cell count, Albumin level, COVID-19 severity level, antiviral, time to start remdesivir after diagnosis, antibiotic, corticosteroids, ICU admission, mechanical ventilation and oxygen therapy were selected for multivariable cox regression at P-value ≤ 0.25. In multivariate Cox regression analysis those variables with p-value <0.25 in the bivariate analysis variables were included. finally, eight of the predictors such as; age of patients, comorbidity, presence of symptom at admission, O2 saturation % at admission, COVID-19 severity level, Antiviral, ICU admission and oxygen therapy were found to have statistically significant association with recovery time during multivariable cox proportional regression analysis. The result of multivariable analysis revealed that Patients older than 60 years were had lower rate of recovery by 46% (aHR = 0.54, 95% CI; 0.35,0.84) as compared to 18-25 age groups. In addition, the presence of comorbidity lowers the rate of recovery by 34% as compared to those patients who had not admitted with comorbidity (aHR = 0. 66, 95% CI; 0.45 ,0.97). Accordingly, the rate of achieving recovery among symptomatic patients was 44% (aHR= 0.56, 95% CI; 0.42,0.73) lower than patients who were asymptomatic at admission. Patients who were detected ≤ 93% oxygen saturation at admission were 0.52 times less likely to recovery as compared to patients with >93% oxygen saturation at admission (aHR= 0.52, 95%CI; 0.38,0.70). The rate of recovery was 97% lower for patients who were severe case compared with mild cases patients (aHR=0.03, 95%CI; 0.02,0.04). Additionally, moderate patients had 69% lower recovery rate compared with mild cases patients (aHR=0.31, 95% CI; 0.22, 0.43). Patient who treated with Antiviral (lopinavir/ritonavir/ remdesivir) drug were 1.98 more likely to recovery as compared with those who did not treat with Antiviral(lopinavir/ritonavir/remdesivir) (aHR=1.98, 95% CI; 1.36, 2.23). Those patients who cared or admitted in ICU were 73% times less likely to recovery than those who did not admitted to ICU (aHR=0.27, 95% CI; 0.19, 0.36). The rate of recovery was 52 % lower for patients who use oxygen supplement compared with patients who did not use oxygen supplement (aHR=0.48, 95%CI; 0.34, 0.67) **(Table 5**).

Table 5 : Multivariable Cox regression analysis of median recovery time and its predictors among patients admitted with COVID-19 in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023 (n=295).

Variable	Category	Survival status		CHR (95%CI)	AHR (95%CI)	P-value
		Recovered	Censored			
Age	18-25	55	5	1	1	
	26-44	102	6	0.74(0.53,1.03)	0.87(0.62,1.23)	0.451
	45-59	57	6	0.6(0.41,0.87)	0.79(0.54,1.18)	0.262
	>=60	51	13	0.39(0.26,0.58)	0.54(0.35,0.84)	0.005 *
comorbidity	Yes	104	20	0.61 (0.47,0.79)	0. 66(0.45 ,0.97)	0.035 *
	No	161	10	1	1	
Symptom at admission	Yes	130	23	0.48(0.37,0.62)	0.56(0.42,0.73)	0.000**
	No	135	7	1	1	
O2 saturation % at admission	≤ 93%	85	21	0.44 (0.34, 0.58)	0.52(0.38,0.70)	0.000**
	>93%	180	9	1	1	
Severity level	Mild	84	10	1	1	
	Moderate	102	11	0.38(0.28, 0.52)	0.31 (0.22, 0.43)	0.000**
	Severe	79	9	0.03(0.02,0.051)	0.03 (0.02, 0.04)	0.000**
Antiviral	Yes	50	3	1.47(1.12, 1.92)	1.98(1.46, 2.23)	0.000**
	No	215	27	1	1	
ICU Admission	Yes	74	9	0.24(0.18, 0.32)	0.27(0.19, 0.36)	0.00**
	No	191	21	1	1	
Oxygen therapy	Yes	218	23	0.37(0.26, 0.52)	0.48(0.34, 0.67)	0.000*
	No	47	7	1	1	

