FACTORS INFLUENCING LENGTH OF STAY IN INTENSIVE CARE UNIT AT A SELECTED REFERRAL HOSPITAL IN RWANDA.

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Masters of Science in Nursing (Critical Care and Trauma track)

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RESEARCH PROJECT

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DECLARATION

I, NYISHIMIRENTE Sylvie declare that this research report entitled "Factors influencing length of stay in intensive care unit at a selected referral hospital in Rwanda" is my own work. It is being submitted for Master's Degree in Critical Care and Trauma Nursing at the University of Rwanda- College of Medicine and Health Sciences-School of Nursing and Midwifery. It has not been submitted before for any degree or examination at this university or other institution. In addition, a complete list of references is provided indicating all the sources of information quoted or cited.

Sylvie NYISHIMIRENTE

Date: 02nd, Septembre 2019

Signature

DEDICATION

To Almighty God for his protection, to my husband HABUMUGISHA Emmanuel, my beloved daughter and parents for their main support.

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God is above all; first I am thankful to Almighty God for blessing each day of my life more especially during my studies.

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Thanks to my family and friends.

ABSTRACT

Introduction: Length of stay (LOS) in the intensive care unit (ICU) is one of the most important factors that influence patient outcome and vary depending on severity of illness, the use of invasive medical devices, nutritional status and comorbidities. ICU length of stay is one impact of patient complications and high cost of health care on both family and hospital.

Objective: The study aimed to assess factors that influence patient length of stay in intensive care unit at the University Teaching Hospital of Kigali.

Method: Non-experimental retrospective descriptive design and quantitative approach were used. The study was conducted at the University Teaching Hospital of Kigali in intensive care unit on 176 out of 315 files of patients admitted in ICU from January to December 2018 were selected using systematic sampling method. A self-developed structured checklist on **"**factors influencing length of stay in intensive care unit" was used for data collection.

Results: Among 176 reviewed patients 'files, the average of length of stay was 24 days with the mean of length of stay 10.02 with standard deviation 13.068. The majority of patients did not have prolonged stay 159(90.9%) and only 16(9.1%) had prolonged stay. Post cesarean peritonitis and AKI , tracheoesophagial fistula and lung contusion, UTI post severe malaria, diffused axonal injury blunt chest trauma and blunt abdominal injury were associated with prolonged stay $P<0.05$ and a Multinomial logistic regression shows that intubation with mechanical ventilation, reintubation and unplanned extubation are more likely to cause prolonged stay ODDs ratio>1.

Conclusion: Patients who stayed over 24 days in ICU had prolonged stay. Physicians and nurses should carefully take care of ICU patients to avoid prolonged stay.

Key words: Factors, Intensive care unit, length of stay.

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LIST OF ABBREVIATIONS AND ACRONYMS

AM: Ante Meridiem (Before Noon)

AKI: Acute Kidney Injury

C/S: Cesarean section

CI: Confidence Interval

HDU: High dependent unity

CHUK : Centre Hospitalière Universitaire de Kigali

CMHS: College of Medicine and Health Science

COPD: Chronic Obstructive Pulmonary Disease

CUAG: Council of Australian Governments

HAIs: Hospital Associated Infections

ICU: Intensive Care Unit

LOS: Length of Stay

PM: Post Meridiem (After Noon)

R-HMIS: Rwanda Health Management Information System

SPSS: Statistical Package of Social Sciences

UR: University of Rwanda

OR: ODDs Ratio

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CHAPTER 1: INTRODUCTION

1.1. Introduction

This chapter describes the background of the study, also explains the problem of the study, objectives, and research questions, significance of the study and shows subdivision of the study.

1.2. Background

Intensive care unit (ICU) is a specialized unit in the hospital that requires various specialized medical and nursing care to enhance rapid recovery. Length of stay (LOS) in the intensive care unit (ICU) is one of the most significant factors that influence patient outcome (Almashrafi *et al.*, 2016). Length of stay is a number of days that a patient spends in hospitalization (Yaghoubi *et al.*, 2011).

Acute patient length of stay is a well-accepted indicator of hospital efficiency and a driver of hospital cost that affects the capacity of the health care system. The Council of Australian Governments (CUAG) used length of stay as one of the indicators in its 2011 performance and accountability framework (Zimmerman *et al.*, 2011).

In a study conducted by Williams et al., (2010) to assess the independent effect of ICU LOS in hospital and long-term mortality after hospitalization in Australia, showed that among 19921 hospital survivors, 94% of patients stayed in ICU for ≤10 days and 6% of patients stayed >10 days. There was an over representation of trauma and sepsis ($p<0.001$) in patients who stayed in ICU for >10 days.

A study conducted by Kasturi et al. (2015) to find out the length of stay in different intensive care unities (ICU) and high dependency units (HDU) of a large multispecialty hospital in Pune (India) revealed that the overall mean length of stay in four ICUs was 3.37± 5.54 days.

As revealed in a systematic review on factors influencing length of stay in intensive care unit in the United States, factors contributing to the length of stay were ranged in four categories that are institutional, medical, social and psychological factors (Almashrafi *et al.*, 2016) .

A study conducted in Indonesia revealed that four factors from medical records related to ICU length of stay are age, the use of invasive medical devices, nutritional status and comorbidities (Kisat et al, 2016).

According to Khosravizadeh *et al.,* (2016) the mean length of stay in teaching hospitals of a middle-income country, the mean of hospital LOS was 5.45 ± 6.14 days and age, employment, marital status, history of previous admission, patient condition at discharge, method of payment and types of treatment had an impact on LOS ($p<0.05$).

Furthermore the study conducted by Johnson *et al.*, (2017) found that the mean days of physical therapy treatment and mechanical ventilation influence hospital length of stay as revealed in retrospective chart review which examined variables that influence physical therapy evaluation and treatment in the intensive care unit.

Poor nutrition has been related to prolonged stay with a p=0,013 in the study conducted in Ethiopia to assess the factors affecting prolonged intensive care unit stay in Nigist Eleni Mohammed Memorial Hospital from January 2015 to January 2016. The mean length of stay in the intensive care unit was 5.49 ± 4.36. and male sex, presence of comorbidity and unexpected extubation were significantly found to influence length of stay in intensive care unit at p-value less than 0.05 (Suleiman and Worji, 2017).

Further factors that influence the ICU length of stay were highlighted in a study conducted among the surviving trauma patients. The majority were renal failure (8.1 days), sepsis (7.8 days), respiratory failure (4.9 days), the massive blood transfusion (3.3 days), the invasive ventilation (3.1 days), and an initial Glasgow Coma Scale score of ≤8 (3.0 days) with significant impact on ICU LOS in this study (Böhmer *et al.*, 2014).

1.3. Problem statement

ICU length of stay is associated with high cost and ICU resources are expensive and scarce (Skupski *et al.*, 2018). The cost of ICU limits access of patients to ICU especially in a resource constraint country like Rwanda.

ICU length of stay is one impact of patient complications with high cost of health care on both family and hospital. Thus it is important to identify factors which affect the ICU length of stay and predictors of prolonged ICU stay that can be a way to predict hospital bed preparedness, family cost and efficiency of ICU care (Beatriz *et al.*, 2010).

Therefore, ICU beds must be utilized by as many patients as possible rather than one patient over a long period. Different literature predict the average of ICU length stay in some settings, but it is not clear how many days are average length of stay in Rwanda.

According to Rwanda health information system (2014), the average duration of hospital stay generally is 7.12 in referral hospitals, however there are no studies done about ICU stay and factors contributing to ICU length of stay. This study determined the average ICU stay, main diagnosis associated with prolonged ICU stay and assessed factors associated with the main diagnosis of the client to cause prolonged stay in ICU. This would be helpful in predicting patient ICU stay from his/her admission and bed utilization that will help in unit organization in developing strategies to limit prolonged ICU stay and optimize utilization of ICU resources.

1.4. Main objective

The study aimed to assess factors influencing patient length stay in intensive care unit at university teaching hospital of Kigali.

1.5. Specific objectives

1**.** To determine the average of length of stay in days in ICU at the University Teaching Hospital of Kigali.

2. To identify factors associated to the main diagnosis of the client causing prolonged length of stay in ICU at University Teaching Hospital of Kigali.

1.6 Research questions

1. What is the average length of stay in days in ICU at the University Teaching Hospital of Kigali?

2. What are factors associated to the main diagnosis of the client causing prolonged length of stay in ICU at the University Teaching Hospital of Kigali?

1.7. Significance of the study

The study hopped to benefit the following areas:

Clinical area

The results from this study will help in awareness of factors that influence ICU patient length of stay that will enable the health workers and hospital management to develop interventions that will reduce length of ICU stay in order to optimize care for ICU patients and utilization of resources including promotion of efficiency through preparedness for predicted length of stay.

Educational area

The findings of the study will help nurse educators to find where to emphasize in critical patient management in the curriculum to limit the average length of stay.

Research area

The findings of the study will add to the bank of knowledge and baseline for further research and replication of the study to accommodate a larger sample for generalization.

1.8. Definitions of Key terms

Intensive care unit (ICU): Specialized inpatient unit that provides care for the critically ill patients (Shuka et al, 2015). In this study intensive care unit is specialized inpatient unit that provide care for the critically ill adult patients in a referral hospital.

Factor: is one of the things that affects an event, decision or a situation (Collins dictionary.com). In this study factors associated to the main medical diagnosis causing ICU length of stay were determined.

The length of stay: it refers to the number of calendar days from the day of patient admission to the day of discharge (Jones and Bartlet, 2014). In this study length of stay was determined by subtracting the date of admission in ICU from the date of discharge. Prolonged or short stay were determined after getting average length of ICU stay.

1.9. Organization of the research report

Chapter one illustrates the information about background, problem statement, the purpose and specific objectives of the study, research questions and significance of the study.

Chapter two is related to literature review which clarifies in depth information and findings from relevant previous studies and describes generalities on actual problem from literature. It closes with conceptual framework which provides a full justification of the relationship between study variables based on theoretical framework and hypothesized ideals for this study.

Chapter three deals with Methodology which demonstrates the complete clarification on the study area, population, methods and techniques applied in sampling, data collection and data analysis including ethical considerations to be respected during the study.

