

**FACTORS CONTRIBUTING TO WAITING TIMES AMONG PATIENTS UNDERGOING COMPUTERIZED TOMOGRAPHY, ULTRASONOGRAPHY AND GENERAL RADIOGRAPHY AT KENYATTA NATIONAL HOSPITAL, NAIROBI KENYA.**

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**MAY 2019**

**APPROVAL**

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Finally, my utmost gratitude to my family for their love, patience, and support during the entire period of my studies.

May God Bless You All

## TABLE OF CONTENTS

<u>APPROVAL</u> .....	ii
<u>ACKNOWLEDGEMENT</u> .....	iv
<u>TABLE OF CONTENTS</u> .....	v
<u>LIST OF TABLES</u> .....	viii
<u>LIST OF FIGURES</u> .....	ix
<u>LIST OF ABBREVIATIONS</u> .....	x
<u>OPERATIONAL DEFINITIONS</u> .....	xi
<u>CHAPTER ONE: INTRODUCTION</u> .....	1
<u>1.0 Background</u> .....	1
<u>1.1 Problem statement</u> .....	3
<u>1.2 Rationale for the study</u> .....	3
<u>1.3 Broad Objectives</u> .....	4
<u>1.4 Specific objectives</u> .....	4
<u>CHAPTER TWO: LITERATURE REVIEW</u> .....	5
<u>2.0 Waiting times</u> .....	5
<u>2.1 Improving patient flow in and out of radiology department</u> .....	7
<u>CHAPTER THREE: RESEARCH METHODOLOGY</u> .....	10
<u>3.0 Study design</u> .....	10
<u>3.1 Study area description</u> .....	10
<u>3.2 Study population</u> .....	10
<u>3.3 Sample size determination and formula used</u> .....	10
<u>3.4 Sampling</u> .....	11
<u>3.5 Study variables</u> .....	11
<u>3.6 Inclusion criteria</u> .....	11
<u>3.7 Exclusion criteria</u> .....	11
<u>3.8 Data collection methods</u> .....	12
<u>3.8.1 Data Analysis and management</u> .....	12

<a href="#"><u>3.9 Ethical considerations</u></a> .....	13
<b><a href="#"><u>CHAPTER FOUR: RESULTS</u></a></b> .....	14
<a href="#"><u>4.0 Introduction</u></a> .....	14
<a href="#"><u>4.1 Demographic characteristics</u></a> .....	14
<a href="#"><u>4.1.1 Bivariate Analysis</u></a> .....	15
<a href="#"><u>4.2 Type of examination</u></a> .....	15
<a href="#"><u>4.3 Type of examination done</u></a> .....	16
<a href="#"><u>4.4 Time taken at various service points</u></a> .....	16
<a href="#"><u>4.4.1 Registration time</u></a> .....	17
<a href="#"><u>4.4.2 Time taken at the cash point</u></a> .....	17
<a href="#"><u>4.4.3 Waiting time – registration and waiting bay</u></a> .....	18
<a href="#"><u>4.4.4 Examination time</u></a> .....	18
<a href="#"><u>4.4.5 Time taken for handwritten report</u></a> .....	19
<a href="#"><u>4.4.6 Time taken for report typing</u></a> .....	19
<a href="#"><u>4.4.7 Verification time</u></a> .....	20
<a href="#"><u>4.4.8 Correction time</u></a> .....	20
<a href="#"><u>4.4.9 Countersigning time</u></a> .....	21
<a href="#"><u>4.4.10 Return to typing area time</u></a> .....	21
<a href="#"><u>4.4.11 Dispatch time</u></a> .....	22
<a href="#"><u>4.5 Radiology Turnaround time</u></a> .....	22
<a href="#"><u>4.6 Factors contribution to delays</u></a> .....	23
<b><a href="#"><u>CHAPTER FIVE: DISCUSSION</u></a></b> .....	26
<a href="#"><u>5.0 Introduction</u></a> .....	26
<a href="#"><u>5.1 Discussion</u></a> .....	26
<a href="#"><u>5.1.2. Demographic Characteristics</u></a> .....	26
<a href="#"><u>5.1.3. To determine the time taken in CT, Ultrasound and general examinations</u></a> .....	26
<a href="#"><u>5.1.4. To determine factors that contributes to patient waiting times in CT, US,GEN</u></a> ....	27
<a href="#"><u>5.1.5. To determine patient flow for CT, ultrasound and General radiography</u></a> .....	29
<a href="#"><u>5.1.6. Study limitations</u></a> .....	29

**6.0 CONCLUSION** ..... 29

**7.0 RECOMMENDATION** ..... 30

**8.0 REFERENCES**..... 32

**9.0 APPENDICES**..... 35

**Appendix 1: Study Participation Consent** ..... 35

**Appendix 2: Questionnaires** ..... 37

**Appendix 3: Timeline/Time frame**..... 41

**Appendix 4: Budget Form** ..... 42

**Appendix 5: Radiology Charter**..... 43

**Appendix 6: Approval ERC** ..... 44

**Appendix 7: Study Registration Certificate**..... 45

## LIST OF TABLES

<a href="#">Table 1: Respondent Demographic characteristics</a> .....	14
<a href="#">Table 2: Bivariate Analysis</a> .....	15
<a href="#">Table 3: Type of examination done</a> .....	16
<a href="#">Table 4: Registration time</a> .....	17
<a href="#">Table 5: Time taken for handwritten report</a> .....	19
<a href="#">Table 6: Time taken for report typing</a> .....	20
<a href="#">Table 7: Correction time</a> .....	21
<a href="#">Table 8: Countersigning time</a> .....	21
<a href="#">Table 9: Return to typing area time</a> .....	21
<a href="#">Table 10: Radiology Turnaround time</a> .....	22
Table 11: Factors contributing to delays.....	34
<a href="#">Table 12: Logistic regression of factors contributing to departmental turnaround time</a> .....	25



## LIST OF FIGURES

<a href="#">Figure 1: Root Cause Analysis</a> .....	6
<a href="#">Figure 2: Workflow of Radiology Department</a> .....	<b>Error! Bookmark not defined.</b>
<a href="#">Figure 3: Conceptual Framework</a> .....	<b>Error! Bookmark not defined.</b>
Figure 4:Type of exam requested.....	26
<a href="#">Figure 4: Time taken at the cash point</a> .....	18
<a href="#">Figure 5: Examination time</a> .....	18
<a href="#">Figure 6: Verification time</a> .....	20
<a href="#">Figure 7: Dispatch time</a> .....	22

## **LIST OF ABBREVIATIONS**

CT	-Computed Tomography
MRI	-Magnetic Resonance Imaging
KNH	-Kenyatta National Hospital
NHIF	-National Hospital Insurance Fund
USA	-United States of America
IOM	-Institute of Medicine
UoN	-University of Nairobi
SPSS	-Statistical Package for Social Sciences

## OPERATIONAL DEFINITIONS

Patient waiting times	-Total period of time a patient takes to obtain a radiological service. This time was measured as total waiting time and section waiting time.
Radiology	- A medical specialty that uses imaging to diagnose disease
Computed tomography	- A diagnostic imaging modality that utilizes ionizing radiation and obtains cross sectional images of the body
Ultrasound-	- Diagnostic imaging modality that uses high frequency sound waves to acquire images of the body
General radiography	- A 2D diagnostic imaging modality that utilizes ionizing Radiation to obtain 2D images of the body
Patients	-Any person in need of services in a healthcare facility
Queue theory	-A mathematical study of waiting times that predicts the queue lengths and waiting times
Service points	- Refers to various stations within the department where the patient receives specific services
Arrival time	-The time the patient reports to the radiology department.
Departure time	- The time the patient leaves the radiology department
Patient flow	- The patients' movement through radiology sections from the time they walk into department to the time they leave
Section waiting time	-The time the patient spends waiting to receive a service at a specific service point within the department
Total waiting time	-The sum of all the section waiting times

## ABSTRACT

**Background-**Lengthy patient waiting time is a major cause of dissatisfaction of patients with healthcare providers. Determining the optimum waiting time for any given radiological service is often part of a larger assessment of customer behavior and satisfaction. The purpose of this research was to suggest possible solutions for the reduction of waiting times, improve the quality of services which in return would reduce queue lengths, increase staff productivity and operational efficiency.

**Objectives-**To determine the time taken by the patient from reporting to radiology department to the time they exit, identify the waiting times for the specific areas and factors contributing to these times and suggest possible solutions for the reduction of these times.

**Methodology-**A longitudinal observational study was conducted with an aim of determining turnaround times among the patients utilizing the various services at radiology department, KNH. The sample size was 596 patients for the three modalities. Simple random sampling was employed to select participants. Every patient that came to the department on Monday to Friday 8am to 5pm was enrolled in the study until the required sample size was obtained. The data was collected over a 3 month period from 1<sup>st</sup>July 2017 to 1<sup>st</sup>September 2017.

**Data collection and Analysis-**A Structured questionnaire was used to collect data which was piloted. The filled questionnaires were checked daily by the researcher to ensure completeness. Data generated was entered & analyzed using statistical package SPSS version 22. The descriptive characteristics of the patients was presented as means, medians and percentages for continuous & categorical variables respectively. Waiting time was analyzed and presented as means with standard deviations. Comparisons across the three study groups was done using logistic regression test. Factors associated to waiting time was determined using linear regression analysis. All statistical tests were performed at 5% level of significance. A Process Map/Flow Chart was used to show description, sequence of the process sections, & a cause and effect diagram was used to show the relationship between waiting times.

**Results-**The information generated will be important for the management in guiding decisions to improve service delivery. Presentation of findings was done in tables and graphs.

## CHAPTER ONE: INTRODUCTION

### 1.0 Background

Lengthy waiting time is one of the major causes of dissatisfaction among patients undergoing radiological examinations and remains an important indicator of quality of services offered by health facilities (Olisemeke et al.,2014).Waiting time in Radiology Department covers the time from when the patient reports to the radiology department reception area to the time the report is taken to the medical records for dispatch. Measure of waiting time can thus cover the time the patient is registered for the investigations, till the time the patient finally collects his/her diagnostic report for prognostic or further investigation(Nwobi et al., 2014).