***CI* Confidence interval, *AHR* Adjusted Hazard Ratio, *CHR* Crude Hazard Ratio**

*** Statistically significant at p<0.05**

Testing proportional hazard assumption

A goodness-of-fit (GOF) test was conducted to assess the proportional hazard (PH) assumptions of the Cox model for a given predictor variable. After fitting multivariable Cox Proportional Hazard Model, adequacy of a fitted model was assessed by using cox Snell residuals. Finally, the graph of Nelson-Aalen cumulative hazard function and the cox Snell residuals variable were compared to the hazard function to the diagonal line. The hazard function follows the 45-degree line, which approximately, indicated that the model fitted the data well (**fig.10)**. Additionally, the global test of the proportional hazards assumption for this study was 0.38. The findings indicated that all variable included in the model satisfied PH assumptions (p-value>0.05**).**

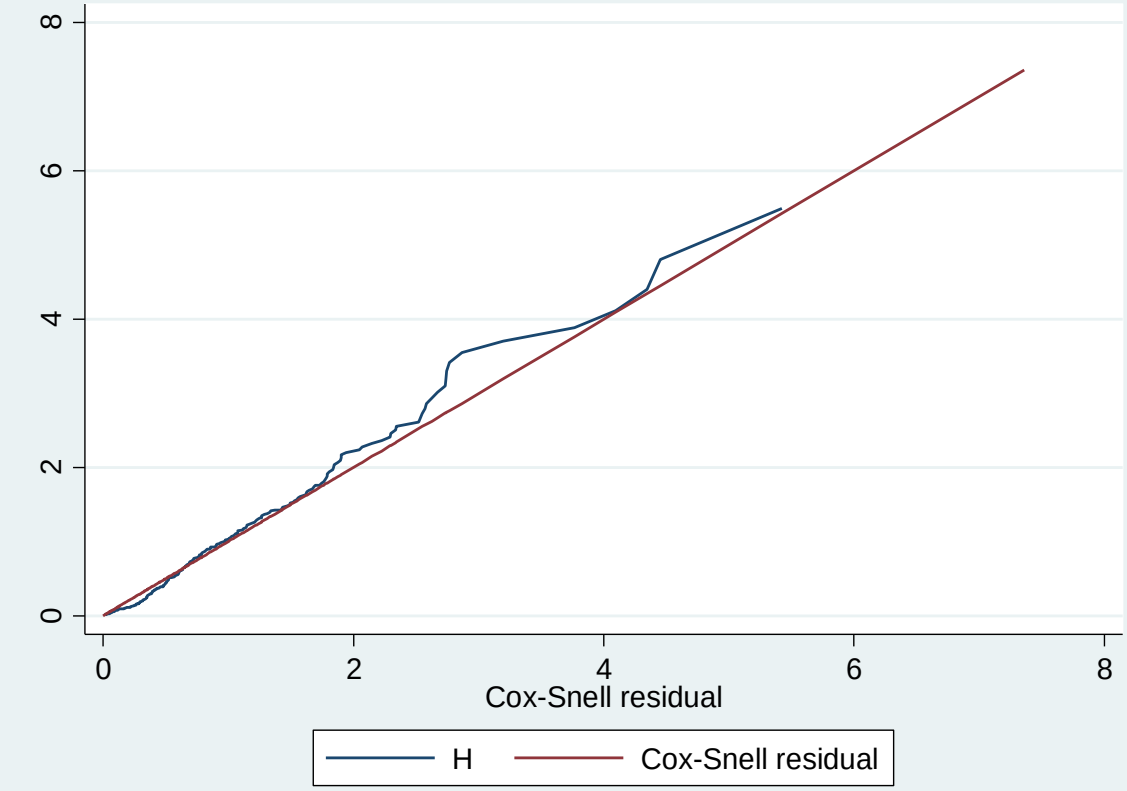

Figure 10: Cox-Snell residual test for overall adequacy of the model on COVID-19 recovery in selected COVID-19 Isolation and Treatment Center in Addis Ababa, Ethiopia,2023.