Chapter four illustrates the study result where by study findings are described.

Chapter five is related to discussion, conclusion and recommendations which give clarification on study findings in relation to other previous study findings.

1.10. Conclusion

This chapter mentioned the background and problem statement of the study. It highlights also the objectives formulated along with the research questions to be addressed by the study. Significance of the study was also clearly specified, and it is closed with definition of the key terms.

CHAPTER TWO: LITERATURE REVIEW

2.1. INTRODUCTION

Literature review is the frame of the study where the investigator present what has been published on the topic by licensed scholars and investigators to convey to the readers what knowledge and ideas have been established on a topic, and what their strengths and weaknesses are (Proctor and Taylor, 2005). The literature of this study is going to rely on both quantitative and qualitative published literature on the concept of ICU length of stay and associated factors written in English language and is composed of theoretical and empirical literature withidentified gaps in the literature concluding by the presentation of the conceptual framework of the study.

2.2. THEORETICAL LITERATURE

The intensive care unit (ICU) is especially devoted to patients who can recover from severe and/or high risk illnesses and necessitate nonstop medical care, multi-professional health care team, and other specialized human resources, in addition to distinct devices (Bakımda et al., 2011).

The length of stay denotes the number of days since the day of patient admission to the day of discharge (Jones and Bartlet, 2014). There is no consensus definition of patient long stay. Numerous definitions of ICU "long stay" have been proposed, but none is universally accepted. It may vary both internationally and between different units in the same country. According to some reviewed publications by Crozier *et al.*, (2007), various definitions, for example,14, 21, 30, and 60 days were found while acknowledging that no consensus definition exists.

According to Chan *et al,* (2014) in the study to define extended intensive care unit stay for spontaneous intracerebral hemorrhage patients, extended ICU stay was defined as being equal to or longer than 10 days. In a study to define long stay in Australian and New Zealand ICUs and to find the common aggregate of length of stay, the mean of 3.86 days observed ICU stay and mean predicted stay of 3.78 days (Zimmerman *et al.,* 2006).

Length of stay in the intensive care unit is exacerbated by numerous factors that are grouped as medical, social, psychological and institutional factors (Almashrafi *et al.*, 2016).

In the study to identify and categorize the factors associated with prolonged stay, diseases or medical factors such as patients with cardiovascular system diseases, multiple organ diseases, nervous system diseases, and cerebrovascular diseases have been associated with prolonged patient stay in ICU (Almashrafi *et al.*, 2016). On the other hand, Sugiarto and Darmawan (2014), in a study to identify the factors associated with the length of stay (more than 3×24 h) in the intensive care unit, and the prevalence rates of health associated infections (HAIs) from January 2011 to December 2012, have shown four factors from medical records related to length of stay, namely, age, the use of invasive medical devices, nutritional status and comorbidities.

Poor nutritional status, male sex, presence of co-morbidity and unintended extubation were significantly related with length of stay in intensive care unit. Unconscious patients were found to be two times more likely to have prolonged length of stay in intensive care unit than conscious patients (OR 1.724; 95% CI : 809 to 3.676) (Obsa *et al.*, 2017).

The study conducted by Deer and Volpi, (2018, p 1) revealed that inadequate intake of protein to satisfy daily requirements leads to negative protein balance and result in skeletal muscle atrophy, impaired muscle growth and functional decline. This means that it is necessary to provide proper amount of proteins to prevent muscle wasting and maintain skeletal muscle mass and function to reduce the length of stay as a result of these complications.

In a study aimed to assess characteristic outcomes and cost of ICU patients with a prolonged stay (≥21 days) at Gati University, Ankara, Turkey, on a total of 72 patients, intubation, reintubation, catheter insertion, catheter complications, mechanical ventilation, vasopressor support, additional investigations and procedures, changing antibiotics frequently and using expensive antibiotics had a significant association with prolonged ICU stay and cost (Bakımda et al., 2011).

Further factors influencing length of stay in the intensive care unit were analyzed on 30,157 cases in a retrospective study conducted for surviving trauma patients, revealed that factors that influenced the prolongation of ICU LOS mostly were renal failure (± 8.1 days), sepsis (± 7.8 days) and respiratory failure (± 4.9 days). Furthermore massive transfusion (±3.3 days), invasive ventilation (±3.1 days) and an initial Glasgow coma scale ≤8 (±3.0 days) had a significant impact on length of stay (Böhmer et al., 2014).

Alternatively, increased age, atrial fibrillation, arrhythmia, chronic obstructive pulmonary disease (COPD), low ejection fraction, renal failure, dysfunction and non-elective surgery status have been reviewed in a systematic review of twenty-nine papers on factors influencing length stay in ICU after adult cardiac surgery to be factors associated with ICU LOS (Almashrafi, Elmontsri and Aylin, 2016).

In addition, Geographic location, resources, organizational structures and leadership have been identified as factors that may have an effect on patient care and length of stay in ICU in the United States in a review of articles published on factors influencing length of stay in intensive care unit (Gruenberg et al., 2006).

1.3. EMPIRICAL LITERATURE

2.3.1 AVERAGE LENGTH OF STAY IN ICU

Prolonged ICU stay was found to worsen long-term outcome post-hospital discharge. A retrospective, cohort study conducted to determine in hospital and post discharge long term survival in patients with extended intensive care unit (ICU) stay after cardiac surgery found that among 4,963 patients, 3.3%, 1.6%, and 2.9% of patients stayed 1 to 2 weeks, 2 to 4 weeks, and > 4 weeks in the ICU, respectively. Patients with > 4 week ICU stays had significantly lower post discharge survival rates, 41.1% at 6 months (Yu et al, 2016). A study conducted by Khattab *et al.* (2017) on predictors and outcomes of prolonged stay in the respiratory ICU where the mean ICU stay of ASUSH patients was 24.17 days and that of Demerdash patients was 22.8 days.

In a study conducted by Williams et al., (2010), among 19,921 hospital survivors, 94% of patients stayed in ICU for ≤10 days and 6% of patients stayed >10 days.

Mortality and length of stay (LOS) are two frequently reported outcomes in intensive care units (ICUs) as has been evidenced in a study done by Strand et al. (2010), on variations in the length of stay of intensive care units. Non-survivors in three Scandinavian countries revealed overall ICU mortality of 9.1%, median LOS of the non-survivors with 1.3 day in Finland and Sweden and 1.9 days in Norway.

In the survey done by Rm *et al.,* (2018) revealed that intensive care unit length of stay was

measured and found as a median of 8 days for different medical diagnosis but for the patients who were under mechanical ventilation, it was observed with a mean of 2.49 days.

The study done by Rozenbaum *et al.*, (2015, p 3) has shown that the mean length of stay was 15.2 days for patients who were treated in ICU and patients spent 44% of their hospitalized time in ICU.

4.3.2. FACTORS ASSOCIATED TO MAIN DIAGNOSIS INFLUENCING LENGTH OF STAY IN ICU

The three diagnoses most likely to lead to a long ICU stay; (>21 days was later selected as the cut-off point), neuromuscular disease (odds ratio [OR], 13.3; 95% CI, 10.2–17.4; P< 0.001), burns (OR, 6.0; 95% CI, 4.9–7.3; P < .001) and cervical spine injury (OR, 5.1; 95% CI, 3.4–7.5; P< 0.001), were strongly associated with long ICU stay. Long-stay patients had a significantly higher predicted risk of death in the study on demographics and outcomes of Long-stay patients in Australian and New Zealand intensive care units (Crozier et al., 2007). Thus, development of intermediate care units, palliative care and home care services were suggested modalities to decrease the LOS in ICUs (Kose et al., 2016). In a study conducted by Almashrafi et al., (2016) factors most commonly associated with increased ICU Length of stay found to be old age, cardiac arrhythmia like atrial fibrillation, chronic obstructive pulmonary disease (COPD), low ejection fraction, renal failure and non-elective surgery status.

Further study to determine mortality associated with varying ICU Length of stay among trauma patients and to assess for independent predictors of mortality revealed that critically injured adult trauma patients who do not die within the first few days demonstrate an enhanced ability to survive, with an overall survival of > 92% and maintained at >85% among extreme ICU Length of stay >40 days. This data advocates the utility of aggressive critical-care support for trauma patients, irrespective of duration of ICU stay (Kisat et al, 2016).

2.4. CRITICAL REVIEW AND RESEARCH IDENTIFICATION

In the reviewed literature, there was no common days known to be considered as prolonged stay in ICU. However, each hospital should calculate its ICU stay basing on its daily activities.

Several hospitals have determined the average of ICU stay but there are no reviewed literature showing the average of ICU stay for any hospital in Rwanda.

Many reviewed literature were retrospective that can hinder some factors as documentation is limited in some hospitals therefore, there is a need to conduct a cohort study for in-depth identification of medical factors.