KNH radiology service charter (2015-2016), indicates the turnaround time in terms of procedure time and waiting time equivalent to 24hrs for CT, 12 hours for Ultrasound and General radiography respectively. This is important because it guides the patient on the expected waiting time of each modality. The patient is any person often in need of treatment from medically educated or health care provider, and most important person in the entire hospital sets up(Yeddula, 2012).

It is the duty of the health care personnel to give special attention to the management of patient to enhance effective service delivery. Thus this is not only restricted to giving the appropriate treatment only but the patient's time must be respected as well(Nwobi et al., 2014).Turnaround time management can help in any situation where direction, strategy or a general change of the ways of working needs to be implemented to make the patient's journey more superior and seamless (Nuti&Vainieri, 2012).

High speed of advancement in technology makes radiology department a complex system to run (Nuti & Vainieri, 2012).Plus the requirements of evidence based care has made physicians to increasingly request for diagnostic imaging services. The available diagnostic services do not cover the demand from patients, thus causing waiting lists to be increasingly longer and patients to be highly unsatisfied(Little & Pritchard, 2013).

Thus, queuing remains one of the most common reasons for customer disgust during working hours in radiology department (Onwuzu et al.,2014).The radiology department performs

approximately 100, 000 examinations per year, mostly general radiographic examinations as well as CT scans and ultrasound examinations.

General radiography is responsible for all plain films work including chest, extremities, pelvic girdle and the skull(Nuti & Vainieri, 2012).it does not require appointments or patient preparation and patients are done on a prioritized demand basis. Waiting time is dependent on how busy the department is at the time of registration. At KNH Ultrasounds are usually booked dependent on the urgency of the examination. For examination done without booking the registration is dependent on the degree of urgency and need for preparation. Radiology ultrasound KNH covers 24 hours and the given booking period for the department is two weeks. In urgent cases the ultrasound waiting time may be influenced by the need of preparations.

In Computed Tomography biopsies can be performed in the scanner instead of the patient going to theatre for the operation(Onwuzu et al., 2014). Due to the magnitude of examinations performed the demand for the CT examinations are high and patients have to be scheduled. Some of the examinations require preparation. However for emergencies no patient preparation is needed, therefore examination time will be dependent on the need of preparation.

Hospital setup may also contribute to the patient waiting times. Some of the patients may require services not provided in the radiology department. KNH primary mandate is to provide specialized health-care services to patients on a referral basis, facilitate medical training and research and participates in national health-care policy planning. on average KNH has about 2000 in patients and attends to about 1500 outpatients on a daily basis(Ouko, 2012).

Therefore, determining the optimum waiting time for any given radiological examination is paramount in preventing the potential delay in diagnosis, treatment and disease outcome of the patient (Onwuzu et al., 2014). According to (Ouko 2012), some of the factors contributing to delays in other specialized areas could be traced from lack of enough staff, billing system breakdown, cases requiring further discussion or consultation, patient preparation for different modalities, counterchecking of the request form for justification of examination and lack of proper direction to the examination rooms.

### **1.1 Problem statement**

Kenyatta National Hospital operates in a dynamic environment. The external forces such as industrial unrest of the health workers hugely affect the patient flow to the hospital. Further, since KNH is at the apex of healthcare system in Kenya and across Eastern Africa, a huge number of patients tend to seek medical attention from the facility. In addition, accessibility, affordability and strategic location of the hospital play a key role in the high turnover of patients.

Towards this, there exist consistent complaints on services offered due to: long waiting times in CT, Ultrasound and general radiography as manifested in the complaints and complement register maintained by the department which is reviewed monthly by quality control committee. The long queues affect daily operations since the available tools of work are inadequate and overstretched leading to continuous breakdowns. Consequently, the available few staff are demotivated and overworked due to the huge numbers of patients and even time taken to complete report writing. The manual systems make the process slow and tedious since patients move back and forth so as meet the basic hospital requirements such as registration, payments and examination. According to (Yeddula, 2012), long waiting times appears to be the main challenge in efficient service delivery which in return address the patient expectations.

Therefore, this study aims to determine the factors contributing to waiting times among patients undergoing computerized tomography, ultrasonography and general radiography at the radiology department. It will also seek to recommend possible strategies to better service delivery to the citizens.

### **1.2 Rationale for the study**

Diagnostic imaging modalities are valuable tools for solving a variety of clinical problems and serve as a first-line diagnostic tool for determining further steps in the establishment of a diagnosis, treatment, and follow-up procedure(Nwobi et al., 2014). Nearly half of the patients seen at the emergency department require imaging and since decision-making in the emergency department rests heavily on image interpretation, delays can have serious consequences on the quality of service delivery (Nuti&Vainieri, 2012).There have been many studies that have investigated the factors that influence patient satisfaction in the health care setting. However, there is still limited

data related to the factors that may be important in an outpatient setting like radiology(Syed et al.,2013).

The purpose of this research is to determine the time taken by the patient from reporting to radiology department to the time they exit, identify the waiting times for the specific areas, factors contributing to these times and suggest possible solutions for the reduction of these times.

### **1.3 Broad Objectives**

To determine the factors contributing to patient waiting times for Ultrasound, CT and General radiography at the Radiology Department KNH

### **1.4 Specific objectives**

- a) To determine the time taken in CT, Ultrasound and General examination in radiology department
- b) To determine factors that contribute to patient waiting times in CT, Ultrasound and general radiography examinations in the radiology department
- c) To determine patient flow for CT, ultrasound and general radiography.



## CHAPTER TWO: LITERATURE REVIEW

### 2.0 Waiting times

Patient waiting times is one of the critical issues that have been raised in numerous health care reports and most pressing policy issues affecting the health care system (Onwuzu et al., 2014).As far as 2004, federal throne speech, the government stated that ‘the length of waiting times for the most important diagnosis and treatments is a litmus test of our health care system and these waiting times must be reduced .Furthermore, in a more competitive health market, increased patients time decreases patient’s willingness to return.

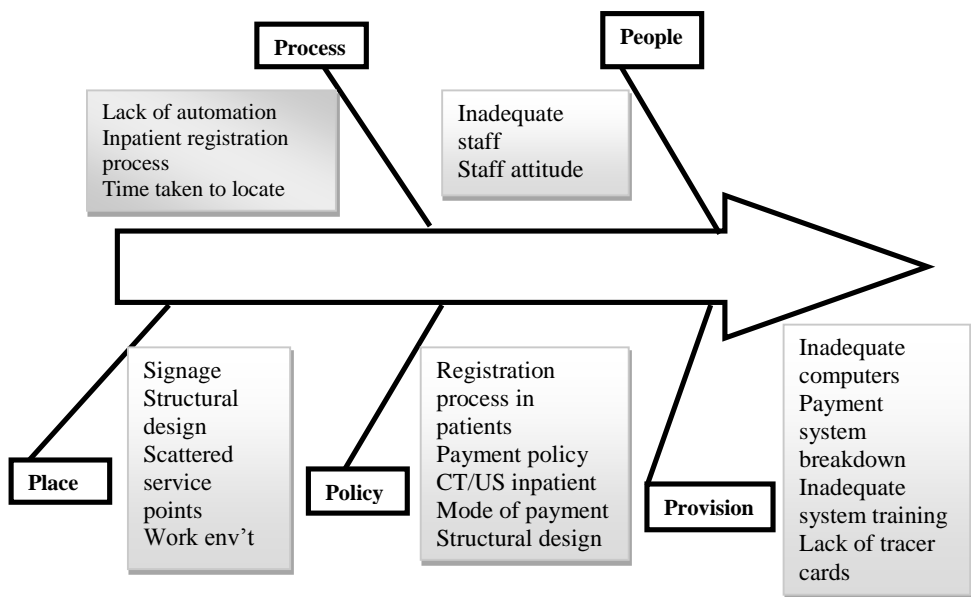
There are no standard or universally accepted definitions of waiting times, depending on the definition used estimates of wait times may vary significantly(Syed et al., 2013). Patient waiting time in the radiology department was a total period of time a patient spends to obtain radiologic services. This covers from the time the patient was registered for investigations till the time the patient finally collects their diagnostic report for prognostic or further investigations (Nwobi et al., 2014).Hence, Long wait times limit the ability to provide the right care at the right time and are commonly products of inefficient workflow. Patient satisfaction is an important metric for health care improvement.

The KNH Performance audit report of the specialized healthcare delivery highlighted the effects of long delays in delivery to long waiting times before the examinations are performed which prolong suffering, heighten anxiety of the sick and increase the risk of failure of any belated treatment that may eventually be provided to them (Ouko, 2012). The report also highlighted the reasons for delays in delivery of the specialized services to; Lack of sufficient numbers to cater for the very large number of patients who come to the radiology department, lack of medical equipment’s, weak management information system and ineffective revenue management practices which hinder timely delivery of services. In addition, efficiency standards and guidelines on the Hospital’s key operations are not fully developed and among the missing operational standards are those on waiting-time (Ouko, 2012).

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The below cause and effect diagram shows the relationship of causes of Increased waiting time.

**Figure1: Root Cause Analysis**



On the other hand, Radiology Department have a patient charter describing the patient waiting time for different modalities. However, at a point in time the waiting times for the examination have been long than what is stated on the service charter. Factors contributing to delays have been workload, billing system breakdown, cases requiring further discussion or consultation, patient preparation for different modalities, cost implication and lack of proper direction to the examination rooms. Therefore, probing most previous studies done on factors affecting patient's satisfaction revolve in health care services and mostly on time spent in the department (Onwuzu et al., 2014).