CHAPTER SIX: DISCUSSION

This study was aimed to assess time to recovery and its predictors among adults hospitalized with COVID -19 in COVID -19 Isolation and Treatment Center, Addis Ababa, Ethiopia from March 18, 2020 up to March 18, 2022. At the end of follow up, 265 of the patients were recovered and 30 were censored. This study pointed out that the median time to recovery from COVID-19 was 14 days (95%, CI:13-15). There is no predetermined goal or standard that may be utilized as a reference internationally or nationally. This is approximately similar to median time to recovery with the previous study done in Singapore(12 days)(28), Tehran(13.5 days)(9), Qingdao, Shandong(14 days)(29), Jiangsu, Anhui(11 days)(30) and in Ethiopia, Amhara regional state(11 days)(33). However, this median recovery time was lower than pervious study done in Shenzhen (21 days)(26), Wuhan (20 days)(27), Indian states (25 days)(7) and in Ethiopia, Eka Kotebe General Hospital(19 days)(21) and Wollega University Referral Hospital(18days)(32). This variation may be explained by difference in the severity of the disease, in the patient backgrounds and in the time variability between the start and end of the follow-up. For example, a study done in Shenzhen, 6% of the patients were asymptomatic which is very much smaller than the number of asymptomatic patients in this study 48.14% (26). It is likely to take longer duration for patients with severe Covid-19 to recover than asymptomatic patients. Additionally study conducted in Wuhan , China 48% of the patients were had comorbid background distribution which is higher than in this study (42.03%) which results prolong recovery time(27). Moreover, variation in recovery time can also be explained by the time variability between the follow-beginning up's and ending(49). According to a study from western Ethiopia, patients diagnosed as being negative for COVID-19 and being released from the hospital are thought to be the end point of a follow-up. As a result, waiting until the patient discharged from the hospital may result in a lengthy recovery period in the study. The overall incidence rate of recovery in this study was of 5.2 per 100 (95% CI: 4.6, 5.9) person-days observations. However, this incidence of recovery was higher than the recovery rate in Wollega University Referral Hospital (4.38 per 100 person days)(32). The difference across studies may be due to comorbidity distribution variation and socio-demographic characteristics of the patients. Additionally, settings are different in terms of availability of medical equipment and staff. In this study, one of the significant independent predictors of delayed recovery time from COVID-19 was

older age. Patients older than 60 years old had lower rate of recovery by 46% (aHR = 0.54, 95% CI; 0.35,0.84). Several studies from Qingdao China(29),Guangzhou China(10), Tehran(9), Israel(36),Wollega University Referral Hospital(32) and Amhara regional state(33) also reported that older age was lower rate recovery time. It might be due to older age causing immune system number of biological changes that make people more prone to infectious diseases. In addition, it might also be because there will be degeneration of pulmonary function among older patients, which contributes to severe COVID-19 cases and delays in recovery time. However, according to study conducted in Eka kotebe general hospital and outside of Wuhan, China reported no significant association between age group and recovery time(21, 41). This study revealed that, the rate of recovery is 34% lower when comorbidity was present than when it was absent (aHR = 0. 66, 95% CI; 0.45 ,0.97). Similarly, existing evidences are supporting the finding, for instance, the study done in Jiangs, China(30),Wuhan, China(27), Guangzhou(10), Tongji, Jin Yin-tan hospital(38), Italy(39), Eka Kotebe General Hospital(21), Wollega University referral hospital(32) and Amhara regional state(33), state that comorbid conditions attributed to the delayed duration of recovery from COVID-19.The observed correlation may be a result of aging since comorbidities are a common in the aged population. Additionally having one or more co-morbid illness results in a decreased immune defense mechanism of the body, it increases the patients' probability of developing a disease from any infectious agent which results delay in recovery. However other studies reported no significant association between comorbidity and time to recovery(10, 41).The possible reason for variation might be depending on the nature of treatment for comorbidities and/or whether patients had been compliant with treatment regimens or not. Furthermore, the current study shows that duration of recovery time from COVID-19 was significantly affected by the symptom status of the patient at presentation. Accordingly, the rate of achieving recovery among symptomatic patients was 44% (aHR= 0.56, 95% CI; 0.42,0.73) lower than patients who were asymptomatic at admission. This is in line with study conducted in Qingdao (29), Changsha(41), Wollega University referral hospital(32) and Amhara regional state(33) in which presence of clinical manifestation on admission prolong the time of recovery from COVID-19. This could be because usually COVID-19 patients who have no symptoms are in a stage of mild COVID-19 severity, which results in fast recovery from the disease. That