2.5. CONCEPTUAL FRAMEWORK

According to Wondimu (2008) a conceptual framework is a model that determines what questions need to be answered by the person conducting the research, as well as how empirical procedures are to be used as an instrument when answering these questions. Conceptual framework to guide this study was developed based on reviewed literature by researcher. The figure illustrates the independent variables influencing LOS, such as main diagnosis, associated health problems, for examples: substance abuse, co morbidities, complications, nutrition status and accessibility to medication. It further describes independent variables such as medical intervention and invasive procedures, for examples: intubation and reintubation, unplanned extubation**,** central catheters**,** mechanical ventilation as influencing ICU LOS. Also, the figure illustrates dependent variable to determine ICU short or long stay by considering admission time and discharge time. As illustrated in Figure 2.1 below**.**

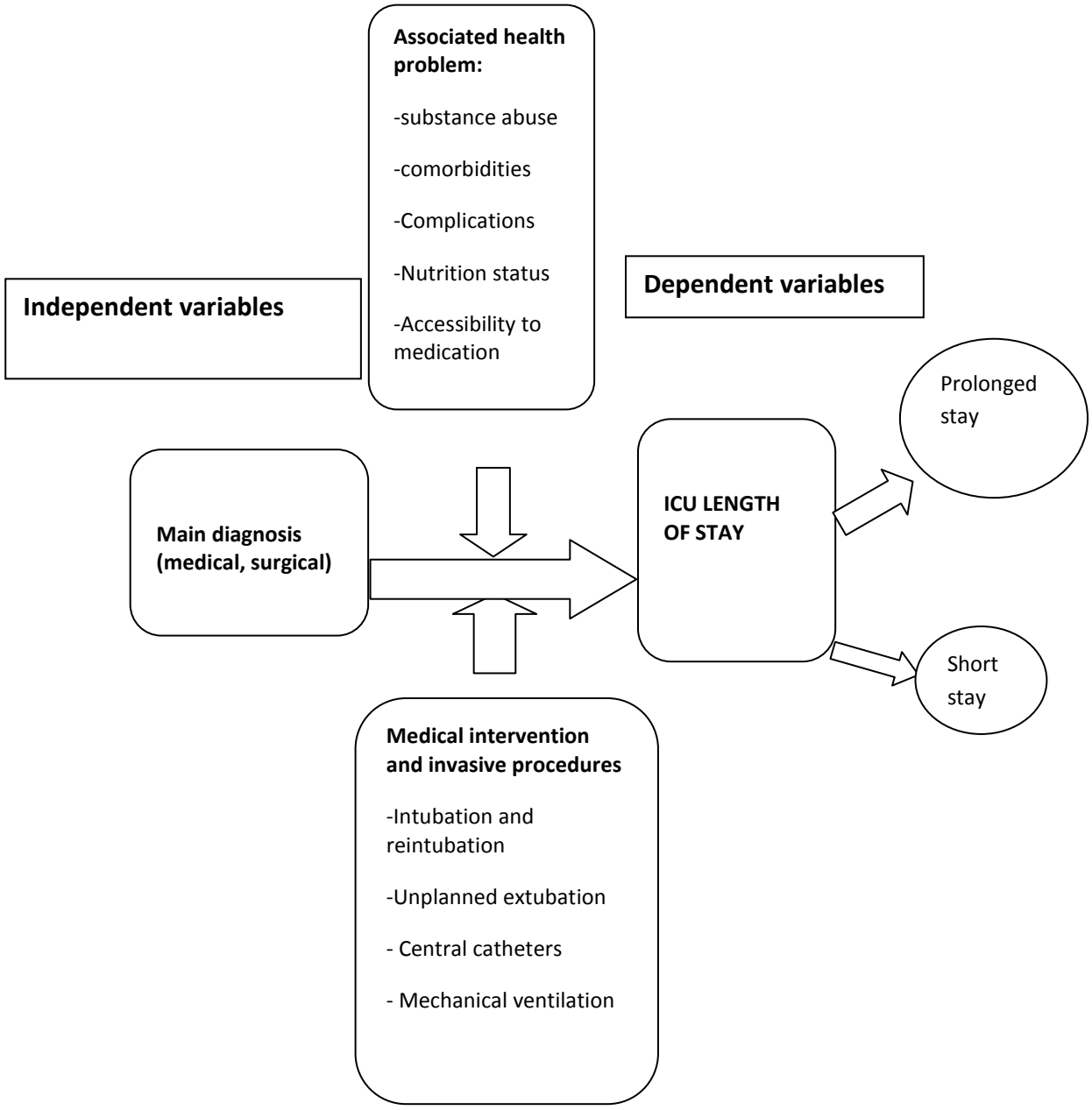

Figure 2 1. A developed conceptual framework on factors influencing length of stay in ICU.

2.5. CONCLUSION

The reviewed literature in this study shows that ICU length of stay varies according to the setting and ICU equipment. Prolonged stay was associated with high mortality and disabilities. In addition, different medical factors such as patient condition on admission, hospitalization days before admission in ICU, reason for ICU admission, nutritional status, co-morbidity, and medical devices are factors influencing ICU length of stay. It is crucial to know the average length of stay for each disease and associated factors to develop, improve and maintain strategies to reduce complications related to prolonged ICU stay and to predict ICU resources utilization.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. INTRODUCTION

Research methods are all those methods, techniques that are used in this research project. It refers to the behavior and instruments used in selecting and constructing research technique (Kathari, 2004).

It includes a research design, research approach, study setting, population, sampling method, data collection tool and its validity and reliability, data analysis, ethical considerations, data management, dissemination and limitations used to respond to the specific objectives and research questions of the study.

3.2. RESEARCH DESIGN

Research design is a plan according to which the research must be carried out and focuses on the kind of study being planned and what kind of results are aimed at (Almec, 2015). In this study a non-experimental retrospective descriptive design was used.

3.3. RESEARCH APPROACH

Approach means plans and the procedure for research that encompass the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation (Grover, 2015)

Quantitative research approach was used in this study. Quantitative approach involves the generation of data in quantitative form which can be further sub-classified into inferential, experimental, and simulation approach to reach the results of the study (Katari, 2004, p.22).

3.4. RESEARCH SETTING

The study was conducted at University Teaching Hospital of Kigali (UTHK), located in center of Kigali, Nyarugenge District in Rwanda. UTHK is the second among public referral hospitals in Kigali. Currently it has 12 of the following clinical services: Anesthesia and Critical care, Physiotherapy, orthopedic, dermatology, ENT, Stomatology, ophthalmology, pediatrics, accident and emergency, gynecology and obstetrics, surgery and internal medicine. ICU is located behind

imaging department and emergency. It serves people from the entire country especially those fro Northern province,Nyarugenge district and Gasabo district. It has seven beds for critically ill patients on respiratory and cardiac support and four beds for high dependency unit where improving patients are cared before being discharged from ICU to other departments.

3.5. STUDY POPULATION

Population is the group of people or subjects that the researcher wants to make a conclusion about once the research study is completed (Korb, 2012). The study subjects included patients' files in intensive care unit (ICU). Intensive care unit at CHUK admitted 315 patients in 2018 according to the register of admission in ICU for 2017-2019.

3.5.1. STUDY SAMPLE

The sample for this study was drawn from the files of admitted patients in ICU from January to December 2018.

3.5.2. SAMPLE SIZE

Sample size for this study was obtained using formula given by Taro Yamane 1967 as follows:

$$n = \frac{N}{1 + N*(0.05)^2}$$

N=315

$n=315/1+315*(0.05)^2$

n=315/1.7875

n=176 files

3.5.3. SAMPLING STRATEGY

Systematic sampling method was used to obtain a sample of 176 patients' files for which every 2^{nd} file was selected from a list of annual admission patient register. As long as the list does not

contain any hidden order, this sampling method is as good as the random sampling method. Its only advantage over the random sampling technique is simplicity. The n^{th} number is determined by dividing the number of people in the population by the number of people you want in your sample (StatPacInc, 2014).

$$n = \frac{N}{n}$$

n=315/176

n=1.789

n≈2

To select patients' files, the investigator listed admitted patients in ascending order following daily admission number. Thereafter, took the 1^{st} file randomly and other patients' files were selected by taking every 2^{nd} file to get a sample size of 176 patient files.

3.6. DATA COLLECTION

Data collection is the process of assembling and computing information on variables of interest, in a well-known systematic manner that allows one to respond to research questions, test hypotheses, and evaluate outcomes (Burns and Grove, 2005).

3.6.1. DATA COLLECTION INSTRUMENTS

Data collection for this study was done through a structured checklist titled **"**factors influencing length of stay in adult ICU checklist" that was developed by the researcher based on reviewed literature. The checklist is divided into 3 parts:

Part 1: Demographic data such as age, gender, insurance, type of health insurance, occupation.

Part2: Medical factors: GCS on admission, any cardiopulmonary arrest during hospitalization, intubation with mechanical ventilation, reintubation, unplanned extubation, central Intravenous infusion, co-morbidities, and complications, nutrition status: Good, malnutrition: underweight, overweight, obesity.

Part 3: Patient discharge: date of admission to ICU, date of discharge from ICU, Length of stay in days, medical diagnosis on discharge.

3.6.2. VALIDITY AND RELIABILITY OF THE TOOL

The tool of this study was developed by a researcher based on literature. To assess validity and reliability of the checklist face validity and inter-rater reliability methods were used in pilot study that has been conducted in CHUK.

3.6.1.1. FACE VALIDITY

According to Khandoker (2016) face validity is a subjective judgment of whether a measure of certain constructs "appears" to measure what it intends to measure. This is usually done by showing the measurements to experts (could be fellow researchers or teachers) and get their feedback on whether these measures are relevant in measuring what the researcher intends to measure. For this study the tool was shown to supervisors to see if it measures what it is supposed to measure.

3.6.1.2. INTER-RATER RELIABILITY

According to William, (2006) inter-rater reliability is used to assess the degree to which different raters give consistent estimates of the same phenomenon and if the measurement consists of categories the raters are checked off, which class each observation falls in, then calculate the percent of agreement among the raters.

For this Inter-Rater Reliability the investigators selected patients' files and gave them to Rater One to both check and rate it against the tool being tested. Then after, the same files were given to the Second Rater to do the same. Thereafter, using SPSS, Cohen's (κ) kappa was calculated for agreement and found at 0.84. According to Anthony (2005), Kappa Agreement <0 indicates less chance of agreement, 0.01–0.20 Slight agreement, 0.21– 0.40 Fair agreement, 0.41–0.60 Moderate agreement, 0.61–0.80 Substantial agreement**,** 0.81–0.99 Almost perfect agreement. Therefore the tool showed perfect agreement.

3.6.1.3 CONTENT VALIDITY

Validity can help to ensure construct validity and give confidence to the readers and researchers about instruments.

Content validity refers to the degree to which the instrument covers the content that it is supposed to measure. For content validity two judgments are necessary: the measurable extent of each item for defining the traits and the set of items that represents all aspects of the traits (Yaghmal, 2003.p1).

For this study the tool was given to two experts one from clinical area and second from academic area for verification if it covers all objectives and the framework of the study as summarized in the content validity Table 3.1.