According to Nwobi et al., (2014), a study done in Nigeria found that the registration process significantly took 1 hour and affected the time the patient spent in radiology department. This included the time the patient took to queue at the cashier point in designated area in the hospital

and take the receipt back to the radiology reception area for registration. Therefore, time could be saved by availing a cash point in the radiology department. Onwuzu et al., 2014, supported the study by emphasizing the need of reviewing the department registration process to assist in reduction of lengthy time spent by patients thus improving service delivery. This is because most of the time was wasted on billing and registration of the patient before the examination.

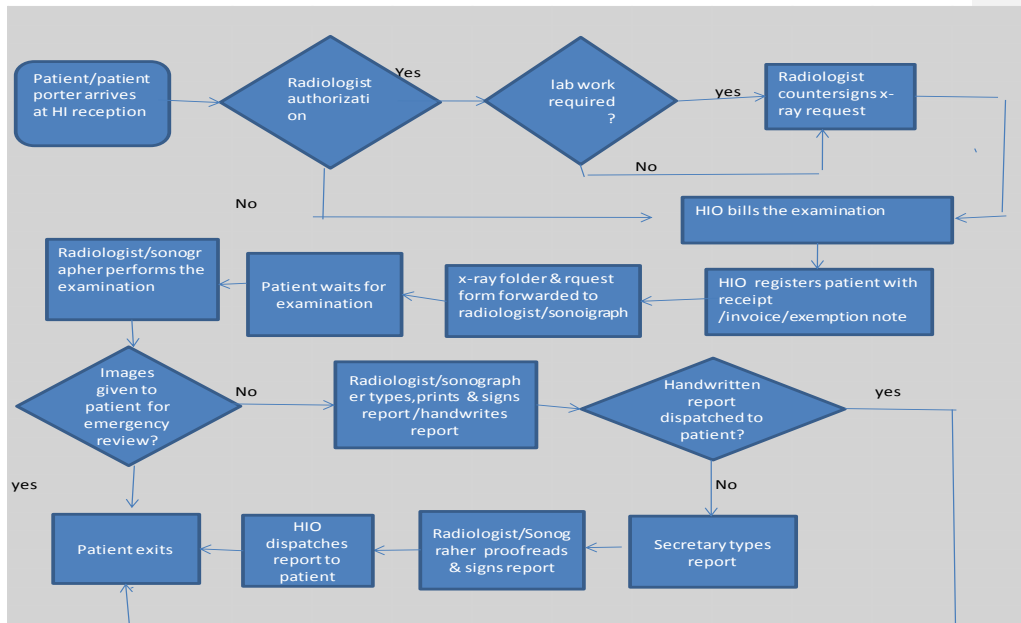
### **2.1 Improving patient flow in and out of radiology department**

In radiology department different patients require different imaging modalities. Patient flow represents the ability of the department to serve patients quickly and efficiently as they move through the sections in the department. Blockage in the flow can increase waiting time (Wagner et al., 2010). When patient flow is handled well it is represented by short waiting time at registration, waiting area, examination and discharge. In addition, physical accessibility is an important factor for optimizing patient flow and to achieve that controlling movement in terms of the number of changes in direction needed to access different service points is paramount. Thus improving patient flow is one way of improving operational efficiency in the radiology department (Conrad, 2013)

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Although the flow may seem simple, it is complex in its procedure which makes it's hard to identify appropriate interventions. Smoothing the flow of patients in and out of radiology department can reduce overcrowding and avoid delays(Gunn et al., 2013).

Current patient registration flow chart at the radiology health information desk



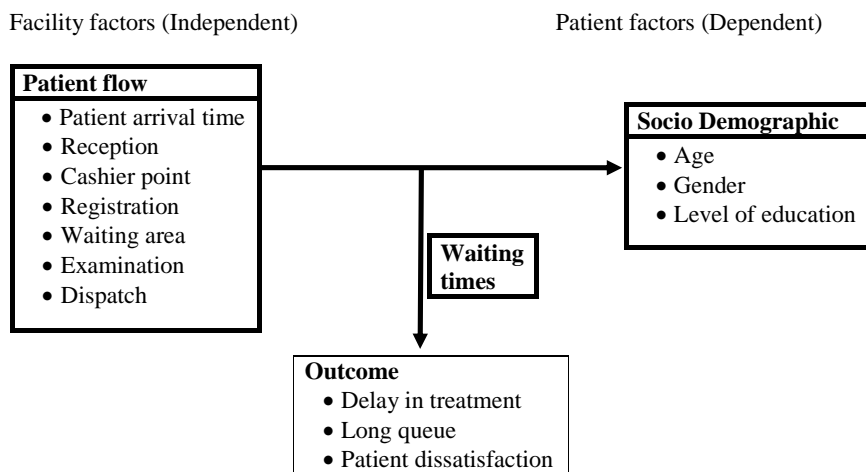
**Source: KNH, 2018**

In addition, Optimizing patient flow is part of a series of innovative programs in hospitals to improve the care provided to patients, which can assist in tracking progress to improve patient satisfaction (Nuti&Vainieri, 2012).With the current access to National Hospital insurance fund (NHIF) gazette on 24<sup>th</sup> march 2016, the situation may worsen as many people gain access to insurance coverage and care. Therefore, the hospital must pursue strategies to improve patient flow such as queuing theory.

Queuing theory is a management system tool used to control queues and is extremely useful in predicting and evaluating system performance(Randolph, 2013). Its application has been used widely from supermarkets, health services to telecommunications but the challenge is the cost implication involved such as redesigning the waiting areas and software upgrade. With the queuing systems one can view the healthcare processes that these organizations provide as in which patients

arrive, wait for service, obtain service, and then depart. Milliken et al., (2016), also emphasized that best practices could also include the use of modern queuing methods, and other methods to improve the flow of appropriately queued patients into the system for enhancing information technology. This is because clinical guidelines on time management, building capacity and best practices are critical for better managing patient waiting time. This study seeks to generate baseline data and identify gaps on waiting times for the services in order to improve patient's satisfaction which is also fundamental within the service delivery process. Below is a conceptual framework showing the relationship between the factors associated with patient waiting times undergoing CT, Ultrasound and General examinations.

**Figure 3: Conceptual Framework**



**Facility factors:** These are essential points within the hospital structures that patients go through in the process of accessing treatment.

**Patient factors:** Routine patient evaluation includes patient age, gender and education level which are important to consider as their expectations and desires will significantly affect the management plan.

## CHAPTER THREE: RESEARCH METHODOLOGY

### 3.0 Study design

This was a longitudinal type of study design conducted to determine waiting times for CT, Ultrasound, General examination services at the Radiology Department, Kenyatta National Hospital

### 3.1 Study area description

The study was conducted at the Radiology Department of KNH. The largest Referral Hospital in East and Central Africa. The radiology department is a section under the division of Diagnostic services. It offers specialized diagnostic imaging services that include fluoroscopy, portable Radiography, Computerized Tomography, Mammography, ultrasonography, Magnetic resonance imaging as well as general examinations. The radiology health information section statistics show that the annual examinations performed for CT, Ultrasound and general are 12,474, 20,637 and 51,283 respectively.

### 3.2 Study population

The study population were all adults patients referred from the outpatient clinics for radiological services at KNH in CT scan, Ultrasound & General Radiography during this period of three months from 1<sup>st</sup> July 2018 to 30th September, 2018.

### 3.3 Sample size determination and formula used

Radiology Department records a population of 20,637, 12,474 and 51,283 patients per year respectively in Ultrasound, CT scan and general radiography. The sample size was calculated using fisher's et al (1998) formula for calculating sample size for descriptive study design

$$n = \frac{Z^2 * (p) * (1-p)}{C^2 c^2} = \frac{Z^2 pq}{C^2 c^2} \quad q=1-p$$

Where:

Z = Z value standard deviation of required confidence level (1.96 for 95% confidence level)

p = proportion of target population estimated at 0.5 (0.5 used for sample size needed maximum variability)

c = confidence interval (5%)

Therefore the sample size  $n = \frac{(1.96)^2 \times 0.5 \times 0.5}{$

a.  $(0.05)^2$

b.  $= (3.8416 \times 0.25) / 0.0025 = 385$  patients for each modality

To account for non-response, 10% of the calculated sample size was computed to make a total of 423 participants in each modality CT, Ultrasound and General examination respectively adding to 1269 sample size in total. However due to financial constraints only half of the total sample size of 634 participants were recruited. Out of the 634 recruited only 596 were analyzed, 38 questionnaires were incomplete.

### **3.4 Sampling**

Simple random sampling was employed to select participants. Every patient that came to the department Monday to Friday 8am to 5pm was enrolled in the study until the required sample size was obtained. This randomization approach was appropriate because patients visit the facility at different times, without scheduled appointments and therefore it was feasible to achieve the sample size required. Randomization also reduced biasness and minimized the effect of confounders. Sampling was done separately for each of the 3 modalities. Data was collected from 1st July 2018 to 30th September, 2018.

### **3.5 Study variables**

Waiting time was the dependent variable while factors influencing waiting time for CT, ultrasound and general examinations as the independent variables. Some of the Independent variables were personnel, equipment, and patient flow.

### **3.6 Inclusion criteria**

The study included all adults 18 years and above who were referred from outpatient clinics for radiological studies in CT, Ultrasound & General and who agreed to sign the informed consent.

### **3.7 Exclusion criteria**

Adult patient who refused to consent.

### **3.8 Data collection methods**

A structured questionnaire (see Appendix 2) was administered by research assistant to collect quantitative data for the period of study. The questionnaire assessed the socio demographic data, recorded the x-ray number, type of examination, examination room, examination time and exit time. The research assistant at the registration area numbered the request forms as submitted by the patient. Numbers were used in place of names. Lockable cupboards were accessible to the researcher and research assistant.

The research assistant took the patient through the process of consenting and filling the questionnaire. The research assistant was recruited on the basis of qualification. She/he must have had completed form four education with English proficiency and good communication skills. The research assistants were trained for a day by the researcher on the data collection tool and how to administer the tool. The assistants guided by the researcher participated in the selection of participants, requested consent, allocated serial numbers on the questionnaire, then recorded the socio-demographic data of the participant selected, and then tracked the participants through the service points while recording the actual waiting time on the tool.