means, having symptoms from SARS-CoV-2 infection are associated with developing a more severe disease as compared to the asymptomatic patients which results prolong recovery time. Additionally, this study indicates that Patients who were detected ≤ 93% O_2 saturation at admission were 0.52 times less likely to recovery as compared to >93% O_2 saturation at admission (aHR= 0.52, 95%CI; 0.38,0.70). This was consistent with previous studies in Tehran arterial O2 saturation < 93% were significantly associated with prolonged recovery time(9).The most probable reason might be the majority of the patient who were detected ≤ 93% O_2 saturation at admission was in worsening or critical condition that deteriorate their immunity status contribute delay recovery time. The current study has also demonstrated that the rate of recovery was 97% lower for patients who were severe case compared with mild cases patients (aHR=0.03, 95%CI; 0.02,0.04). It is consistent with studies conducted in Guangzhou, China, and Millennium Covid-19 Care Center indicate that moderate and severe COVID-19 severity score showed a relatively delayed recovery time(10, 17). Evidences have shown that severely ill patients stay longer to recover from COVID-19(42). The possible reason for this finding could be that the lymphocyte count falls as Covid-19 clinical stages, thus, severe and critical clinical stages result in poor clinical outcome. In contrast other studies conducted in Zhuhai, China shows that there is no association between time to recovery and COVID-19 severity(40). This study revealed that patient who treated with Antiviral drug were 1.98 more likely to recovery as compared with those who did not (aHR= 1.98, 95% CI; 1.36, 2.23). Similarly, previous studies done in Jiangsu, China supports that use of antiviral were significantly associated with shorten recovery time from COVID-19(30). The observed correlation may be as a result of antiviral treatment may significantly decrease viral load, slow COVID-19 progression and improve the prognosis of patients which fasten recovery time. In contrast, according to study conducted in Zhejiang Province, China Antiviral therapy were not independent factors for time to recovery from COVID-19(35). Additionally, this study indicates that those patients who cared or admitted in ICU were 0.27 times less likely to recovery than those who did not (aHR=0.27, 95% CI; 0.19, 0.36). This finding was in line with previous studies conducted in Guangzhou, China and Zhejiang Province, China (10, 35). The observed might be due to patients admitted to ICU being at a high-level of the severity of the disease and deregulated autoimmune response that increased their time to recovery. Moreover, this study revealed

that the rate of recovery was 52% lower for patients who use oxygen supplement compared with patients who did not use (aHR=0.48, 95%CI; 0.34, 0.67).This is similar to the findings in studies done in Guangzhou, China and Zhejiang Province, China(10, 35). The most probably reason might be the majority of the patient receiving this supportive care (i.e., Oxygen therapy) was in worsening condition and had chronic illnesses that deteriorate their immunity status which results delay in recovery time.

6.1. Strength and Limitations

6.1.1. Strength

It is one of the few studies conducted in the country that contributed significantly to the body of literature by reporting a finding from the largest COVID-19 Center in Addis Abeba, Ethiopia's capital city, whose finding may be representative of hospitalized patients' characteristics and outcomes in the country. The study was included a robust sample size from the most representative care center in the country and included two years data. The study was collect the data by using random sample, which enhances the generalizability of the results. The study was included the important variables that were potential predictors for time to recovery from COVID-19 such as laboratory related (i.e., Albumin level), treatment related (i.e., antiviral, ICU care) and covid-19 severity level. The study was able to included Participants in younger adult and older adult age groups. The data was collected by experienced BSc nurses at each hospital, which decreased the chance of misinformation from patients' charts.

6.1.2. Limitations

As this study is based on a retrospective review of patient records, it may not display all factors that could influence recovery rate from COVID-19. Secondly, those patients excluded from the study, who have incomplete outcome variables and lack baseline information, could influence the regression results significantly. Finally, professionals usually use self-reports to record comorbidity on the patient's charts, and it was considered comorbidity in the collection and analyses of this study.

CHAPTER SEVEN: CONCLUSION

In general, a relatively short median recovery time was found in this study compared to local finding. The overall incidence rate of recovery was of 5.2 per 100 (95% CI: 4.6, 5.9) person-days observations. According to this study, those patients who used antiviral had a faster recovery rate. On the contrary, older age, presence of comorbidity, presence of symptom, ≤ 93% O_2 saturation, severe stage of Covid-19, ICU admission and use of oxygen therapy were independently associated with prolonged recovery time from COVID-19.