Table 3. 1. Summarized study content validity

Research objectives	Variables in conceptual framework	Variables on the checklist
Objective 1: What is the average length of stay in days in ICU in CHUK?	- Date of admission to ICU, Date of discharge from ICU, Length of stay in days (short LOS or prolonged LOS)	Date of admission to ICU, date of discharge from ICU, length of stay in days .
Objective2: What are factors associated to the main diagnosis of the client influencing prolonged length of stay in ICU.	-Demographic data - Patient conditions on admission: GCS on admission / 15, - Medical devices: Intubation with ventilation, reintubation, Central /Intravenous infusion, unplanned extubation, -Nutritional status: Good, Malnutrition: underweight, overweight, obesity. -Patient diagnosis on discharge and co-morbidities -Complications -Main diagnosis	Demographic data Emergency, planed surgery, elective surgery. - GCS on admission / 15, -Medical devices: Intubation with ventilation, reintubation, Central/Intravenous infusion, unplanned extubation, -Nutritional status: Good, Malnutrition: underweight, overweight, obesity. -Patient discharge: Medical diagnosis on discharge and co-morbidities.

3.6.2. DATA COLLECTION PROCEDURE

After securing ethics clearance from the IRB of the University of Rwanda: College of Medicine and Health Sciences and piloting the study instrument, data were collected through checking the files of hospitalized patients.

For the first day of data collection, the researcher introduced herself to the matron and unit manager of the intensive care unit during nurses' meeting and explained the objective of the study and data collection methods.

The second day, the researcher made contact with the in charge of archive service to ask for files and give code to files. Patients' files were paper based files. To give code numbers the first code corresponded with the first admitted patient file in January 2018 and the last code was given to the last patient file admitted in December 2018. After coding patients' files, the following days were spent collecting data. Data were collected for a period two months during working day hours from 08 h00 to 05 h00.

3.6.3. DATA ANALYSIS

The gathered information was entered into statistical package for social sciences (SPSS, Version 21). Descriptive statistics using frequency, mean, and standard deviation were used to analyze continuous or categorical variables specifically. Inferential statistics using chi-square tests and multiple regressions were used to associate the length of stay and related factors. The significant level was set at 95 CI and p value of 0.05.

3.6.4. DATA MANAGEMENT

Hard copies of data were secured in a locked cupboard with the key kept by the researcher only. Soft information was kept in software with secured password and will be disseminated with the permission of the institution where the study was conducted. The storage of data is valid for 5 years after which hard copies will be shredded and incinerated and soft copies will be deleted.

3.7. DISSEMINATION OF FINDINGS

The findings of the study will be disseminated through oral presentation at the University of Rwanda, there after a copy will be submitted to the library of the University of Rwanda and feedback will be given to the hospital where the study was conducted. Also, findings of the study will be disseminated in conferences and published through peer reviewed journals.

3.8. PROBLEMS AND LIMITATIONS OF THE STUDY

This study is the first study assessing the length of stay in ICU in Rwanda that will add to some knowledge base. However, the study was conducted in one hospital therefore the results are applied to the particular hospital. Involvement of more than one hospital would be useful in obtaining a more comprehensive picture. Also the study was retrospective. A cohort study can be helpful in determining factors. There was a limitation of missing some information because it was not documented in files.

3.9. ETHICAL CONSIDERATIONS

The researcher has received ethics clearance to conduct the study from CMHS research ethics committee of the University of Rwanda. The researcher also requested and was granted a permission to conduct the study at the University Teaching Hospital of Kigali by the ethics committee of this hospital as the reference for a complete ethical consideration for data collection in the hospital. Explanation about the research was given to the nursing managers and manager of the archives where the records are stored to have permission to review patients' files. It is assumed that the records belong to the hospital management once the patients are discharged.

To ensure anonymity of the gathered information there was no name of health care professionals who cared for the patient and no number of the file recorded on the checklist. The information received from the files will not be divulged to anyone.

CHAPTER FOUR: THE RESULTS

4.1. INTRODUCTION

The implementation of the methodology exposed in the previous chapter gave the respective quantitative results. These results are presented in this chapter. The tables and figures were used to summarize results and are presented according to the objectives of the study. A total of 176 files of admitted patients in ICU of University Teaching Hospital of Kigali from January to December 2018 were observed.

4.2. SOCIAL DEMOGRAPHIC DATA

Table 4.1 below highlights that the majority of patients (39.2%) in reviewed files were between 19-35 years of age followed by 36-50 years of age (26.7%), patients between 51-100 years of age were 25% and 9.1% were under 18 years of age, participant mean age was 39.04. According to gender the majority were male, 92(52.3%), while the females were 84(47.7%) and majority 156 (88.6%) had health insurance where the majority 137(77.9%) were using community based health insurance (CBHI), 6(3.4%) were private. Among 137 patients insured by CBHI the majority, 86(49.4%), were in category 3 of ubudehe, 29(16.5%) second category and 22(12.5%) in category 1. Regarding the occupation the majority of reviewed files, 101(57.4%), were in agriculture and 39(22.2%) were unemployed.

Mean age

	N	Minimum	Maximum	Mean
Age	176	4	93	39.04

Table 4.1. Distribution of patients' social demographic data (N=176)

Variables	Frequency	Percent
Age(N=176)		
≥18	16	9.1
19-35	69	39.2
36-50	47	26.7
51-100	44	25.0
Gender(N=176)		
Male	92	52.3
Female	84	47.7
Health insurance(N=176)		
YES	156	88.6
NO	20	11.4
Type of patients' health insurance(N=161)		
CBHI	137	85.1
MMI	3	1.9
RAMA	12	7.5
HCR	3	1.9
PRIVATE	6	3.7
Category of ubudehe (N=137)		
1	22	15.9
2	29	21.0
3	87	63.0
Occupation (N=176)		
Unemployed	39	23.2
Self-employed	18	10.7
Laborer	1	.6
Professional	8	4.8
Agriculturer	101	60.1
Security guard	1	.6

4.3. Average of length of stay

4.3.1 Patients' ICU length of stay in days

Table 4.2 below shows that the majority of patients, 28(15.9%), had 1day of stay in ICU, followed by 5 days of stay among 21(11.9%), while the minority, 1(0.6%), stayed 106 days.

Table 4.2. Length of stay in days (N=176)

Days	Frequency	Valid Percent
1	28	15.9
2	20	11.3
3	13	7.4
4	21	11.9
5	9	5.1
6	9	5.1
7	9	5.1
8	5	2.8
9	4	2.3
10	2	1.1
11	5	2.8
12	4	2.3
13	3	1.7
14	8	4.5
15	1	.6
16	4	2.3
18	1	.6
20	2	1.1
21	2	1.1
22	3	1.7
23	4	2.3
24	2	1.1
26	2	1.1
27	1	.6
28	1	.6
31	1	.6
33	1	.6
34	2	1.1
38	1	.6
39	1	.6
40	2	1.1
48	1	.6
56	1	.6
60	1	.6
106	1	.6
Total	175	99.4
Not documented	1	.6
Total	176	100

4.3.2 Average length of stay

Table 4.3 below shows that the average of length of stay is 24 days. The mean of length of stay was 10.02 with standard deviation of 13.068. The minimum day was 1 and maximum was 106.

Table 4.3. Average length of stay (N=176)

Length of stay	Minimum	Maximum	Average
in days	1	106	24

4.3.3. Level of stay in ICU: Average is considered as cut off point.

Taking the average length of stay of 24 days as cut off point, Table 4.4 below reveals that the majority 160(90.9%) did not have prolonged stay while 16(9.1%) had prolonged stay.

Table 4.4. Level of stay in ICU: average is considered as cut off point N=176

	Frequency	Percent
<24day	160	90.9
>24Prolonged stay	16	9.1

4.4. Factors associated with the main diagnosis of the client causing prolonged stay in ICU.

4.4.1. Distribution of patients according to Glasgow coma score on admission in ICU

Table 4.5 below shows documented 161 GCS on admission. The majority 28(15.9), entered ICU with 10/15 of GCS followed by 15/15, 26(14.8%) and 3/15, 25(14.2%).

Table 4. 5. Distribution of patients according to Glasgow coma score on admission in ICU (N=176)

GCS. On admission	Frequency	Percent
3	25	14.2
4	8	4.5
5	8	4.5
6	16	9.1
7	16	9.1
8	11	6.3
9	11	6.3
10	28	15.9
11	3	1.7
12	1	.6
13	6	3.4
14	2	1.1
15	26	14.8
Total	161	91.5
Not documented	15	8.5

4.4.2. Patients who had cardiopulmonary arrest during hospitalization

Table 4.6 below shows that among 176 reviewed file, 85 (48.3%) had cardiopulmonary arrest during hospitalization and 74(42.1%) did not. Seventeen files did not document any cardiac arrest

Table 4.6. Patients who had cardiopulmonary arrest during hospitalization (N=176)

	Frequency	Percent
YES	85	48.3
NO	74	42.1
Total	159	90.3
Not documented	17	9.7

4.4.3. Intubation with mechanical ventilation

Table 4.7 below reveals that among 176 reviewed files, 143(81.3%) have been put on mechanical ventilation while 24(13.6%) were not intubated. Nine patients files did not document if patients intubated or not.

Table 4.7. Intubation with mechanical ventilation (N=176)

	Frequency	**Percent**
YES	143	81.3
NO	24	13.6
Total	167	94.9
Not documented	9	9

4.4.4. Unplanned extubation

Table 4.8 below shows that only 17(10.1%) patients underwent unplanned extubation and 144 (81.8%). In 15patients'files, unplanned extubation were not documented.

Table 4.8. Unplanned extubation (N=176)

	Frequency	**Percent**
YES	17	10.1
NO	144	81.8
Total	161	91.5
Not documented	15	8.5

4.4.5. Reintubation of patients

Figure 4.1 shows that 28(17%) have been re-intubated while 140(83%) have not been re-intubated.