A pilot study was performed prior to the study to check on the validity of the tool. Internal validity was ensured through random selection of the participants while external validity was ensured by pre-testing and correcting the questionnaire.

#### **3.8.1 Data Analysis and management**

The filled questionnaires were checked daily by the researcher to ensure completeness. Data generated was entered and analyzed using statistical package SPSS version 22. The descriptive characteristics of the patients was presented as means, medians and percentages for continuous and categorical variables respectively. Waiting time was analyzed by computing time differences at various service points and presented as means with standard deviations. Comparisons across the three study groups was done using Logistic regression which was used to describe data and to explain the relationship between waiting time and slow systems, long queues and few staff. A Process Map/Flow Chart was used to show description and sequence of the process sections, and



a cause and Effect Diagram was also used to show the relationship between waiting times. Data was presented in form of text, tables, graphs and figures.

The results of the study was presented as a dissertation to the UoN library for reference, a summary report to the radiology and research departments KNH with recommendation's for improvement.

### 3.9 Ethical considerations

Written Consent was obtained from the patient after explanation by the research assistant into the study. It was voluntarily and participants were informed of no monetary gain towards participating in the study. Further, Ethical approval reference KNH-ERC/A/111 (Appendix 1) was obtained from Kenyatta National Hospital University of Nairobi Ethics and Research committee (KNH/UoN-ERC) to which this proposal was submitted. Information collected for this research was treated with utmost confidentiality and study participant were at all times treated with respect during data collection. The information gathered was used solely for the study and at no times was the patient's names used. X-ray number were used at all times as unique identifiers. No direct benefit from this study would be gained by the researcher.

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## CHAPTER FOUR: RESULTS

### 4.0 Introduction

A total of 596 patient forms were extracted from the health records, data entered and analyzed using SPSS version 22. The study revealed that 67.3% (n=401) of the participants were females with 32.7% (n=195) males with participant age reported as Mean± SD of 40.34±17.64 ranging from 18 to 95 years. Most (45.1%, n=269) were tertiary level holders i.e. college level of education and above, followed by 34.4% (n=205) secondary and 11.6% (n=69) primary.

### 4.1 Demographic characteristics

**Table 1: Respondent Demographic characteristics**

Parameter	Frequency (n)	Percent (%)
<b>Gender</b>		
Male	195	32.7
Female	401	67.3
<b>Age in years</b>		
=< 20	84	14.1
21 – 30	125	21.0
31 – 40	133	22.3
41 – 50	89	14.9
>50	165	27.7
<b>Level of education</b>		
Primary	69	11.6
Secondary	205	34.4
Tertiary	269	45.1
None	53	8.9

Table 1 above illustrates participant characteristics. Two thirds of the study participants were females with a third indicating males. Over a quarter of the participants (27.7%, n=165) were more than fifty (50) years old, followed by 22.3% (n=133) aged between 31 to 40 years, 21% (n=125) aged between 21 to 30 years, 14.9% (n=89) aged between 41 to 50 years and 14.1% (n=84) aged

below 20 years with a median (IQR) of 35.5(25-53) years. Majority of the participants (45.1%, n=269) were tertiary level holders, followed by 34.4% (n=205) secondary, 11.6% (n=69) primary with less than a tenth (8.9%, n=53) having attended no informal education.

#### 4.1.1 Bivariate Analysis

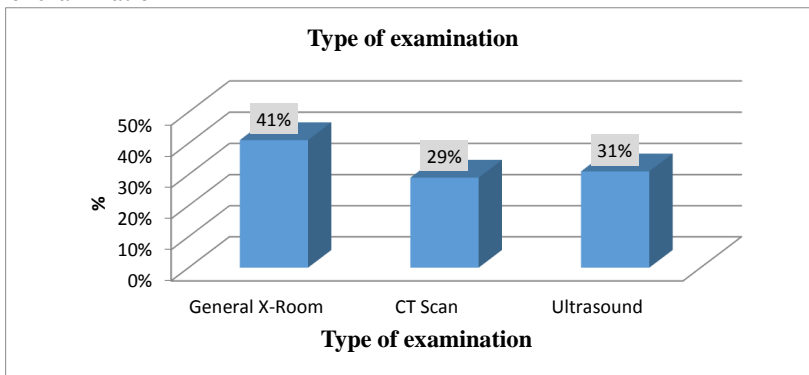
Bivariate analysis is the simultaneous analysis of two variables (attributes). It explores the concept of relationship between two variables, whether there exists an association and the strength of this association, or whether there are differences between two variables and the significance of these differences. Table below illustrates bivariate analysis

**Table 2: Bivariate analysis**

Variable		Age	Education level	Gender
Age	Pearson Correlation	1	-.154**	-.056
	Sig. (2-tailed)		.000	.171
Education level	Pearson Correlation	-.154**	1	.040
	Sig. (2-tailed)	.000		.328
Gender	Pearson Correlation	-.056	.040	1
	Sig. (2-tailed)	.171	.328	

Correlations were computed for Age, Education level and gender. The results suggest that 1 (education level) out of 3 correlations was statistically significant and was equal to  $r(-.154)$ ,  $p < 0.05$ . The correlations of age and gender concept measures were not significant.

#### 4.2 Type of examination



**Figure 4: Type of examination requested**

According to the study findings, 40.8% (n=243) of the patient examination requested was ultrasound, followed by 30.7% (n=183) general X-Ray and 28.5% (n=170) CT scan. There exists a clear indication that most of the patients requested ultrasound

**4.3 Type of examination done**

**Table 3: Type of examination done**

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Type of examination done	Frequency (n)	Percent (%)
Upper extremity	23	3.9
Lower extremity	78	13.1
Pelvis	54	9.1
Chest	132	22.1
Obstetrics	133	22.3
Spine	28	4.7
Neck	17	2.9
Abdomen	72	12.1
Skull	66	11.1
Pelvic	11	1.8
Angiograms	9	1.5

Out of the 596 patients, 22.3% (n=133) had obstetrics scan done, followed by 22.1% (n=132) chest examinations, 13.1% (n=78) lower extremity, 12.1% (n=72) abdomen examination with 1.5 % (n=9) angiograms. A portion (4.5%, n=27) underwent multiple examination which included more than one type of examination. Most of the participants (84.6%, n=504) did not require prior examination preparation with 15.4% (n=92) prepared before the examination was undertaken. There exists a clear indication that most of the patients requested ultrasound scans.

**4.4 Time taken at various service points**

Time taken at key service points such as registration point, cash point, waiting bay, examination time, report writing was determined. Time differences were summarized below.

#### 4.4.1 Registration time

Time taken for registration to be done was reported as Mean±SD of 22.93±12.35 ranging from 0 to 59 minutes with Median (IQR) of 23.0(15-30).

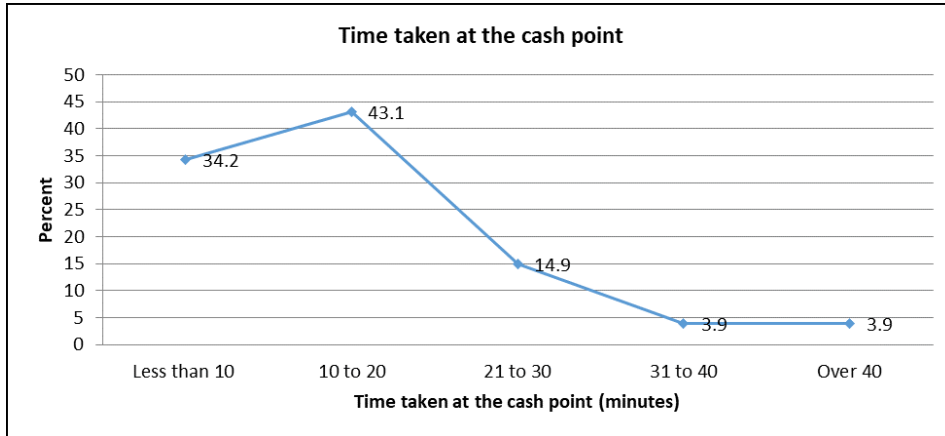
**Table 4: Registration time**

Service Delivery Charter Time	Frequency (n)	Percent (%)
Less than 10	74	12.4
10 to 20	221	37.1
21 to 30	166	27.9
31 to 40	92	15.4
Over 40	43	7.2
<b>Reasons for delay</b>		
Less than 30	461	77.3
Long queues	110	18.5
Slow computer systems	13	2.2
Inadequate personnel	12	2

Most of the participants took between 10 to 20 minutes(37.1%, n=221) for registration to be completed, followed by 21 to 30 minutes representing 27.9% (n=166), 15.4% (n=92) taking half an hour to 40 minutes, 12.4% (n=74) taking less than 10 minutes with less than 10% taking over 40 minutes. Further analysis indicated that 77.3% (n=461) took less than 30 minutes at the registration point with minimal or no delays. However, 18.5% (n=110) highlighted long queues, 2.2% (n=13) slow computer systems and 2% (n=12) indicating presence of inadequate personnel in the registration desk as reasons for delayed in registration.

#### 4.4.2 Time taken at the cash point

Figure 2 below illustrates time taken at the cash point. 43.1% (n=257) took between 10 to 20 minutes, followed by less than ten minutes 34.2% (n=204), 14.9% (n=89) taking 21 to 30 minutes and 3.9% (n=23) taking either half an hour to 40 minutes or over 40 minutes. According to the Radiology Service Delivery Charter, time taken at the cash point should be 30 minutes. Therefore a higher proportion of the participants received cash point services on a timely manner (550, 92.2%) with less than a tenth (7.8%, n=46) taking more than the stipulated service timelines.



