



**UNIVERSITY OF NAIROBI**  
**COLLEGE OF HEALTH SCIENCES**  
**DEPARTMENT OF ANAESTHESIOLOGY**

**A SURVEY OF THE FACTORS AFFECTING THEATRE TURNAROUND TIME IN KENYATTA NATIONAL HOSPITAL**

**MAIN THEATRES.**

**BY**

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**H58/33924/2019.**

**A DISSERTATION PRESENTED IN PART FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER  
OF MEDICINE (ANAESTHESIA) OF THE UNIVERSITY OF NAIROBI.**

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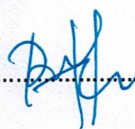
## DECLARATION

I, the undersigned declare that this study on a survey of the factors affecting turnaround time in Kenyatta National Hospital, main theatres, is my original work and has never been submitted to any school, college or university for an academic award.

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## Certificate of Approval

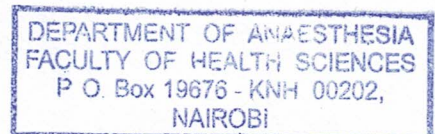
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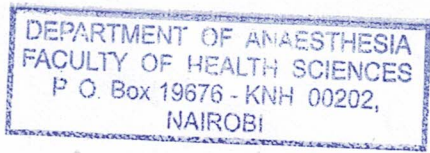


**Departmental Approval**

This study has been approved by the Department of Anaesthesia, University of Nairobi, for submission to the UON Digital Repository.

Chairman, Department of Anaesthesia, University of Nairobi.

Signature ..... *W. S.* ..... Date..... *5th October 2023* .....



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## **DEDICATION**

I dedicate this dissertation to my husband Alex Kasuku Kimani for his selfless support throughout my study program and this dissertation.

Your support, encouragement, patience and financial provisions are invaluable to me.

## ABSTRACT

**Introduction:** Operation theatres are essential departments in health facilities, responsible for the surgical care of patients. They are some of the most heavily budgeted departments. Monitoring processes that ensure that the systems are efficient in theatres is instrumental. One key process is Turnaround time (TAT). It is a significant determinant of patient care efficiency, improved service delivery and effective utilization of hospital revenues.

This study aimed to determine the factors affecting turnaround time in Kenyatta National Hospital's main theatres.

**Methodology:** This was a descriptive observational study carried out over 7 weeks (6<sup>th</sup> September 2021 to 25<sup>th</sup> October 2021). It was conducted on 400 staff in KNH main theatres using the proportionate stratified sampling method. The staff included were all working in KNH main theatres and postgraduate students from the University of Nairobi practising in main theatres. The data collected indicated variables related to different factors affecting TAT in KNH such as the personnel, surgical, equipment and consumable factors, and infrastructural factors. Data was collected using researcher-assistant semi-structured questionnaires as well as digital administration using the KoBo Toolbox. The data was analyzed using STATA and Statistical package for social sciences (SPSS) version 24.0.

Descriptive statistics was used to give overall insights of variables corresponding to factors affecting TAT.

The chi-square tests indicated the bivariate associations between TAT estimates and different factors such as personnel, surgical and infrastructural factors.

The multinomial regression model was used to conduct multivariate analysis to identify each factor's significance to the TAT in the main theatres.

A p-value of 0.05 was considered significant for all the tests.

Results were presented in frequency tables, bar charts and pie charts.

**Results:** A total of 400 staff participated in the study where N= 231, 57.75% were male, while N=169, 42.25% were female. The Chi-square tests of association indicated a significant relationship between personnel factors, surgical factors, equipment and consumable factors with TAT in KNH main theatres ( $p < 0.05$ ).

According to the multinomial regression analysis, the personnel factors that have a significant influence on TAT include: prolonged nursing handover time ( $p = 0.000, < 0.05$ ), staff shortage ( $p = 0.039, < 0.05$ ), and lack of support of the theatre managers ( $p = 0.020, < 0.05$ ).

The surgical factors that have significant influence on TAT include: urgency of surgery (theatre preparation for emergency surgery versus elective surgery) ( $p = 0.025, < 0.05$ ) and lack of efficient and adequate response of blood transfusion units during surgery ( $p = 0.000, < 0.05$ ).

The equipment and consumable factors that affect TAT significantly include: adequacy of anaesthesia machines to cater for patients ( $p = 0.019, < 0.05$ ), adequacy and reliability of supply of anaesthetic drugs ( $p = 0.041, < 0.05$ ), adequacy in number of stretchers and wheelchairs ( $p = 0.022, < 0.05$ ) and lack of adequacy and reliability of supply of drapes and gowns ( $p = 0.019, < 0.05$ ).