CHAPTER EIGHT: RECOMMENDATION

Based on this study finding, the following recommendations should have been forwarded with each respective body.

For Addis Ababa COVID-19 treatment center

To improve the recovery rate from COVID-19, it is better, to give priority and special attention of hospitalized patients with predictor variables such as older age, presence of comorbidity, presence of symptom, $\leq 93\%$ O_2 saturation, severe stage of Covid-19, Admitted to ICU and use of oxygen therapy.

In addition, these factors should be placed under consideration while developing a strategy for quarantining and treating COVID-19 patients

For health professionals working in the COVID-19 treatment centers: Health professionals should engage themselves in continuous medical education towards predictors of recovery time from COVID-19, so as to update themselves on optimal practices.

For Future researchers

Other researchers are also encouraged to further large-scale study identified gaps by mitigating the limitations of this report that include radiologic data and create strategies to improve completeness by use of prospective study design to further understand about predictors of recovery time from COVID-19 in Ethiopia.

It is better to conduct research concerning time to recovery from COVID-19 at national level.

REFERENCES

1. Fotouhi F, Salehi-Vaziri M, Farahmand B, Mostafavi E, Pouriayevali MH, Jalali T, et al. Prolonged viral shedding and antibody persistence in patients with COVID-19. Microbes and Infection. 2021;23(4-5):104810.
2. Abere OJ. Survival analysis of novel coronavirus (2019-nCov) using nelson aalen survival estimate. International Journal of Finance, Accounting and Corporation. 2020;1:17-24.
3. Singh R, Kang A, Luo X, Jeyanathan M, Gillgrass A, Afkhami S, et al. COVID-19: Current knowledge in clinical features, immunological responses, and vaccine development. The FASEB Journal. 2021;35(3):e21409.
4. FMOH E. National comprehensive covid19 management handbook. Ethiopian Federal Ministry of Health; 2020.
5. Udugama B, Kadhiresan P, Kozlowski HN, Malekjahani A, Osborne M, Li VY, et al. Diagnosing COVID-19: the disease and tools for detection. ACS nano. 2020;14(4):3822-35.
6. Organization WH. Laboratory testing for coronavirus disease (COVID-19) in suspected human cases: interim guidance, 19 March 2020. World Health Organization; 2020.
7. George N, Tyagi NK, Prasad JB. COVID-19 pandemic and its average recovery time in Indian states. Clinical Epidemiology and Global Health. 2021;11:100740.
8. Bhapkar H, Mahalle PN, Dey N, Santosh K. Revisited COVID-19 mortality and recovery rates: are we missing recovery time period? Journal of Medical Systems. 2020;44(12):1-5.
9. SeyedAlinaghi S, Abbasian L, Solduzian M, Ayoobi Yazdi N, Jafari F, Adibimehr A, et al. Predictors of the prolonged recovery period in COVID-19 patients: a cross-sectional study. European Journal of Medical Research. 2021;26(1):1-10.
10. Chen X, Zhu B, Hong W, Zeng J, He X, Chen J, et al. Associations of clinical characteristics and treatment regimens with the duration of viral RNA shedding in patients with COVID-19. International Journal of Infectious Diseases. 2020;98:252-60.
11. Jebril N. World Health Organization declared a pandemic public health menace: a systematic review of the coronavirus disease 2019 "COVID-19". Available at SSRN 3566298. 2020.
12. Organization WH. COVID-19 weekly epidemiological update, 13 April 2021. 2021.
13. Pei G, Zhang Z, Peng J, Liu L, Zhang C, Yu C, et al. Renal involvement and early prognosis in patients with COVID-19 pneumonia. Journal of the American Society of Nephrology. 2020;31(6):1157-65.
14. Nyenswah T, editor Africa has a COVID-19 time bomb to defuse. World Economic Forum, April; 2020.
15. Guan W, Ni Z, Hu Y, Liang W, Ou C, He J. & Zhong, NS (2020). Clinical characteristics of coronavirus disease. 2019:1708-20.
16. Ortiz-Prado E, Simbaña-Rivera K, Gomez-Barreno L, Rubio-Neira M, Guaman LP, Kyriakidis NC, et al. Clinical, molecular, and epidemiological characterization of the SARS-CoV-2 virus and the Coronavirus Disease 2019 (COVID-19), a comprehensive literature review. Diagnostic microbiology and infectious disease. 2020;98(1):115094.
17. Leulseged TW, Hassen IS, Maru EH, Zewde WC, Chamesew NW, Yegile KT, et al. Determinants of Time to Convalescence among COVID-19 Patients at Millennium COVID-19 Care Center in Ethiopia: A prospective cohort study. medRxiv. 2020.
18. Organization WH. COVID-19 weekly epidemiological update, edition 134, 16 March 2023. 2023.

19. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. Journal of autoimmunity. 2020;109:102433.
20. Zhou B, She J, Wang Y, Ma X. Duration of viral shedding of discharged patients with severe COVID-19. Clinical Infectious Diseases. 2020;71(16):2240-2.
21. Abrahim SA, Tessema M, Defar A, Hussen A, Ejeta E, Demoz G, et al. Time to recovery and its predictors among adults hospitalized with COVID-19: A prospective cohort study in Ethiopia. PloS one. 2020;15(12):e0244269.
22. Rothan H. SN Byrareddy The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun. 2020;102433.
23. Hopkins J. COVID-19 dashboard by the center for systems science and engineering (CSSE) at Johns Hopkins University (JHU). Baltimore: Johns Hopkins University. 2020.
24. Organization WH. Coronavirus disease 2019 (COVID-19): situation report, 82. 2020.
25. Khalili M, Karamouzian M, Nasiri N, Javadi S, Mirzazadeh A, Sharifi H. Epidemiological characteristics of COVID-19: a systematic review and meta-analysis. Epidemiology & Infection. 2020;148.
26. Bi Q, Wu Y, Mei S, Ye C, Zou X, Zhang Z, et al. Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: a retrospective cohort study. The Lancet infectious diseases. 2020;20(8):911-9.
27. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The lancet. 2020;395(10229):1054-62.
28. Young BE, Ong SWX, Kalimuddin S, Low JG, Tan SY, Loh J, et al. Epidemiologic features and clinical course of patients infected with SARS-CoV-2 in Singapore. Jama. 2020;323(15):1488-94.
29. Hu X, Xing Y, Jia J, Ni W, Liang J, Zhao D, et al. Factors associated with negative conversion of viral RNA in patients hospitalized with COVID-19. Science of the Total Environment. 2020;728:138812.
30. Wu J, Li W, Shi X, Chen Z, Jiang B, Liu J, et al. Early antiviral treatment contributes to alleviate the severity and improve the prognosis of patients with novel coronavirus disease (COVID-19). Journal of internal medicine. 2020;288(1):128-38.
31. Guo Y-R, Cao Q-D, Hong Z-S, Tan Y-Y, Chen S-D, Jin H-J, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak–an update on the status. Military Medical Research. 2020;7(1):1-10.
32. Tolossa T, Wakuma B, Seyoum Gebre D, Merdassa Atomssa E, Getachew M, Fetensa G, et al. Time to recovery from COVID-19 and its predictors among patients admitted to treatment center of Wollega University Referral Hospital (WURH), Western Ethiopia: Survival analysis of retrospective cohort study. PLoS One. 2021;16(6):e0252389.
33. Dessie AM, Feleke SF, Anley DT, Anteneh RM, Demissie ZA. Assessment of Factors Affecting Time to Recovery from COVID-19: A Retrospective Study in Ethiopia. Advances in Public Health. 2022;2022.
34. Bouman A, Heineman MJ, Faas MM. Sex hormones and the immune response in humans. Human reproduction update. 2005;11(4):411-23.
35. Shi D, Wu W, Wang Q, Xu K, Xie J, Wu J, et al. Clinical characteristics and factors associated with long-term viral excretion in patients with severe acute respiratory syndrome coronavirus 2 infection: a single-center 28-day study. The Journal of infectious diseases. 2020;222(6):910-8.