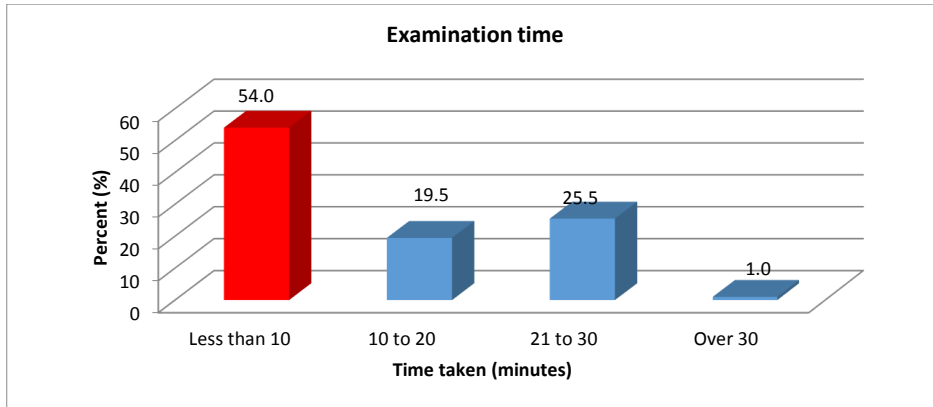
**Figure 5: Time taken at the cash point**

**4.4.3 Waiting time – registration and waiting bay**

Time spent at the registration area was reported as Mean±SD of 10.12±12.35 ranging from 0 to 166 minutes (2hr 46min) with Median(IQR) of 8(2-15). Of the participants 579 (97.1%) did not indicate reasons for delay with 2.9% (n=17) indicating that delays were due to: 2.2% (n=13) long queues and 0.7% (n=4) few staff to attend to patients. Time spent at the waiting area was reported as mean (SD) of 116.6 ± 101.4 minutes with a minimum and a maximum of 3 and 519 minutes respectively.

**4.4.4 Examination time**

Examination time was reported as Mean (SD) of 13.5 ± 10.5 minutes with a minimum of 2 minutes and a maximum of 41 minutes. Over half of the patients took less than 10 minutes for examination to be done, followed by 21 to 30 minutes (25.5%, n=152), 19.5% (n=116) taking 10 to 20 minutes and less than a fifth (1%, n=6) taking over half an hour as shown in figure 5 below.



**Figure 6: Examination time**

Of the study participants 41.8% (n=249) indicated that it took long due to long queues, 7.7% (n=46) stating either lack of proper direction to examination room or few staff, 1.7% (10) change of shift, 1.5% (n=9) multiple examination, 0.3% (n=2) poor patient preparation prior to the examination with 39.3% (n=234) having not indicated any complain of examination time.

#### 4.4.5 Time taken for handwritten report

Time taken for handwritten report was reported as Mean (SD) of 15.9(34.5) minutes ranging from immediate to 209.75 hours. Table 5 below illustrates time taken to finalize handwritten report.

**Table 5: Time taken for handwritten report**

Time taken in hour (s)	Freq. (n)	Percent (%)
Less than 1hr	28	15.6
1 to 2	57	31.8
2 to 3	28	15.6
Over 3	66	36.9

#### 4.4.6 Time taken for report typing

Time taken for handwritten report to be typed was reported as Mean (SD) of 230.1(573.3) minutes ranging from immediate to 5,571 minutes. Table 6 below illustrates time taken to finalize handwritten report.

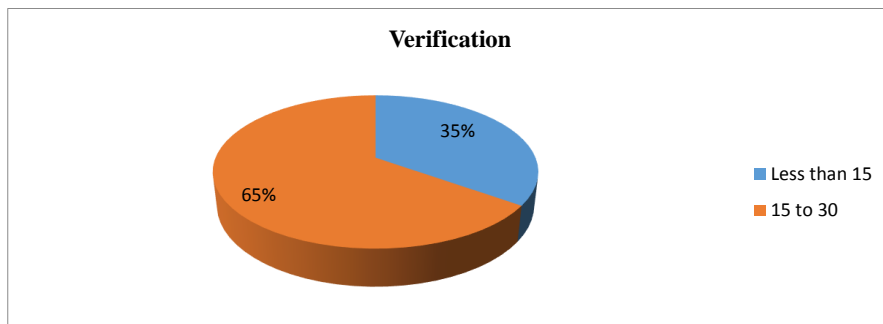
**Table 6: Time taken for report typing**

Time in hour (s)	Freq.	Percent (%)
Less than 0.5	12	7.9
0.5 to 1	26	17.2
1 to 1.5	26	17.2
1.5 to 2	13	8.6
Over 2	74	49.0

Of the 596 patients, 151 (25.3%) required report typing. Almost half of the patients reports took over 2 hours, followed by either half an hour or 1 to 1.5 hours 17.2% (n=26), 8.6% (n=13) 1.5 hours to 2 hours and less than a tenth (7.9%, n=12) taking less than 0.5 hours.

#### 4.4.7 Verification time

Verification time was reported as  $18.71 \pm 3.54$  with a median (IQR) of 20(15, 20) minutes ranging from 10 to 25 minutes. More than half of the reports (65%, n=43) were verified between 15-30 minutes and 35% (n=23) were verified between 0 to 15 minutes with most (85 of 151) of the reports not requiring any verification after typing.



**Figure 7: Verification time**

#### 4.4.8 Correction time

Of the 66 reports which required verification, 30.2% (n=20) required correction. Correction time was reported as  $323.1 \pm 605.7$  with a median (IQR) of 107(34.8, 370.1) minutes ranging from 4 to



2,578 minutes. Most (35%, n=7) of the reports requiring corrections took less than an hour for corrections to be done, followed by 30% (n=6) taking over 3 hours, 2 to 3 hours 20% (n=4) taking 1 to 2 hours and 15% (n=3) taking 1 to 2 hours.

**Table 7: Correction time**

<b>Time in hour (s)</b>	<b>Freq. (n)</b>	<b>Percent (%)</b>
Less than 1	7	35
1 to 2	3	15
2 to 3	4	20
Over 3	6	30

**4.4.9 Countersigning time**

Time take for countersigning corrected reports took an overall time of 18.75 with a median of 15 ranging from 5 to 70 minutes. According to the study findings, 40% took 10 to 20 minutes, followed by 25% (n=5) taking 20 to 30 minutes, 20% (n=4) taking less than 10 minutes and 15% (n=3) taking over 30 minutes.

**Table 8: Countersigning time**

<b>Time in minute (s)</b>	<b>Freq. (n)</b>	<b>Percent (%)</b>
Less than 10	4	20
10 to 20	8	40
20 to 30	5	25
Over 30	3	15

**4.4.10 Return to typing area time**

Of the 151 reports requiring typing, most of the reports (59.6%, n=90) took between 10 to 30 minutes to be returned to the typing area, followed by 37.1% (n=56) less than 10 minutes, 2.6% (n=4) taking thirty to sixty minutes and 0.7% (n=1) taking over 60 minutes.

**Table 9: Return to typing area time**

<b>Time in minute(s)</b>	<b>Freq. (n)</b>	<b>Percent (%)</b>
Less than 10	56	37.1
10 to 30	90	59.6
30 to 60	4	2.6
Over 60	1	0.7

#### 4.4.11 Dispatch time

According to study findings, dispatch time was reported as Mean (SD) of 10.1(8.4) ranging from 2 to 58 with a Median (IQR) of 8(5-12) minutes. Figure 5 below illustrates distribution of dispatch time in minutes.

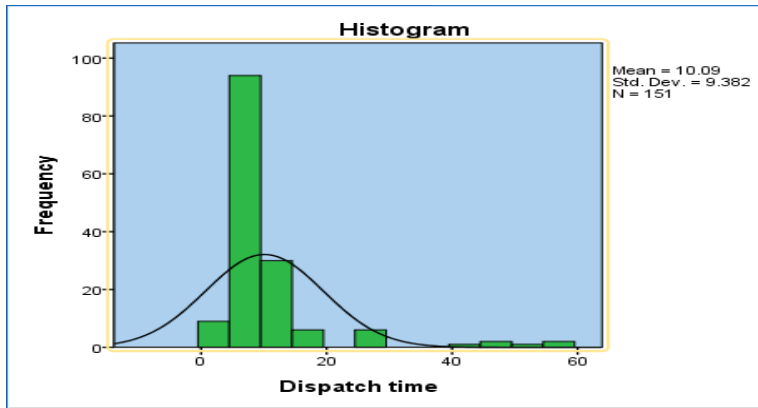


Figure 8: Dispatch time

#### 4.5 Radiology Turnaround time

The overall time taken to receive services at the radiology department which takes cognizance of CT Scan time, Ultrasound and General radiological services had a mean  $\pm$  SD of 458.6  $\pm$  1,412.0 minutes ranging from 49 to 17,139 minutes(285 hours) equivalent to 11 days with a median (IQR) of 203(134, 320) minutes. Notably, 41.1% (n=245) took over 4 hours, followed by 22.8% (n=136) 2 to 3 hours, 18.6% (n=111) taking 1 to 2 hours, 16.8% (n=100) 3 to 4 hours and 0.7% (n=4) taking less than 1 hour.

Table 10: Radiology Turnaround time

Time in hours	Frequency	Percent
Less than 1 hour	4	0.7
1 to 2 hours	111	18.6
2 to 3 hours	136	22.8
3 to 4 hours	100	16.8
Over 4 hours	245	41.1

The outcome variable which is the time taken from registration at the entry point to exiting from the department. The overall time taken per category was reported as: CT scan turnaround time was reported as Mean (SD) of 932.99(2476.4) ranging from 55min (less than an hour) to 17,139 minutes (285.7hrs) equivalent to 11 days; Ultrasound turnaround time was further reported as Mean (SD) of 205.4(101.3) ranging from 70min (1hr 10min) to 491 minutes (8hrs) and general turnaround time was reported as a Mean (SD) of 317.5(620) ranging from 49min (less than an hour) to 7,075 minutes (117.9hrs) equivalent to 5 days.

#### 4.6 Factors contribution to delays

According to the study, three key factors contributing to radiology turnaround time were obtained. Towards this, long queues, few staff and slow systems were identified and analyzed as shown in table 11 below.