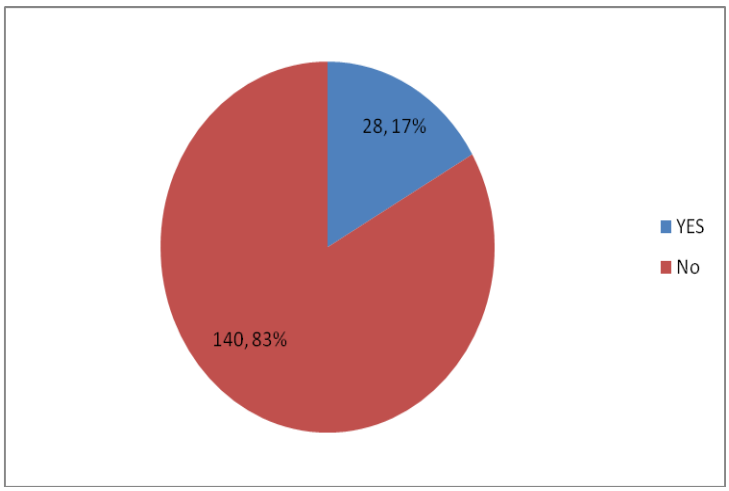

Figure 4.1 Reintubation of patients (n=168)

4.4.6. Patients who had central lines

Below Figure 4.2 shows that only 45(26%) underwent the central intravenous infusion

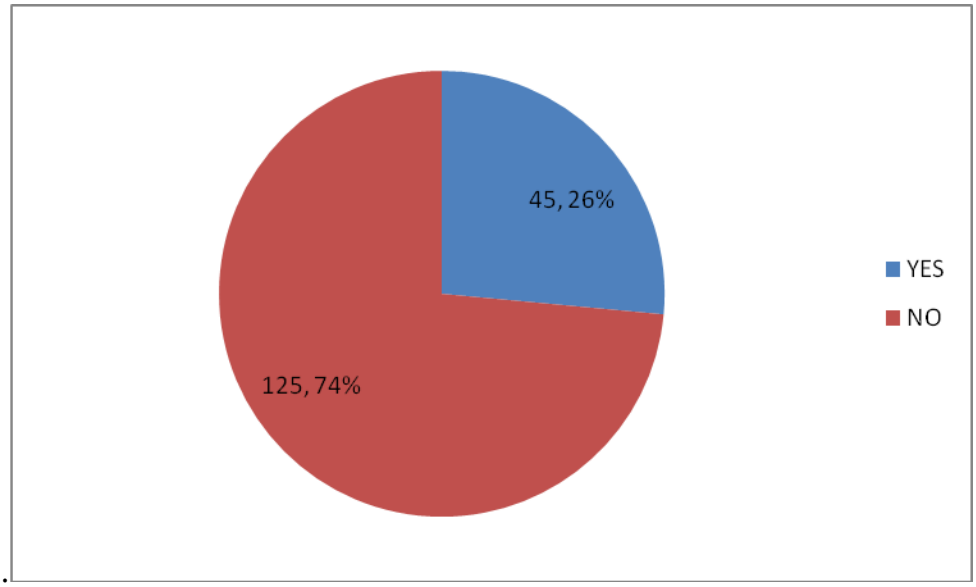

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Figure 4.2 Patients who had central lines (n=170)

4.4.7. Accessibility to all prescribed medications

Figure 4.3 shows that the majority, 156(92%), had an accessibility to all prescribed medications while only 13(8%) did not access all medication.

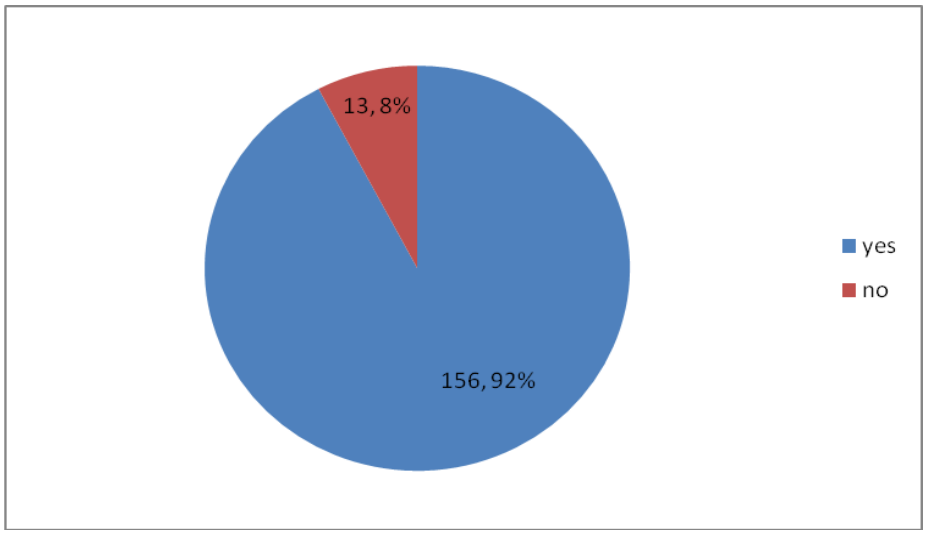

Figure 4.3 Accessibility to all prescribed medications (N=176)

4.4.8. Patients who had surgery

Among 176 patients, 110 underwent surgery. The majority, 65(59.1%), had emergency surgery while 45(49.9%) were elective surgery. See Table 4.9 below.

Table 4.9. patients who had surgery (N=176)

	Frequency	**Percent**
YES	110	62.5
NO	66	37.5
Status of the surgical operation (n=110)		
Elective surgery	45	40.9
Emergency surgery	65	59.1

4.4.9. Origin of Patients

Figure 4.4 below shows that among 176 reviewed patients files, the majority of patients 107(61%) were transferred from other hospitals.

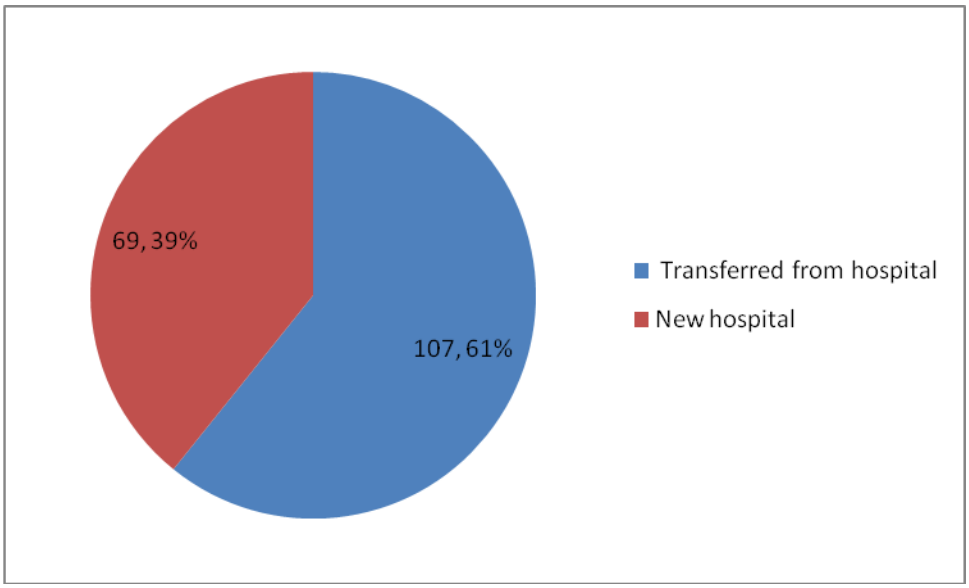

Figure 4.4 Origin of Patients (N=176)

4.4.10. History of substance abuse

Table 4.10 below shows that, among 176 reviewed files, the majority, 110(67.6%), had no history of substance use, while 42(23.9%) used alcohol, and 15(8.5%) used tobacco.

Table 4.10. History of substance abuse (N=176)

Substance abuse	**Frequency**	**Percent**
Alcohol	42	23.9
Tobacco	15	8.5
No substance use	110	67.6

4.4.11. Patient who had Co- morbidities

Table 4.11 below reveals that the majority of reviewed files, 87(49.4%) did not present any co-morbidity while 77(43%) presented co-morbidities.

Table 4. 11. Patient who had Co- morbidities (N=176)

	Frequency	Percent
YES	77	43.8
NO	87	49.4

4.4.12. Type of co-morbidities

Figure 4.5 below demonstrates that the major co-morbidity was Human Immunodeficiency Virus (HIV), 10(5.7%), followed by Hypertension (HTA), 9(5.1%), Diabetes, 8(4.5%) and Ischemic stroke, Cardiopathy and hypertension on pregnancy and gastritis,4(2.3%).