36. Voinsky I, Baristaite G, Gurwitz D. Effects of age and sex on recovery from COVID-19: Analysis of 5769 Israeli patients. Journal of Infection. 2020;81(2):e102-e3.
37. Murillo-Zamora E, Hernandez-Suarez CM. Survival in adult inpatients with COVID-19. Public health. 2021;190:1-3.
38. Fu Y, Han P, Zhu R, Bai T, Yi J, Zhao X, et al. Risk factors for viral RNA shedding in COVID-19 patients. European Respiratory Journal. 2020;56(1).
39. Ciceri F, Castagna A, Rovere-Querini P, De Cobelli F, Ruggeri A, Galli L, et al. Early predictors of clinical outcomes of COVID-19 outbreak in Milan, Italy. Clinical immunology. 2020;217:108509.
40. Zheng X, Chen J, Deng L, Fang Z, Chen G, Ye D, et al. Risk factors for the COVID-19 severity and its correlation with viral shedding: a retrospective cohort study. Journal of medical virology. 2021;93(2):952-61.
41. Qi L, Yang Y, Jiang D, Tu C, Wan L, Chen X, et al. Factors associated with the duration of viral shedding in adults with COVID-19 outside of Wuhan, China: a retrospective cohort study. International journal of infectious diseases. 2020;96:531-7.
42. Xu J, Yang X, Yang L, Zou X, Wang Y, Wu Y, et al. Clinical course and predictors of 60-day mortality in 239 critically ill patients with COVID-19: a multicenter retrospective study from Wuhan, China. Critical Care. 2020;24(1):1-11.
43. Mozaffari E, Chandak A, Zhang Z, Liang S, Thrun M, Gottlieb RL, et al. Remdesivir Treatment in Hospitalized Patients with Coronavirus Disease 2019 (COVID-19): A Comparative Analysis of In-hospital All-cause Mortality in a Large Multicenter Observational Cohort. Clinical Infectious Diseases. 2022;75(1):e450-e8.
44. Mehta RM, Bansal S, Bysani S, Kalpakam H. A shorter symptom onset to remdesivir treatment (SORT) interval is associated with a lower mortality in moderate-to-severe COVID-19: a real-world analysis. International Journal of Infectious Diseases. 2021;106:71-7.
45. Csa I. Central statistical agency (CSA)[Ethiopia] and ICF. Ethiopia demographic and health survey, Addis Ababa, Ethiopia and Calverton, Maryland, USA. 2016;1.
46. Marchenko Y. Power analysis and sample-size determination in survival models with the new stpower command. Boston Univ. 2007.
47. Peng Y, Zhu Q, Wang B, Ren J. A cross-sectional study on interference control: age affects reactive control but not proactive control. PeerJ. 2020;8:e8365.
48. Organization WH. Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected: interim guidance, 13 March 2020. World Health Organization; 2020.
49. Benoni R, Campagna I, Panunzi S, Varalta M, Salandini G, De Mattia G, et al. Estimating COVID-19 recovery time in a cohort of Italian healthcare workers who underwent surveillance swab testing. Public Health. 2021;196:52-8.

APPENDIX

Annex I: Information sheet

Title of the project: Time to recovery and predictors among adults hospitalized with COVID-19 in COVID -19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023: institutional based retrospective cohort study

Name of principal Investigator: Worku Balcha (BSC)

Advisor: Tefera Mulugeta (asst. professor) and Mekonen Adimasu (MSc in pediatrics)

Name of the Organization: Addis Ababa University, College of Health science, Department of nursing

Purpose of the Research thesis: To assess time to recovery and predictors among adults hospitalized with COVID-19 in COVID-19 Isolation and Treatment Center, Addis Ababa, Ethiopia, 2023.

Procedure and participation: In order to achieve the above objective, information, which is necessary for the study, will be taken from registration book, and patient card. In order to get with the above-mentioned findings, total document of clients enrolled during March 18, 2020 -March 18 2022 will be selected and review of the required information from the records will be made by using the checklist.

Confidentiality: To ensure confidentiality the data on the chart will be collected without the name of the patients. In addition, it will not be revealed to anyone except the investigator and it will be kept in key and locked system with computer password.

Benefits: there is a benefit for clients in the program of getting appropriate care and treatment services for the COVID-19 client. Of all, the research work has a paramount direct benefit for health care planners and managers.

Risk: Since the study will be conducted by taking appropriate information from registration book, and card number it will not inflict any harm on the patients.

Person to contact: this research project will be reviewed and approved by the institutional ethics research committee of Addis Ababa University, college of health sciences, and department of nursing.