**Table 11: Factors contributing to delays**

Variable	Reasons for increased TAT			Chi-Square	P-Value
	Long Queues	Few staff	Slow systems		
<b>Gender condition</b>				12.464	0.0143
Male	21(22.1%)	33(34.7%)	41(43.2%)		
Female	2(16.7%)	6(50%)	4(33.3%)		
<b>Age in years</b>				0.3148	0.0514
=< 20	5(83.3%)	1(16.7%)	-		
21 – 30	13(76.5%)	2(11.8%)	2(11.8%)		
31 – 40	1(10%)	4(40%)	5(50%)		
41 – 50	5(55.6%)	3(33.3%)	1(11.1%)		
>50	4(80%)	0(0%)	1(20%)		
<b>Level of education</b>				0.9759	0.315
Primary	194(84.3%)	16(7%)	20(8.7%)		
Secondary	166(94.9%)	5(2.9%)	4(2.3%)		
Tertiary	101(53.2%)	77(40.5%)	12(6.3%)		
None					
<b>Type of examination</b>				95.5364	0.01415

CT	77(45%)	89(52%)	5(2.9%)		
Ultrasound	14(6.4%)	111(50.7%)	94(42.9%)		
General	66(27.8%)	37(15.6%)	134(56.5%)		
<b>Overall TAT</b>				9.142	0.533
1 to 2 hours	45(47.4%)	33(34.7%)	17(17.9%)		
2 to 3 hours	60(44.1%)	51(37.5%)	25(18.4%)		
3 to 4 hours	45(45%)	33(33%)	22(22%)		
Over 4 hours	103(53.1%)	33(17%)	58(29.9%)		

\*\*\*P-Value 0.05 statistically significant

Results indicate a significant association between gender and reasons for increased TAT (X<sup>2</sup> 12.464, P-Value of 0.0143) with most of the females (33.3%, n=4) indicating that the systems were slow and 43.2% (n=41) indicating the similar challenge faced. The increased turnaround time between male and female can be attributed to female preparation examinations conditions prior to the procedure. Over the study period, participants age significantly indicates that there exist an association with reasons for delay (X<sup>2</sup>-0.3148, p=.005). Similarly, level of education is statistically insignificant (X<sup>2</sup>-0.3148, p=.315) hence we can conclude that respondent level of education has no relation with reasons for delay.

Patients undergoing any of the three types of examination (CT, Ultrasound and General) at the radiology department reported long queues (at the CT scan (77, 45%), few staff ultrasound (50.7%, n=111) and 56.5% (n=134) slow systems (X<sup>2</sup>-95.5364, p=.01415). The percentage of participant's overall TAT did not differ by reasons for delay (X<sup>2</sup>-9.142, p=.0533).

The gender, age and type of examination of the respondents and reasons for increased turnaround time was found to be significant (P<0.05) while level of education and overall turnaround time was not significantly associated.

**Table 12: Logistic regression of factors contributing to departmental turnaround time**

Variables	Odds Ratio	Std. Err.	Z	P-value	[95% Conf. Interval]	
					Lower	Upper
<b>Age in years</b>						
=< 20	1					
21 – 30	0.56	0.32	-1.01	0.31	0.18	1.73
31 – 40	1.80	1.21	0.88	0.38	0.48	6.71
41 – 50	1.37	1.24	0.34	0.73	0.23	8.10
>50						
<b>Type of examination</b>	1.39	0.79	0.57	0.57	0.45	4.22
<b>Overall TAT</b>	1.04	0.79	0.06	0.96	0.24	4.58
<b>Gender</b>						
Male	12.67	7.00	4.6	0.001*	4.23	37.42
Female	81.29	64.60	5.53	0.001*	17.12	385.90

The variables which were noted to be significant associated to turnaround time were taken to logistic regression. Table 10 above shows the results of logistic regression. The results indicate that male will significantly contribute to departmental turnaround time by 12.67 times (95% CI 4.23 to 37.42). Similarly, if females have a high association by 81.3 times (95% C.I: 17.1 to 385.9). The older the respondent, the higher the likelihood of contribution to turnaround time. Type of examination and overall turnaround time was also reported to be not significantly associated to turnaround time.

## CHAPTER FIVE: DISCUSSION

### 5.0 Introduction

This chapter discusses the results of the research findings. It also makes conclusions and recommendations based on findings of the study. The recommendations encompass findings based on the study objectives.

### 5.1 Discussion

#### 5.1.2. Demographic Characteristics

A total of 596 patient forms were extracted, data entered, cleaned and analyzed. Of the study participants 67.3% (n=401) were females and 32.7% (n=195) males with age reported as Mean  $\pm$  SD of 40.34  $\pm$  17.64 minutes ranging from 18 to 95 years. Findings revealed that most female participants majorly requested obstetrics ultrasound. Other studies have shown that female patients are more satisfied with health services than males. Umar et al., (2011) also supports this result stating that females are ready to attend clinics than males and easy to participate in any survey. Most of the respondents were tertiary level holders (45.1%, n=269) indicating that most of participants were enlightened.

#### 5.1.3. To determine the time taken in CT, Ultrasound and general examination in radiology department

In CT room the most time spent was during radiologist handwritten report with Mean  $\pm$  SD of 955.6  $\pm$  2067.7 minutes ranging from immediate to 12,585 minutes(209.5 hours)and in general room during report typing with Mean  $\pm$  SD of 230.1  $\pm$  573.3 minutes ranging from immediate to 5,571 minutes(92.85 hrs) respectively. In our setup the number of volumes of radiology work versus the number of radiologist is overwhelming. This is because most of the radiologist have other managerial duties to attend apart from radiology work. Other studies have also shown that delay in reporting works is as a result of lack of professional resources, high volumes of the diagnostic imaging services delivered versus the number of examinations per radiologist (Nuti&Vainieri, 2012). This in many countries has led to inefficiency and long waiting time in radiology department.

In addition, abdominal CT scans examination were the most common done in CT room with 12.1%. This is in agreement with (Chin et al., 2012), that abdomen pains present diagnostic challenges to the physicians and hence there has been an increasing demand on the reliance of CT

abdomen. In Ultrasound the most time spent was at the waiting area with mean (SD) 116.6± 101.4 minutes with a minimum and a maximum of 3 minutes and 519 minutes (8.65 hrs) respectively. Majority of ultrasound examinations were obstetrics ultrasound n=133 which required prior examination preparation of full bladder which took at least 2 hours. These findings compare to studies done both in developed and developing countries. In Malaysia, the average waiting time before examination is 4 to 5 hours. In USA, average waiting area of about 60 min was found in Atlanta and average of 188 minutes (3.13 hrs) in Michigan. In Nigeria average waiting time of about 173 minutes (2.8hrs) was found in Ibadan teaching university hospital. Other studies in Trinidad and Tobago recorded waiting time of 160 minutes (2.66 hrs). Hence majority of the patients spent 2-4 hours in the department before examination (Shahzadi & Annayat, 2017).

Both in our setup and others it has been proved that general radiography are the majority examinations done in any radiology department. Majority of the patients who come to hospital have been proved worldwide to have either limb trauma or chest diseases (Hanson & Honey, 2011). This is also demonstrated on the study findings with chest examination leading at 22.1% and lower extremities following with 13.1%.

Long waiting times in various service points are among the key challenges patients face while seeking services in developing countries (Pract, 2012). Further, Shortage of healthcare providers below the Institute of Medicine (IOM) recommendation is bottleneck to seamless provision of services (Borders LM, 2015). A research conducted by, Pract 2012 also showed that at least 90% of patients should be seen or examined within 30 minutes of their scheduled time

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According to the findings, there exists a statistical significant association between type of examination and reasons for increased turnaround time with  $p < 0.05$ . This is because most of the patients who underwent ultrasound and CT examinations required patient preparations prior to the examination which lead to increased turnaround time.

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#### **5.1.4. To determine factors that contributes to patient waiting times in CT, Ultrasound and general examination in the radiology department**

According to the study findings, there exist three significant contributors to the departmental turnaround time long queues, few personnel and slow systems. Long queues had the highest

Percentage of delay with the highest (n=77) 45.3% in CT examination room. The queuing problem could be as a result of patients attended to by staff in a disorganized manner. The patient are not attended to in the order that they arrive at the service point. This has a large effect on individual patient waiting times. All patients booked for 8 o'clock irrespective of the numbers for the day and limited no of equipment.

Long queue delays could also be as a result of batching of patient records. Batching leads to crowds of patients and disorganization of patients thus increasing individual waiting times. Due to the nature of the patient flow records, it is imperative that the shift design takes into consideration the large numbers expected during the early hours of the day. This is in line with staff allocation since the staffs are overwhelmed in the mornings but fairly redundant in the afternoons (Wagner et al., 2010)thus need to make real time decisions when need arises so as to meet customer needs by allocation of adequate personnel.

The long queues could also be explained by the flow problems such as delay in service points.as a result of system delays or manual process at some point. This is explained by the study findings where time taken at the cash point, waiting area and examination reported the highest complains of delay due to long queues. Respondents further reiterated that long queues, lack of directions as reasons as to why it took longer than expected. The staff were available to see patients but the patients were delayed at the registration desk and other service points due to either computer failures or shortage of staffs. The measure of delay based on radiology charter 2015-2016 also supported the findings.

Moreover, most of the delays were also recorded by patients using NHIF payment. The process is tedious and the patient have to wait for long before approval is provided especially in CT and Ultrasound examinations. The department ought to redesign patient flow process for seamless, effective and timely flow of activities. Long queues could also be attributed to back and forth movements due to lack of an efficient flow design. In addition, adoption of radiology dashboard will ease congestion since the system will align process and adhere to first come first served approach. Due to few personnel at the service points, patients tend to take more time in order to be attended to. Other studies (Conrad, 2013), have also shown that long queues are the main cause



of delays in any outpatients clinic thus improving long queues is one way of improving patient flow.