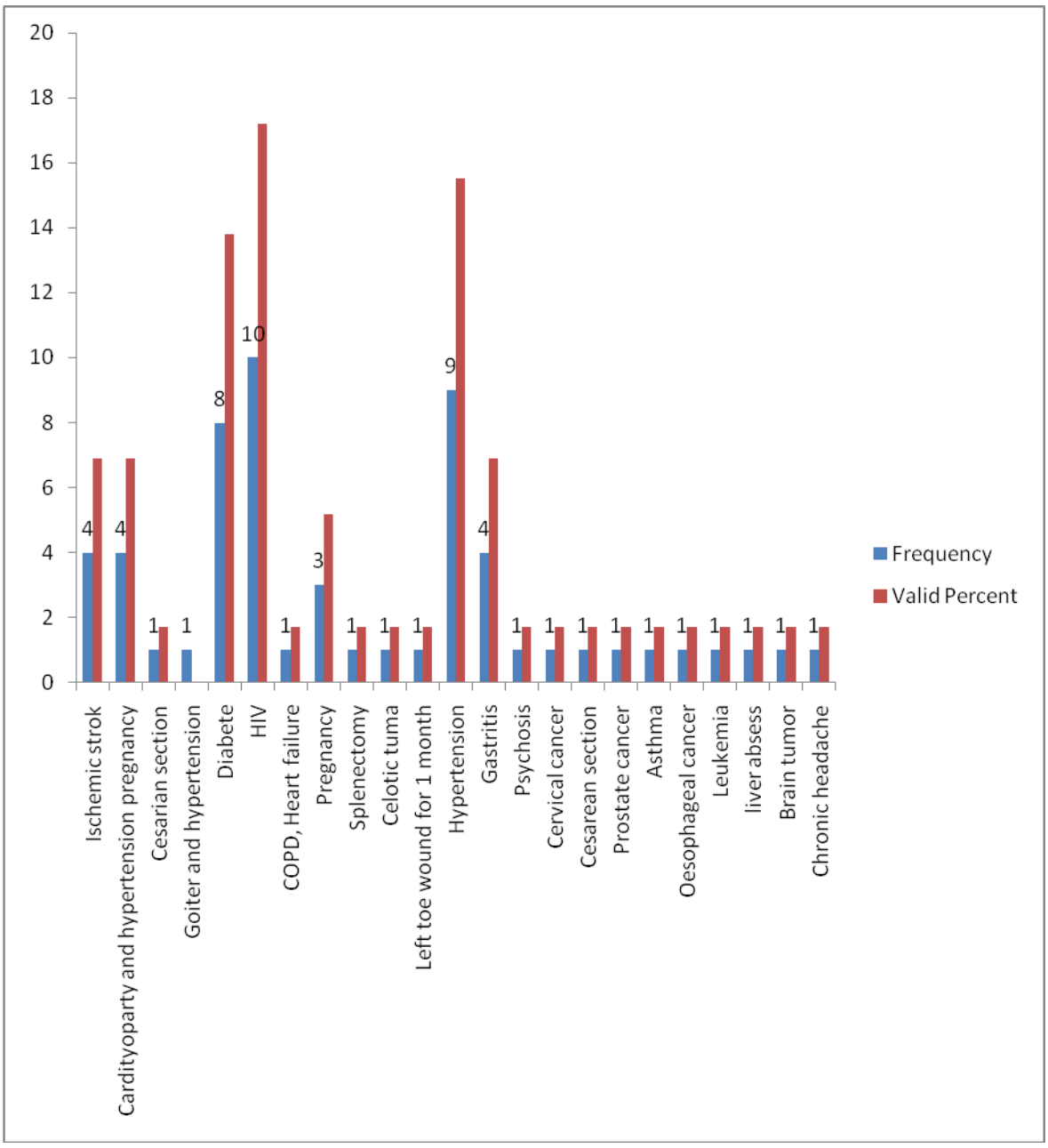

Figure 4.5 Type of co-morbidities (N=176)

4.4.13. Patients who had complication during hospitalization

Table 4.12 below shows that the majority of patients had complications and the subsequent Figure 4.6 reveals that the major complication, 55(31.3%), was pulmonary edema followed by Cardiac arrest 16(9.1%) then bed sores showed among 9(5.1%) charts.

Table 4.12. Patients who had complication during hospitalization (N=176)

	Frequency	Percent
YES	94	53.4
NO	66	37.5

The likely complications are presented in Figure 4.6 below

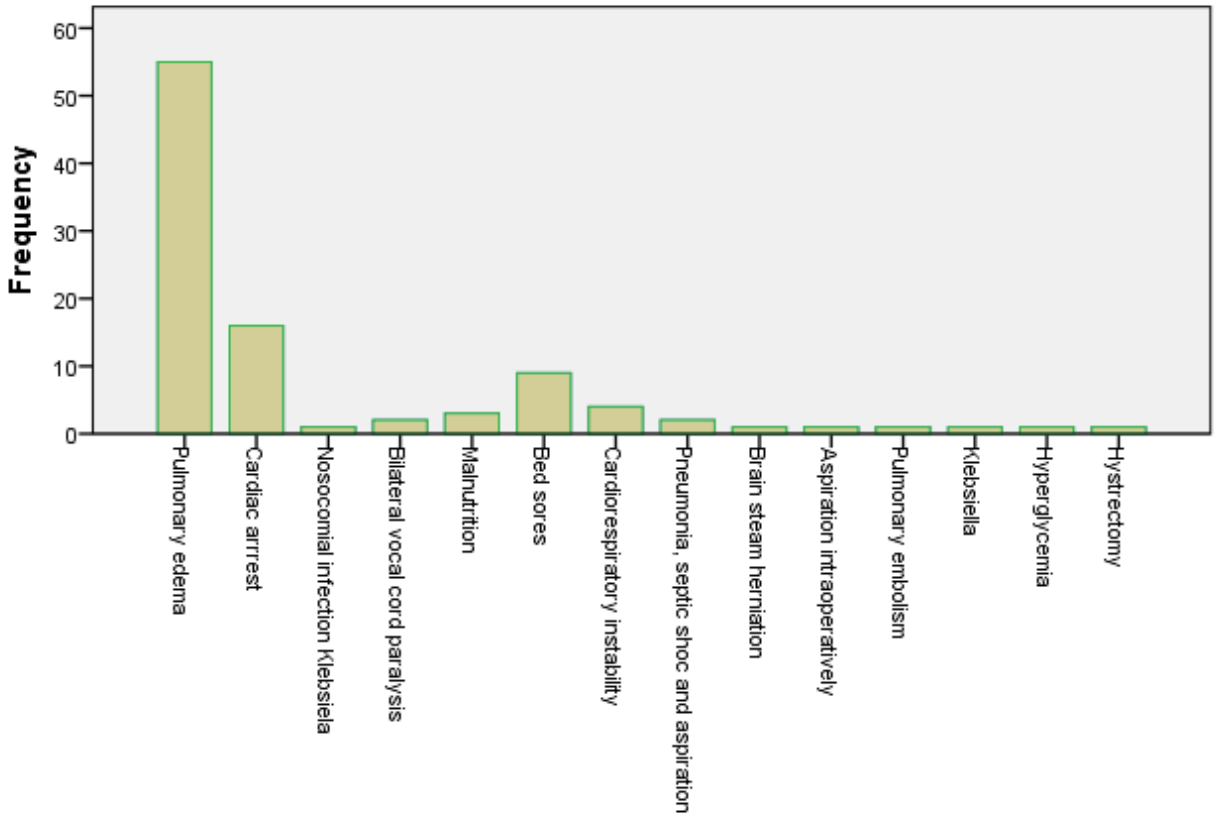

Figure 4.6 Kind of complications during hospitalization (N=176)

4.4.14. Patient nutritional status

According to Table 4.13, among 162 patient files, nutritional status was documented and the majority were well nourished in 134(76%) charts, only 26(14.8%) were reported malnourished: underweight.

Table 4.13. Patient nutritional status (N=176)

Nutritional status	Frequency	Valid Percent
Good	134	76.1
Malnutrition: underweight	26	14.8
overweight	1	.6
obesity	1	.6
Not documented	14	7.9
Total	176	100

4.4.15. Medical diagnosis on discharge

Figure 4.7 below shows that the majority of patients were diagnosed for septic shock, peritonitis, traumatic brain injury, severe pneumonia and left radical nephrectomy.

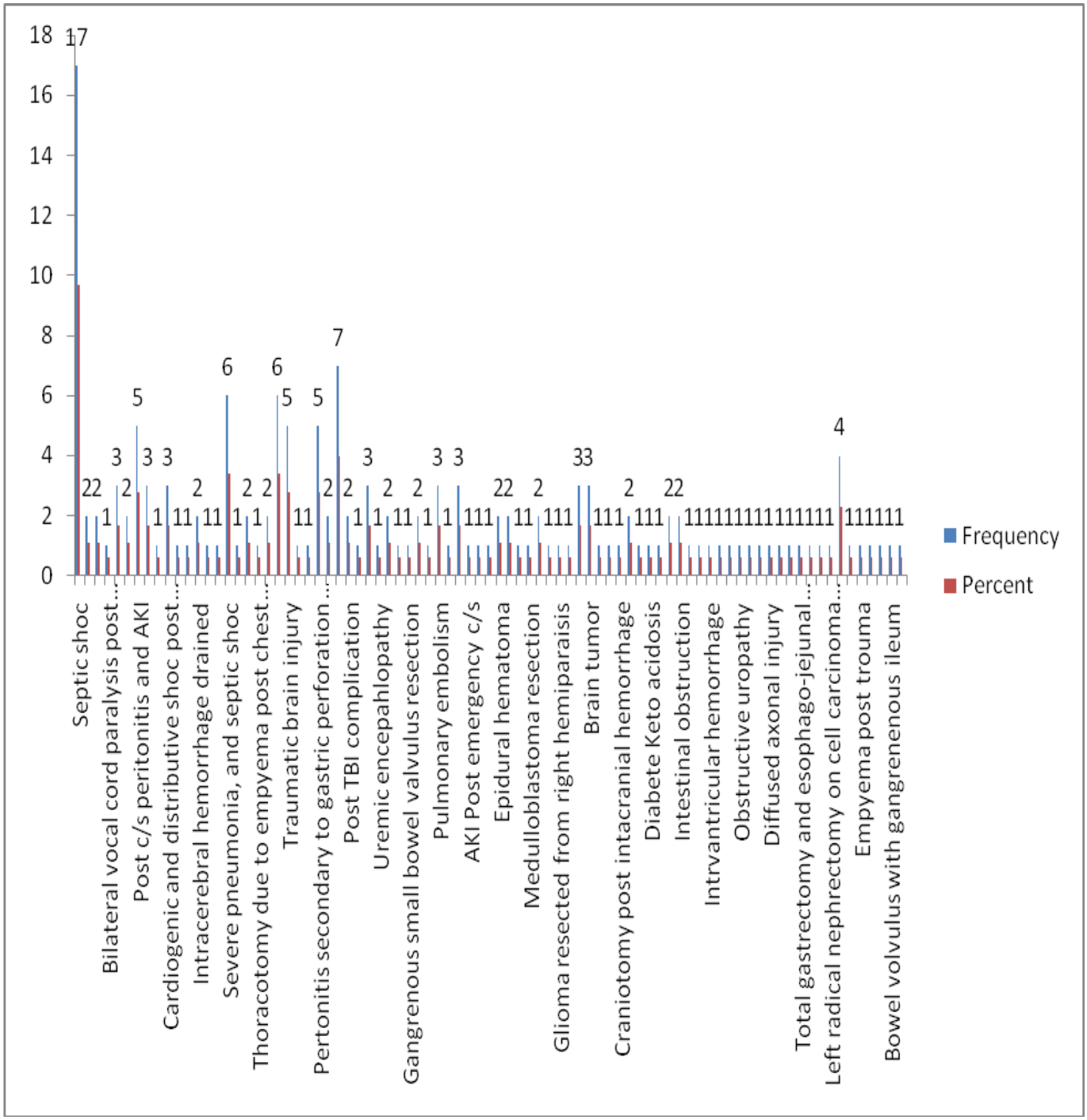

Figure 4.7 Medical diagnosis on discharge (N=176)

4.4.16. Main diagnosis associated with prolonged ICU stay.

Table 4.14 below demonstrates association between post cesarean peritonitis and acute kidney injury, trachea-esophageal fistula and lung contusion, Urinary Tract Infection (UTI) post severe malaria, diffused axonal injury, blunt chest trauma and blunt abdominal injury and Chronic kidney disease and prolonged stay in ICU that were statistically significant with *P<0.005.*

Table 4.14. Main diagnosis associated with prolonged ICU stay CI=95%. N=176 (Chi-Square test).