If you have question or concerns or for information you can call! Please speak to principal investigator, Worku Balcha, Workubalcha9494@gmail.com Tel: 0941941441

Annex II: Consent Form

In signing this document, I as a department head, am giving my consent for patient records to participate in the study. I have been informed that the objective of this study is to assess time to recovery and predictors among adults hospitalized with COVID-19 in COVID-19 Isolation and Treatment Center, Addis Ababa, Ethiopia. I have understood that participation in this study is entirely confidential. I have been told that my answers to the questions will not be given to anyone else and no reports of this study ever identify me in any way. I understood that participation in this study does not involve risks except the time spent on completing the questionnaire. I understood that Worku Balcha is the contact person if I have questions about the study or my rights as a study participant.

The following is his contact address. Address of principal investigator: Worku Balcha, Workubalcha9494@gmail.com Tel: 0941941441

Dep't Head signature: _____date: _____

Thank You for your willingness to participate!!!

Annex III: Data extraction form

Data extraction form for time to recovery and its predictors among adults hospitalized with COVID -19 in selected COVID-19 isolation and treatment center, Addis Ababa, Ethiopia, 2023: institutional based retrospective cohort study

S.NO	Questions/Variable	Response	Skip pattern
	I. Sociodemographic variable		
001	Age (Years)	----------	
002	Sex	1.Male 2.female	
003	marital status	1. Single 2. Married 3. Separated 4. Divorced 5. Widowed	
004	Residence	1. Urban 2. Rural	
005	Occupation	1. Government employee 2. Private employee 3. Farmer 4. Merchant 5. Daily laborer 6. Driver 7. House wife 8. Students 9. Other	
006	Does the patient have contact history with confirmed case?	0.no 1.yes 2. unknown	
	II. Comorbid related variable		

007	Does the patient have any existing co-morbidity	0 .no 1.yes	**If no skip Q 008-014**
008	HIV	0.no 1. yes	
009	Diabetes mellitus	0.no 1. yes	
010	Hypertension	0.no 1. yes	
011	Coronary Heart disease	0.no 1.yes	
012	Chronic obstructive pulmonary disease	0.no 1.yes	
013	Chronic kidney disease	0 .no 1.yes	
014	Cancer	0.no 1.Yes	
	III. Sign and symptom related factors		
015	Does the patient have any symptom of COVID-19 at admission?	0.no 1.yes	**If no skip Q 016-028**
016	If yes date of symptom onset	DD/MM/YYYY_____	
017	Fever before admission	0. no 1.yes	
018	Cough	0.no	

		1.yes	
019	Shortness of breathing	0.no 1.yes	
020	Headache	0.no 1.yes	
021	Anorexia	0. no 1.yes	
022	Chest tightness	0.no 1.yes	
023	Sore throat	0.no 1.yes	
024	Loss of taste	0.no 1.yes	
025	Loss of smell	0.no 1.yes	
026	Joint pain	0.no 1.yes	
027	Easy fatigue	0.no 1.yes	
028	diarrhea	0.no 1.yes	
029	Maximum temperature on admission (°C)	_____	
030	O2 saturation % at admission	_____	

031	Respiratory rate (breaths/min) at admission	_____	
032	Pulse rate (beats/min) at admission	_____	
033	white blood cell count	_____	
034	Albumin (g/l)	_____	
035	COVID-19 severity score	**1. Mild** **2. Moderate** **3. severe**	
IV.	**Treatment related variable**		
036	Antiviral (ritonavir, lopinavir and remdesivir)	0.no 1.yes	
037	**If** remdesivir **yes**, time to start remdesivir after diagnosis	---------(in days)	
038	Antibiotic	0. No 1. yes	
039	Corticosteroid	0. no 1. yes	
040	ICU Admission	0. no 1. yes	
041	Mechanical ventilation	0.no 1. yes	
042	Oxygen therapy	0.no 1. yes	

	COVID-19 Event		
043	Date of first diagnosis positive by RT- PCR DD/MM/YYYY	---------/-------/----	
044	Treatment outcome (final Status)	0. Censored 1. Recovered	
045	If censored, types	1.death 2.drop out 3.transferred	
046	Date of negative result by RT- PCR DD/MM/YYYY	---/------/----	