#### **5.1.5. To determine patient flow for CT, ultrasound and General radiography.**

Patient flow represents the ability of the healthcare system to serve the patient quickly and efficiently as they move through the service processes. Any blockage or delay in the process can cause long waiting time. When patient flow is handled effectively there is less waiting areas in all the service points. Radiology operational areas physical design greatly affects waiting time. This involves clear directions in various service points, alternative routes availability and visibility of the service points (Jamjoom et al., 2014). Therefore, clear signage for the service points and rooms could improve the flow of the patient in the department.

From the study findings, there was also a statistically significant difference in mean in age, education and overall time spent of varied levels ( $p < 0.001$ ). The older the respondent, the higher the likelihood of contribution to turnaround time. The result showed that patients without any form of education took the longest time at the department, whereas the highly educated took the least time. This could be as a result of poor visibility of the service points and due to illiteracy limitations to read the direction (Erhun.et al., 2015). Hence the physical design of the department greatly affects waiting time. This involves change of directions in various service points, alternative routes availability and visibility of the service points (Jamjoom et al., 2014). In addition, Erhun.et al., (2015), urged that the more educated took least time due to the fact that they are more likely to be either students or civil servants in haste due to their occupation and because they may have to get back to their various places of work while most traders (because they are self-employed) are less likely to be in a hurry.

#### **5.1.6. Study limitations**

The data collection was affected by frequent breakdown of CT scan equipment which delayed data collection process. Further, continuous use of manual systems in the department posed a big challenge thus making data collection and follow up difficult and inconsistent. The very sick, bedridden patients and the children. They were given first priority.

## **6.0 CONCLUSION**

Findings from the study have shown varying degrees of waiting time in the three modalities of study, CT (932.99±2476.4), General Radiography (317.5±620) and Ultrasound (205.4±101.3). There is a clear indication that majority of the patients took long to be attended to as a result of large patient numbers, non-aligned departmental coordination systems, manual delivery systems and few staff all affecting smooth delivery of the services.

## 7.0 RECOMMENDATION

From the findings of the study, the following recommendations have been made,

**Commented [MOU9]: Specific objectives**

- a)To determine the time taken in CT, Ultrasound and General examination in radiology department
- b)To determine factors that contribute to patient waiting times in CT, Ultrasound and general radiography examinations in the radiology department
- c)To determine patient flow for CT, ultrasound and general radiography.

1. Introduce an integrated queue management system to assist in allotting appointment time and sorting out patients of different service points. It can also help estimate the patient waiting time, the number of patients served in one section and the total time spent in the department. Further, it will fast track many radiology processes by transferring all the patient information via computer network system to all the service points.
2. Introduction of radiology information system (RIS) to streamline and align all the radiology processes. Most delays were identified in registration because most of the time is lost in paper-work. Therefore, automation of the processes for storing and tracking patient information to all the service points and digitalizing the operations of the facility, will make operations very efficient and allow management to track any bottlenecks and respond in time.
3. Continuous review of the radiology process flow map so as to identify areas that require focus and design strategies to mitigate the identified gaps.
4. Introduce a competent customer care desk that will be in a position to identify clients who require assistance.
5. Different color coding and signage of the rooms is also highly recommended for easy identification by the patients.
6. Another way is to increase the supply throughout by boosting the supply structure. This will entail increasing personnel and equipment. The department can decide when to attend to the ward patients when the demand is predictably lower in the department. Categorization of timings such as early mornings, late afternoon or dedicated day of the week to attend to non-emergency or clinic patients.
7. Radiology dashboard to assist in work flow metrics where the radiologist can be alerted on emergency requests, pending reporting and unsigned reports queue status.

8. Voice recognition software for the radiologist for faster report writing. This will reduce the manual typing processes and the report turnaround times.
9. Streamline NHIF processes for radiology to reduce the identified long waiting times before authorization.
10. The department should periodically carry out turnaround time surveys to monitor the situation. The findings and recommendations of these surveys should be implemented and continuously reviewed.

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**Commented [MOU10]:** check all your references and that the bibliography has complete references

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## 9.0 APPENDICES

### **Appendix 1: Study Participation Consent**

Title; Factors associated with turnaround times among patients undergoing CT, Ultrasound and General radiography at KNH radiology department.

**Investigators' statement:** We are kindly requesting your participation in the study and the purpose of this research study is to improve service delivery as well as for academic purpose. The study will take 3 months and the consent form is to give you the information you need to know pertaining the study. Please read this form carefully or listen as it is read to you. You may ask questions regarding the study or anything about the research that is not clear. When all your questions have been answered, you can decide on your participation to the study. If you wish we will provide a copy of this form for your records.

**Purpose and Benefits:** The aim of this study is determine the factors that contribute to lengthy waiting times in CT, Ultrasound and general radiography. You will not have direct benefit from this study but the information generated will be important for the management in guiding decisions to improve service delivery.

**Procedures:** The research assistant will ask several questions regarding waiting times in the service offered. As you give responses to the questions, a questionnaire will be filled. No invasive procedures will be involved

**Risks, Stress, or Discomfort:** Participation in the study will require you to commit your time. Completing the questions will take 10-15 minutes. However, we will try to serve you as quickly as possible.

**Reimbursement:** You will not receive any monetary compensation for participating in this study.

**Confidentiality:** We will keep your identity as a research subject confidential. Only the investigators and the University of Nairobi Ethics and Research Committee can have access to information about you. The information about you will be identified only by the study x-ray number and will not be linked to your name in any records. The information will be stored in secure computer files and lockable cupboards.

**Voluntarism:** participation in the study is voluntary. You are free to refuse to participate and to withdraw from the study at any time without penalty or loss of benefits and you will receive similar care provided to those participating in the study.

Signature of investigator \_\_\_\_\_ Date \_\_\_\_\_

Name of Investigator \_\_\_\_\_

Subject's statement:

This study has been explained to me. I volunteer to take part in this research. I have had a chance to ask questions. If I have questions about my rights as a research subject, I can call the University of Nairobi Ethics and research Committee at 2726300 Ext 44355 or investigator Catherine Muchuki on +254 724849159. I will receive a copy of this consent form.

Signature of subject \_\_\_\_\_ Date \_\_\_\_\_

Or

Left thumbprint of subject \_\_\_\_\_ Date \_\_\_\_\_



**Appendix 2: Questionnaires**

Questionnaire No.....Of 596

**Date (Day/month/year) ...../...../2017**

**Site; Radiology department**

Dear respondent

KNH is committed to providing our patients with both quality and a caring environment. We are also committed to improving all aspects of the services we provide. The radiology department is conducting a study to find out if patients are taking long before receiving services. We value your feedback as the information will be used to improve services in the department. The information received will be treated with utmost confidentiality.

**SECTION A; DEMOGRAPHIC DATA**

- 1. X ray number .....
- 2. Date of birth.....
- 3. Gender.....7.....  
Male  female
- 4. What is the highest degree or level of school you have completed  
Primary  Secondary  Tertiary  None
- 5. Level of income monthly  
0-40,000ksh  41,000ksh-60,000ksh  61,000ksh-80,000ksh  above
- 6. Examination requested .....
- 7. Any preparation required prior to the examination.....
- 8. Diagnostic room where the exam is to be performed  
Ultrasound  General  CT

**SECTION B; SERVICE POINTS**

- 9. Health information/registration desk
  - i. What time did you arrive .....
  - ii. What time were you coded/billed for payment.....

If more than 30 minutes, what were the reasons?

- a) Long queues at the health information desk
- b) Computer systems were slow
- c) Few staffs
- d) Others (indicate reasons).....
- .....

10. Cashier point

- i. what time did you present yourself at the payment point?.....
- ii. What time were you served?.....

If more than 30 minutes, what were the reasons?

- a) Long queues
- b) Had no money to pay
- c) Computer systems were slow
- d) few/no staff to attend
- e) Others (indicate reasons).....
- .....

11. Registration area

- i. what time did you present the receipt at the registration desk after payment? .....
- ii. What time were you served?.....

If more than 30 minutes, what were the reasons?

- a) Long queues
- b) Few staffs to attend
- c) Others (indicate reasons).....
- .....

12. Waiting area

- i. what time did you present yourself at the waiting area after registration.....
- ii. How long did it take to be called for the examination room? .....

13. Examination room

- i. what time did you present yourself at the waiting area after registration?.....
- ii. How long did it take to be called to the examination room?.....

What were the reasons?

- a) Long queues
- b) Lack of proper direction to the examination room
- c) Few staffs to attend
- d) Poor patient preparation
- e) Multiple examinations
- f) Change of shift
- g) Others (indicate reasons).....

.....

**If no film report is required skip to no 22**

14. Hand written Report writing

- i. What time was the film taken for reporting?.....
- ii. What time was the film reported?.....

What were the reasons?

- a) Long queues of reports
- b) Few staff to attend
- c) Others (indicate reasons).....

15. Report typing by secretary

- i. What time was the report received for typing?.....
- ii. What time was the report typed?.....

What were the reasons?

- a) Long queues
- b) Computer systems were slow
- c) Few staff to type
- d) Others (indicate reasons).....