Diagnosis	Test	Value	P. Value
Post c/s peritonitis and AKI	Pearson Chi-Square	5.900	.007
Tracheo-esophageal fistula and lung contusion	Pearson Chi-Square	9.932	.002
UTI Post severe malaria	Pearson Chi-Square	9.995	.002
Diffused axonal injury blunt chest trauma and blunt abdominal injury	Pearson Chi-Square	20.105	.0001
Chronic KD	Pearson Chi-Square	9.995	.002

4.4.17 Medical Factors associated with the main diagnosis of the client causing prolonged stay in ICU (Multinomial analysis).

Table 4.15 below shows that there are no medical factors associated to the main diagnosis influencing prolonged ICU stay because *p>0.05.* However, based on OR intubation with mechanical ventilation, reintubation and unplanned extubation were found to have relationship with patients' main diagnosis and prolonged ICU stay with an OR>1. Nevertheless other factors were not revealed to have a relationship with the main diagnosis to influence length of stay with *p value*>0.05 and OR<1.

Table 4. 15. Medical Factors associated with the main diagnosis of the client causing prolonged length of stay in ICU N=176

Diagnosis / Medical factors		Post c/s peritonitis and AKI	Tracheo-esophageal fistula and lung contusion	UTI Post severe malaria	Diffused axonal injury blunt chest trauma and blunt abdominal injury	Chronic KD
Intubation with mechanical ventilation	ODDs Ratio	34866571.685	11457266.49	11457266.13	23078234.39	11457266.2
	P.value	1.000	1	1	1	1
Unplanned extubation	ODDs Ratio	1.1120	1.117	1.117	1.118	1.117
	P.value	0.847	0.924	0.924	0.892	0.924
Reintubation	ODDs Ratio	47513950.30	11706339.30	11622122.05	23412674.03	11622120.63
	P.value	0.998	0.998	0.998	0.998	0.998
Central venous infusion	ODDs Ratio	0.350	.000	13028024.44	0.355	0.000
	P.value	0.301	0.996	0.998	0.462	0.996
Nutritional status	ODDs Ratio	.000	.000	.000	.000	.000
	P.value	0.998	0.998	0.998	0.998	0.998

4.4.18. Conclusion

Chapter four has presented the results in the form of tables and figures. Chapter five is going to present the results discussion and conclusion.

CHAPTER FIVE: RESULTS DISCUSSION

5.1 Introduction

Intensive care unit patient files were targeted in this study to be assessed for factors influencing prolonged length of stay. A checklist was used for assessing factors influencing length of stay in adult intensive care unit. One hundred and seventy six **(**176) patient' files were reviewed to determine the average length of stay in days in ICU, the main diagnosis associated to ICU length of stay and to identify factors associated with the main diagnosis of the client causing prolonged length of stay in ICU at the university teaching hospital of Kigali.

5.2 Social-demographic data

The results of the study showed that among 176 reviewed patient's files, the male 92(52.3%) were more than females 84(47.7%) between 36-50 years old, 77.9% were having community based health insurance and were predominantly cultivator by occupation (Table 4.1). These findings were quite similar to the study conducted at Haseki Training and research hospital Istanbul on factors affecting the length of stay in the intensive care unit, where the men were more than women 2185/1741 (Olasheni *et al*, 2017). Further study conducted on four hundred and one patients, 59.6% were men and 40.4% women with mean age of 18.0 ±53.8 years (Ana et al, 2010). This study results were similar to findings from a study conducted by Torabipour, *et al.* (2016 p.126) which revealed that 70.3% were male, 80.4 % of patients were under 70 years the result showed that 96.2% of patients were covered by one of the Iranian medical insurance schemes.

5.3 The average length of stay in days in ICU

The results of the study showed that the majority of patients had 1 day of stay in ICU, followed by 5 days (Figure 4.2). The average length of stay was found at 24 days and referring to the average the majority 159(90.9%) did not have prolonged stay while 16(9.1%) had prolonged stay (Table 4.4).

These findings were similar to the study conducted at Haseki Training and Research Hospital Istanbul, on factors affecting the length of stay in the intensive care unit, the average stay in

intensive care unit was 10.2 ± 25.2 days (Olasheni et al, 2014). The study results also were similar to those of a study conducted by Khattab *et al.* (2017) on predictors and outcomes of prolonged stay in the respiratory ICU where the mean ICU stay of ASUSH patients was 24.17 days and that of Demerdash patients was 22.8 days. Further study on the determination of a Prolonged Intensive Care Unit Stay for Spontaneous Intracerebral Hemorrhage Patients was equal to or longer than 10 days. There were 436 prolonged ICU stay cases and 1,163 non-prolonged cases (Chien et al., 2014). Different results have been found in a study done by Agrawal, *et al*. (2017) in India where the average stay of a patient in ICU was low compared to this current study findings and counted to 4 days. A study done in Indonesia by Nanang Sugiarto and Ede Surya Darmawan, (2014), the average LOS for patients in the intensive care units was 14.36 days which is less. In a study done by Böhmer et al., (2014) on factors influencing length of stay in the intensive care unit for surviving trauma patients: a retrospective analysis of 30,157 cases, average LOS in the ICU was 7 days. This study results ware different to those of a study conducted by Torabipour, *et al.,* (2016 p.127) where results revealed LOS to be 9 days.

5.4 Factors associated with the main diagnosis of the client causing prolonged stay in ICU.

This study showed a significantly increased length of stay in patients with post cesarean peritonitis, acute kidney injury, urinary infection post severe malaria, diffused axonal injury, blunt chest trauma and blunt abdominal injury (Table 4.14). Another retrospective study showed a significantly increased length of stay in patients with cardiovascular diseases, multiple organ failure diseases, and nervous system diseases, (Olasheni *et al*, 2017).

The results of the study revealed also that among associated diagnoses, diffused axonal injury, blunt chest trauma and blunt abdominal trauma are more likely to influence prolonged stay OR=9.807, followed by UTI post severe malaria and chronic kidney diseases OR=4.843, trachea-esophageal fistula and lung contusion OR=4.831 and the least post cesarean peritonitis and AKI with OR =3.588.

Multinomial analysis in Table 4.15 showed that no medical factors influenced the main diagnosis associated with prolonged length of stay $p>0.05$ but the odds ratios, presented in this table revealed that intubation with mechanical ventilation, reintubation and unplanned extubation are more likely to cause prolonged stay Odds ratio>1.

This study is similar to a study by Ozeelliker *et al* (2017, p 20) in India which revealed that intubation, reintubation, catheter insertion, catheter complications, mechanical ventilation, vasopressor support, additional investigations and procedures, changing antibiotics frequently and using expensive antibiotics had a significant association with prolonged ICU stay and costs. These finding are also similar to the study on factors associated with increased mortality and prolonged ICU stay in an adult intensive care unit Tracheotomy and reintubation were significantly associated ($p<0.0001$) with mortality and prolonged intensive care unit stay (Ana et al, 2010). Also a study done by Mahmood *et al.*, (2014) on predictors of reintubation in trauma intensive care unit revealed that reintubation was associated with ICU long stay as it is found in this current study.

This is also in accordance to the study conducted by Rm *et al.*, (2018, p 1) which has shown that intensive care unit length of stay was associated with mechanical ventilation.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This study shows that ICU length of stay is a significant health problem requiring a multidisciplinary team work to provide quality health care services to reduce this LOS.

6.2 Conclusion

This study found 24 days as an average length of ICU stay in the participating hospital and concerning the average, the majority did not have prolonged stay. Post cesarean peritonitis, acute kidney injury, and urinary infection post severe malaria, diffused axonal injury, blunt chest trauma and blunt abdominal injury were found as main diagnoses associated with ICU prolonged stay. The study showed also that there were no medical factors influencing the main diagnosis associated with prolonged length of stay but intubation with mechanical ventilation, reintubation and unexplained extubation were found to be more likely predictors of prolonged ICU stay for patients with main diagnosis associated with prolonged ICU stay.

6.3 Recommendation

Based on the findings of this study, the researcher makes the following recommendations:

1. Physicians and nurses should provide high quality care for patients with identified main diagnoses associated with prolonged stay to prevent prolonged bed rest complications, for example early weaning from mechanical ventilation and early ambulation.

2. Close monitoring of patients with mechanical ventilation to avoid reintubation and unplanned extubation which are associated with prolonged ICU stay.

3. This research was conducted at one referral hospital; also research should be conducted to other referral hospitals to identify factors influencing ICU length of stay so that results can be generalized.

4. Further research to be conducted to find other non-medical factors associated with prolonged stay.

REFERENCES

Almashrafi, A., Elmontsri, M. and Aylin, P. (2016) 'Systematic review of factors influencing length of stay in ICU after adult cardiac surgery', *BMC Health Services Research*. BMC Health Services Research, pp. 1–12. doi: 10.1186/s12913-016-1591-3.

Almashrafi A, Alsabti H, Mukaddirov M, Balan B, Aylin P (2016) 'Factors associated with prolonged length of stay following cardiac surgery in a major referral hospital in Oman : a retrospective observational study', pp. 1–7. doi: 10.1136/bmjopen-2015-010764.

Article, O. (2015) 'A Descriptive Study of Length of Stay at an Intensive Care Unit', pp. 29–32.

Torabipour, M. Arab, H. Zeraati, A. Rashidian, A. Sari and M. Sarzaiem (2014) 'Multivariate Analysis of Factors Influencing Length of Hospital Stay after Coronary Artery Bypass Surgery in Tehran,Iran'.*Acta Medica Iranica, Vol. 54, No. 2 (2016).*

Agrawal, A., Gandhe, M., Gandhe, S. and Agrawal, N., (2017) 'Study of length of stay and average cost of treatment in Medicine Intensive Care Unit at tertiary care center'. *J Health Res Rev 2017;4* pp. 24–29. doi: 10.4103/2394-2010.199329.