Lastly, the infrastructural factors that have significant influence on TAT include: adequacy and reliability of electricity supply ( $p = 0.011, < 0.05$ ), lack of adequacy and reliability of oxygen supply ( $p = 0.023, < 0.05$ ), and lack of ease of accessibility of the main theatres from the surgical wards and ICU ( $p = 0.000, < 0.05$ ).

All the infrastructural factors were significantly associated with TAT, apart from the adequacy and reliability of water supply ( $p = 0.412, > 0.05$ ), PACU sufficiency for accommodation of patients post operatively ( $p = 0.577, > 0.05$ ) and availability of ICU space for deserving surgical patients ( $p = 0.401, > 0.05$ ).

In open ended responses, few number of patient porters, consultant surgeons' delay in joining junior surgeons/registrar during complicated surgeries; and inadequate number of lifts with habitual malfunctions were observed to cause delays in between surgeries in KNH main theatres.

**Conclusion:** Personnel factors: prolonged nursing handover time during shift change, lack of supportive theatre managers, staff shortage and delays by consultant surgeon in joining junior surgeons/registrar during complicated procedures increased TAT time in KNH main theatres. There exists no significant association between staff insufficient qualification for their jobs, inadequately met staff training needs, lack of staff motivation, staff not being highly overworked, lack of lateness to workplace, absconding from work by staff, good teamwork among staff, and TAT in KNH main theatres.

Surgical factors: nature of the urgency of the surgery (theatre preparation for emergency surgery versus elective surgery) and lack of efficiency and adequacy of response of blood transfusion units during surgery increased TAT. There exists no significant association between adequacy in number of surgical sets for surgery, patient being prepared well for surgery preoperatively and TAT in KNH main theatres.

The equipment and consumable factors: lack of adequacy and reliability of supply of drapes and gowns increased TAT in KNH main theatres. The variables that caused decreased TAT include: availability of enough anaesthesia machines to cater for patients, adequacy and reliability of supply of anaesthetic drugs and adequacy in number of stretchers and wheelchairs for patient transport. Lack of adequacy and reliability of laboratory support for patients had no significant influence on TAT.

Infrastructural factors: lack of adequacy and reliability of oxygen supply, lack of ease of accessibility of main theatres from the surgical wards and ICU; and inadequate number of lifts with habitual malfunctions increased TAT. There exists no significant association between availability of ICU space for deserving surgical patients, PACU space sufficiency to accommodate patients post operatively, adequacy and reliability of water supply; and TAT in KNH main theatres.



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## **ABBREVIATIONS**

<b>ASA</b>	American Society of Anaesthesiology
<b>ENT</b>	Ear, Nose and throat
<b>HOT</b>	Handover time
<b>ICU</b>	Intensive Care Unit
<b>KMTC</b>	Kenya Medical Training College
<b>KNH</b>	Kenyatta National Hospital
<b>KPCC</b>	KNH prime care centre
<b>MNH</b>	Muhimbili National Hospital
<b>OT</b>	Operating Theatre
<b>PPE</b>	Personal Protective Equipment
<b>PACU</b>	Post anaesthesia care unit
<b>TAT</b>	Turnaround time
<b>TSA</b>	Theatre service assistant
<b>TOT</b>	Turnover time
<b>SPSS</b>	Statistical Package for Social Sciences
<b>SSA</b>	Sub-Saharan Africa
<b>STATA</b>	Statistical Analysis Software Package

## **DEFINITIONS**

<b>Operating theatre</b>	A facility within a hospital where surgical operations are carried out.
<b>KoBo Toolbox</b>	This is software that is used to virtually collect data which can be exported in excel format.
<b>Pre-operative Procedures</b>	These are preparatory measures done before surgery.
<b>Post-operative Procedures</b>	These are any procedures related measures carried out on the patient after surgery.
<b>Registrar</b>	A medical doctor pursuing master's degree at the university of Nairobi.
<b>Turnaround time</b>	Time between when a patient is taken to PACU after completion of a surgical procedure and the next patient is wheeled in to the operating theatre.
<b>Turnover time</b>	Time interval of a patient entering to leaving theatre.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 Background Information

The operating theatre (OT) efficiency is directly associated with reduced turnaround time (TAT). There is improved patient outcome and optimized costs for health resource allocation with reduced TAT [7]. There is also reduced hospital stay and cost to the patient [7],[8],[10]. This improvement in OT efficiency can be done through enhanced timelines, staff collaboration, and process mapping[9]. Improvement in service delivery and reduction in TAT in theatres is also attributed to factors like motivation in staff performance. This increases job satisfaction and reduced hospital costs by effective utilization of resources [10].