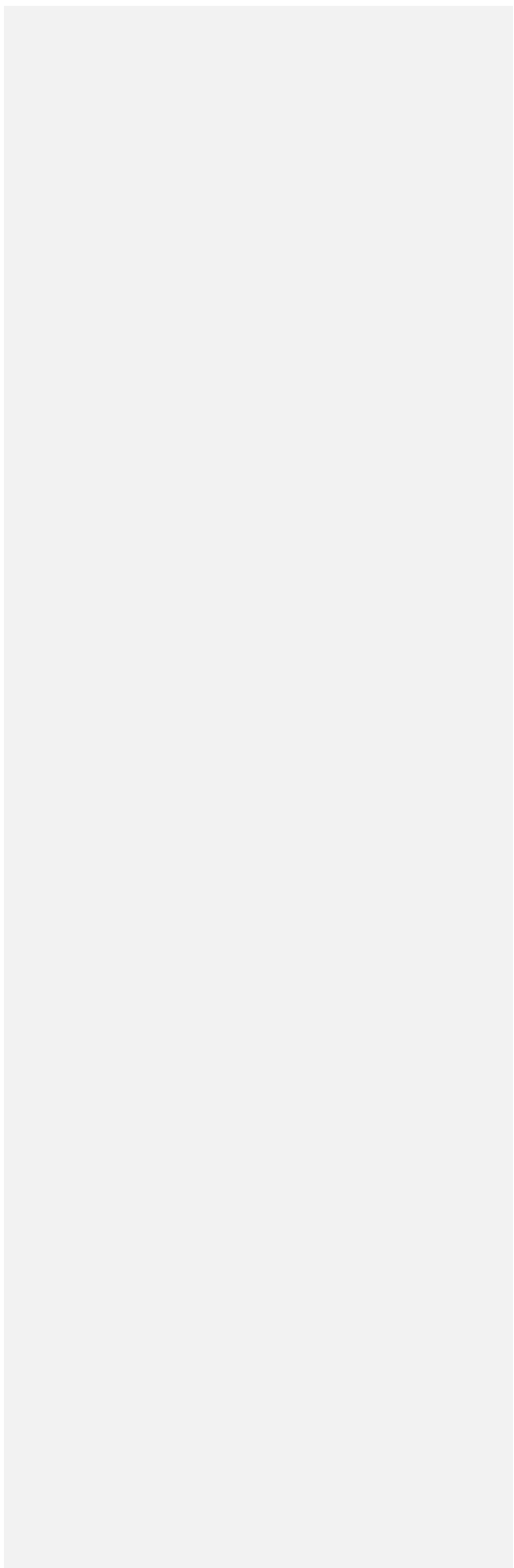
16. Verification of typed reports by consultants

- i. What time was the typed report received?.....
- ii. What time was it verified for corrections or signed?.....

17. Corrections of the report by the secretary

- i. when was is it received?.....
- ii. When was it corrected?.....
- 18. Report presented for countersigning
  - i. when/what time was the report presented for countersigning?.....
  - ii. when/what time was it signed?.....
- 19. Returned to typing area
  - i. when/what time was is received for dispatch to the reception?.....
  - ii. when/what time was it dispatched?.....
- 20. Dispatch to the reception
  - i. what time was the report received at the reception?.....
- 21. Indicate the date and time you left the hospital?.....

**THANK YOU!**



**Appendix 3: Timeline/Time frame**

<b>ACTIVITIES 2016/2017</b>	<b>Proposal writing</b>	<b>Submit Ethics</b>	<b>Corrections /approval</b>	<b>Data collection</b>	<b>Analysis</b>	<b>results</b>
<b>JANUARY</b>						
<b>FEB</b>						
<b>MARCH</b>						
<b>APRIL</b>						
<b>MAY</b>						
<b>JUNE</b>						
<b>JULY</b>						
<b>AUGUST</b>						
<b>SEPTEMBER</b>						
<b>OCTOBER</b>						
<b>NOVEMBER</b>						
<b>DECEMBER</b>						

**Appendix 4: Budget Form**



**KNH Research and Programs**

**Study Budget**

<b>Components</b>	<b>Unit of Measure</b>	<b>Duration/ Number</b>	<b>Cost (Ksh)</b>	<b>Total (Ksh)</b>
<b>Personnel</b>				
Research Assistant	3 pax	44 Days	1500.00	198,000.00
Statistician				30,000.00
<b>Printing</b>				
Consent Form	1 copy	2 pages	10.00	20.00
Questionnaires	1 copy	5 pages	10.00	50.00
<b>Photocopying</b>				
Consent Form	1400 copies	2 pages	3.00	8,400.00
Questionnaires	1400 copies	5 pages	3.00	21,000.00
<b>Other costs</b>				
ERC Fees				2,000.00
Training research assistants	4 pax		500.00	2,000.00
Note books	4 pcs		50.00	200.00
Pens	8 pens		20.00	160.00
<b>Total</b>				<b>261,830.00</b>

## Appendix 5: Radiology Charter





### KENYATTA NATIONAL HOSPITAL RADIOLOGY DEPARTMENT SERVICE CHARTER (2015-2016)

Services rendered	Patient/client requirement	User charges (Kshs.)	Procedure time	Waiting time
Counterchecking of the request form for justification of examination	To present the doctors request form	Nil	5 minutes	30 minutes
Billing	1.Come with unique number from point of entry 2.New/Private patients	Nil	20 minutes 30 minutes	35 minutes
Registration of patients	Patient to present doctor's request form plus payment receipt	Nil	10 minutes	30 minutes
Emergency Ultrasound, CT, X-ray	Doctors request form, payment receipt, X-ray registration number	Nil	30 minutes	2 hours
General ultrasound	Doctors request form plus payment receipt, X-ray registration number, preparation of the patient for as the procedure	See price list	10min-30min	12 hours
General x-ray examination Routine examination	Doctors request form, payment receipt, X-ray registration number		20 minutes	12 hours
MRI examination	Doctors request form, payment receipt, X-ray registration number	"	45- 60 minutes	24 hours
CT scan examination Routine	Doctors request form, payment receipt, X-ray registration number, Blood urea results		20-30 minutes	24 hours
Interventional procedures	Doctors request form, payment receipt, X-ray registration number, full Haemogram, platelets, urea, HIV test, Hepatitis test, Blood urea results.	"	1 – 2 hours	24 hours
<b>RADIOLOGY DEPARTMENT</b>				

NB: Patients must present a doctor's X-ray or imaging request form plus payment receipt

- Patients for abdominal ultrasound, fluoroscopy (screening), CT Scan examination, angiography and IVU should not take breakfast
- Patients for pelvic ultrasound and in early pregnancy require a full bladder
- East Africa residents – same charges as Kenyans, Patients from other countries – double charge
- Patients for intervention procedures require, a full Haemogram, platelets, urea, HIV test, Hepatitis test, Prothrombin time
- Patients for CT scan examinations (abdomen, chest, renal, CT angiography, IVU) require urea results.
- \*All patients should bring previous imaging results. CT abdomen/pelvis take long preparation of 4-6 hours as they have to take medicine to outline the gut before the examination procedure. Waiting time of service to be rendered is from the time of patient registration.
- \*The above waiting times are average and depend on the number of patients registered ahead of you.

## Appendix 6: Approval ERC



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

**KNH-UoN ERC**  
Email: [uonknh\\_erc@uonbi.ac.ke](mailto:uonknh_erc@uonbi.ac.ke)  
Website: <http://www.erc.uonbi.ac.ke>  
Facebook: <https://www.facebook.com/uonknh.erc>  
Twitter: @UONKNH\_ERC [https://twitter.com/UONKNH\\_ERC](https://twitter.com/UONKNH_ERC)

**KENYATTA NATIONAL HOSPITAL**  
P O BOX 20723 Code 00202  
Tel: 726300-0  
Fax: 725272  
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/111

27<sup>th</sup> March 2017

Catherine Wangui Muchuki  
Reg. No. H70/81325/2015  
School of Public Health  
College of Health Sciences  
University of Nairobi

Dear Catherine

**REVISED RESEARCH PROPOSAL – FACTORS CONTRIBUTING TO PATIENTS WAITING TIMES AMONG PATIENTS UNDERGOING COMPUTERISED TOMOGRAPHY, ULTRASONOGRAPHY AND GENERAL RADIOGRAPHY AT K.N.H RADIOLOGY DEPARTMENT (P867/11/2016)**

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above revised proposal. The approval period is from 27<sup>th</sup> March 2017 – 26<sup>th</sup> March 2018.


This approval is subject to compliance with the following requirements:

- Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH-UoN ERC before implementation.
- Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification.
- Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
- Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
- Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
- Submission of an *executive summary* report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

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

"Protect to Discover"

Yours sincerely,




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

c.c. The Principal, College of Health Sciences, UoN  
The Director, CS, KNH  
The Assistant Director, Health Information, KNH  
The Chair, KNH-UoN ERC  
The Director, School of Public Health, UoN  
Supervisors: Dr. Richard Ayah, Dr. Beatrice Mugi



**Appendix 7: Study Registration Certificate**

KNH/R&P/FORM/01

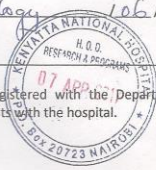


**KENYATTA NATIONAL HOSPITAL**  
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Tel.: 2726300/2726450/2726565  
Research & Programs: Ext. 44705  
Fax: 2725272  
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**Study Registration Certificate**

- Name of the Principal Investigator/Researcher  
CATHERINE WANEU MUCUKU
- Email address: cmucuku@gmail.com Tel No. 0724 249159
- Contact person (if different from PI)..... N/A
- Email address: ..... Tel No. ....
- Study Title  
FACTORS CONTRIBUTING TO PATIENT'S WAITING TIME  
AMONG PATIENTS UNDERGOING COMPUTERISED TOMOGRAPHY  
ULTRASONOGRAPHY AND GENERAL RADIOGRAPHY AT K.N.H  
RADIOLOGY DEPARTMENT
- Department where the study will be conducted RADIOLOGY DEPARTMENT  
(Please attach copy of Abstract)
- Endorsed by Research Coordinator of the Department where the study will be conducted.  
Name: ..... Signature ..... Date .....
- ★ Endorsed by Head of Department where study will be conducted.  
Name: DR. R. Nyabanda Signature [Signature] Date 07/04/2017
- KNH UoN Ethics Research Committee approved study number P867/11/2016  
(Please attach copy of ERC approval)
- I CATHERINE W. MUCUKU commit to submit a report of my study findings to the Department where the study will be conducted and to the Department of Research and Programs.  
Signature [Signature] Date 03/04/2017
- Study Registration number (Dept/Number/Year) Radiology 106/2017  
(To be completed by Research and Programs Department)
- Research and Program Stamp

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



Version 2: August, 2014