Nanang Sugiarto and Ede Surya Darmawan, (2014) 'The Factors Affecting the Length of Stay in the Intensive Care Units of Pertamina Central Hospital in IndonesiaRelated to Healthcare Associated Infections'.*Journal of US-China Medical Science 11 (2014) 195-204* doi: 10.17265/1548-6648/2014.04.004

Bakımda, Y., Yatan U., Özellikleri H., Maliyetleri S., Aygencel Gülbin and Türkoğlu Melda (2011) 'Characteristics , Outcomes and Costs of Prolonged Stay ICU Patients', pp. 53–58. doi: 10.5152/dcbybd.2011.12.

Beatriz A., Oliveira F., Dias O., MelloM., Araújo S., Dragosavac D., Nucci A. and Luis A. (2010) 'Factors associated with increased mortality and prolonged length of stay in an adult intensive care unit', 22(3), pp. 250–256.

Khattab AM, Abd Elgawad El-Masry A, El Maraghy AA, Ahmed NO. (2018) 'Predictors and outcome of prolonged stay in the respiratory ICU'. *Egypt J Bronchol* 12(1): pp.57–68. Available from: http://www.ejbronchology.eg.net/text.asp?2018/12/1/57/223082

Böhmer , K. Just, R. Lefering, T. Paffrath, B. Bouillon, R. Joppich, F. Wappler and M. Gerbershagen (2014) 'Factors influencing lengths of stay in the intensive care unit for surviving trauma patients : a retrospective analysis of 30 , 157 cases', pp. 1–10. doi: 10.1186/cc13976.

Crozier, T. M. E., Pilcher D.V., Bailey M.J., George C., and Hart *G.K.* (2007) 'Long-stay patients in Australian and New Zealand intensive care units : demographics and outcomes', *Australasian Academy of Critical Care Medicine*, 9(December), pp. 327–333.

Ely, E. W., Gautam, S., Margolin, R., Francis, J., May, L., Speroff, T., Truman, B., Dittus, R., Bernard, G R and Francis, J. (2001) 'The impact of delirium in the intensive care unit on hospital length of stay', *Intensive care med.*, 27, pp. 1892–1900. doi: 10.1007/s00134-001-1132-2.

Darmawan, N. S. and E. S. (2014) 'The Factors Affecting the Length of Stay in the Intensive Care Units of Pertamina Central Hospital in Indonesia Related to Healthcare Associated Infections', 11, pp. 195–204. doi: 10.17265/1548-6648/2014.04.004.

Deer, R. R. and Volpi, E. (2018) 'Protein Requirements in Critically Ill Older Adults', pp. 1–7. doi: 10.3390/nu10030378.

Gruenberg, D., Shelton, W., Rose, S., Rutter, E. and Socaris, S., (2014) 'Factors Influencing Length of Stay in the Intensive Care Unit', 15(5).

Johnson, A. M., Henning, A. N., Morris, P. E., Tezanos, A.G. V. and Dupont-versteegden, E. E. (2017) 'Timing and Amount of Physical Therapy Treatment are Associated with Length of Stay in the Cardiothoracic ICU', *Scientific Reports*. Springer US, (November), pp. 1–9. doi: 10.1038/s41598-017-17624-3.

Khosravizadeh, O., Vatankhah, S., Bastani, P., Kalhor, R., Alirezaei, S. and Doosty, F. (2016). 'Factors affecting length of stay in teaching hospitals of a middle-income country'. *Electronic physician.* 8. pp3042-3047. 10.19082/3042.

Kose, I., Zincircioglu, C., Ozturk, Y. K., Senoglu, N., and Erbay, R. H. (2016). 'Characteristics and Outcomes of Patients with Prolonged Stays in an Intensive Care Unit'. European Journal of General Medicine, 13(2), pp.127-133. https://doi.org/10.15197/ejgm.1546

Mahmood, S., Alani, M., Al-Thani, H., Mahmood, I., El-Menyar, A., & Latifi, R. (2014). Predictors of reintubation in trauma intensive care unit: qatar experience. *Oman medical journal*, *29*(4), 289 – 293. doi:10.5001/omj.2014.75

Obsa, M. S., Weji, B. G. and Worji, T. A. (2017) 'Factors affecting prolonged intensive care unit stay in Nigist Eleni Mohammed Memorial Hospital , Hosanna , Southern Ethiopia', 9(September), pp. 105–110. doi: 10.5897/IJMMS2017.1307.

https://academicjournals.org/journal/IJMMS/how-to-cite-article/427537E65933

RM, S., Bellini, A., DS, W., MA, H., Jain, R., Karanth, S. and Namachivayam,A., (2018) 'Cochrane Database of Systematic Reviews BIS monitoring versus clinical assessment for sedation in mechanically ventilated adults in the intensive care unit and its impact on clinical outcomes and resource utilization (Review)', (2). doi: 10.1002/14651858.CD011240.pub2.www.cochranelibrary.com.

R-HMIS, (2014) 'Rwanda Annual Health Statistics Booklet2014'.

Rozenbaum, M. Mangen, M. Huijts, S. Werf, T. Postma and J. Maarten (2015) 'Incidence , direct costs and duration of hospitalization of patients hospitalized with community acquired pneumonia : A nationwide retrospective claims database analysis', *Vaccine*. Elsevier Ltd, 33(28), pp. 3193–3199. doi: 10.1016/j.vaccine.2015.05.001.

Skupski, R., Toth, A., Mccurdy, M.T., Kappler, S., Lantry, J., Pyran, G., Zimmer, D., Dynako, J., Grisoli, A., Zimmer, D., Wilson, J., Patel, B. M., Callisen, H., Chapital, A.,Colas, L.N.,Augustin, Edema, M.E, Brocco, N., Frechette, E.D., Thompson, R., Corcoran, M., Mazowiecki, J. and Walsh, M. (2018) 'Utilizing Anesthesiologists , Emergency and Critical Care Physicians with Telemedicine Monitoring to Develop Intubation and Ventilation Services in an Intensive Care Unit in the Austere Medical Environment : A Case Series . Expansion of the EP / CC GAS Project', (April 2014), pp. 183–197. doi: 10.4236/ojanes.2018.86019.

Stat Pac Inc. (2014)'Survey Sampling Methods'. Survey Sampling Methods, Available at: https://www.statpac.com/surveys/sampling.htm.

Statistics, H. (2014) 'Rwanda Annual Health Statistics Booklet 2014'.

Strand, K., Walther, S., Reinikainen, M., Kokko,T., Nolin, T., Martner, J., Mussalo,P., Soreide

E. and H. Flaatten (2010) ‘Variations in the length of stay of intensive care unit nonsurvivors in three scandinavian countries’, pp. 1–8.

Terms, K. E. Y. and Objectives, L. (no date) ‘B ASIC S TATISTICAL D ATA U SED’, pp. 1–34.

Williams, T A., Ho, K M., Dobb, G J., Finn, J C., Knuiman, M., Webb, S A R (2010) ‘CRITICAL CARE Effect of length of stay in intensive care unit on hospital and long-term mortality of critically ill adult patients’, 104(4), pp. 459–464. doi: 10.1093/bja/aeq025.

Zimmerman, J. E., Kramer, A. A., Mcnair, D.S., Malila, F.M and Shaffer, V. L. (2006) ‘Intensive care unit length of stay: Benchmarking based on Acute Physiology and Chronic Health Evaluation (APACHE) IV*’, 34(10), pp. 2517–2529. doi: 10.1097/01.CCM.0000240233.01711.D9.

Englum BR, Hui X, Zogg CK, Chaudhary MA, Villegas C, Bolorunduro OB, Stevens KA, Haut ER, Cornwell EE, Efron DT and Haider, A. H. (2016) ‘Association Between Insurance Status and Hospital Length of Stay Following Trauma’. *The American surgeon*, *82*(3), 281–288.

Yaghmal, F. (2003) ‘Content validity and its estimation’. *Journal of Medical Education Spring*, Vol. 3, No. 1, pp. 25-27.

Yaghoubi M, Karimi S, Ketabi S, Javadi M. (2011) ‘Factors affecting patients' length of stay in Alzahra hospital based on hierarchical analysis technique’. *Health Inf Manage; 8(3):326-34*

APPENDICES:

CHECKLIST FOR ASSESSING FACTORS INFLUENCING LENGTH OF STAY IN ADULT INTENSIVE CARE UNIT AT A SELECTED REFERRAL HOSPITAL IN RWANDA.

For below items the researcher will check the patient files and complete reserved space.

Part 1: Demographic data

1. Age ☐
2. Gender: Male ☐ Female ☐
3. Insurance: Yes ☐ No ☐
4. If yes type of health insurance:

   …….
5. If the client has Community based health insurance, which category of ubudehe?

   ☐ 1 ☐ 2 ☐ 3 ☐ 4
6. Patient occupation:

   Unemployed

   self-employed

   laborer

   professional

PART 2 : Medical Factors

7. GCS on admission: / 15
8. Any cardiopulmonary arrest during hospitalization yes ☐ No ☐
9. Intubation with mechanical ventilation yes ☐ No ☐

10. Unplanned extubation yes ☐ No ☐

11. Did patient have Reintubation? Yes ☐ No ☐

12. Did patient have Central Intravenous infusion Yes No ☐

13. Did the client have accessibility to all prescribed medications? Yes ☐ No ☐

14. Did patient have surgery: Yes ☐ No ☐

15. If yes was it Elective surgery? ☐ or Emergency surgery? ☐

16. Did the patient have any co morbidities before admission? Yes ☐ no ☐

17. If yes what are the co morbidities? ……

18. Did patient have any complication during hospitalization? Yes ☐ no ☐

19. Nutritional status

Good ☐ Malnutrition: underweight ☐ overweight ☐ obesity ☐

PART 3: Patient discharge

20. Date of admission to ICU…….../……/2018

21. Date of discharge from ICU ……/……. /2018

22. Medical diagnosis on discharge: ……

23. Length of stay in days ☐