Theatre turnaround time is the time between when a patient is taken to PACU after completion of a surgical procedure, and the next patient is wheeled in to the operating theatre [3],[35]. It is also referred to as the approximate minimum time needed to clear the theatre in preparation for the next case[4],[5] . The time varies depending on several factors. The diverse aspects that may influence TAT in theatres include personnel factors, surgical factors, equipment factors and infrastructural factors. A study done at Aga Khan University Hospital, Karachi, showed that causes of increased TAT included factors related to personnel, equipment and scheduling of operation room list [3]. Our study was to identify significant factors affecting the overall theatre efficiency process, which is estimated using the TAT at Kenyatta National Hospital.

Monitoring theatre efficiency is essential since this department in most facilities accounts for at least 40% of the resource utilization [6]. This means that theatre's main objective (with regard to efficiency) is to maintain cost effectiveness and deliver quality services to the patients. Reduction in TAT can improve operating theatre utilization rate by up to 20 % [6].

Increased TAT is associated with loss of training opportunities for trainees [10]. KNH is a teaching hospital with diverse specialties for trainees from university of Nairobi, Kenya Medical Training College, including exchange programs within various institutions. Therefore, there is need for trainees in surgery and anaesthesia to get adequate time allocation for practical exposure. Time available for trainees in OT is directly linked to theatre efficiency and TAT in theatre [36].

Theatre TAT is therefore a quality marker for theatre efficiency. Reduced TAT is associated with adequate theatre utilization, resource allocation and generation of revenue for the hospital. There is reduced theatre cancellation rates and increased number of cases being done. This reduces length of hospital stay for patients, reduces morbidity and cost burden to the patient thus patient satisfaction. There is job satisfaction for the staff too and training opportunities for the trainees.

This study carried out in a Sub-Saharan African setting surveys factors affecting the TAT in a major referral hospital. These findings would therefore cite specific areas of improvement in theatre while identifying the areas that need to be maintained to continue with the expected TAT and theatre output [11].

### **1.2 Similar Studies on Factors Affecting TAT**

There are studies, which have been done that are similar to this one, on different factors associated with TAT in healthcare settings. Sharif et al., (2016) did a retrospective study at Aga Khan University Hospital, Karachi, to identify factors affecting operating theatre turnaround time. Personnel factors, equipment factors and scheduling of cases were found to be associated with increased operating theatre TAT [3]. This study was done retrospectively and mainly focused on the factors increasing TAT. Our study was observational and focused on both factors increasing and decreasing TAT.

Kumar and Malhotra, 2017, did an observational study on reasons for delays in turnover time in operating theatre. They found out that most of the delays caused were due to hospital related issues (management and planning). They concluded that utilization of OT complex can be optimized by team effort, multitasking and parallel processing [17]. This study was conducted at present medical college, which was still in its evolving stage to help in quality improvement. KNH is not a new hospital, it has evolved over time and factors affecting TAT may not be related to findings from this study.



Pandit & Tushar, (2016) did a retrospective study to find out the overall OT utilization, TAT, and other factors affecting OT. They found out that scheduling of OT, delays in starting the case, equipment and infrastructural factors led to delays in the OT (13). This study mainly focussed on the issue of low utilization of the operating theatres. Our study was to give insight into factors affecting overall utilization of operating theatre by assessing the factors affecting TAT.

Fletcher et al., (2017), conducted a quality improvement project to investigate modalities of improving theatre turnaround time. The aim of the quality improvement project was to improve orthopaedic theatre turnaround. There was improvement in TAT which halved from 66.5 minutes to 36.8 minutes. It highlighted the importance of process mapping and streamlining communication pathways to improve theatres TAT [4]. This study focussed on only orthopaedic theatres. Our study investigated all the possible attributes associated with TAT in KNH main theatres hence giving more information on theatre turnaround time and its utilization from the various theatres.

The need for the research was to investigate findings in a Kenyan setting since similar studies had not been done in Kenyan theatres. This implied that the assessment of KNH case would be essential in informing the specific areas that needed to be improved or maintained to enhance improved TAT.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Introduction to Literature Review.**

An ideal TAT is difficult to determine due to the variables and dynamics of different operating theatres. The desired TAT at KNH is approximately 20 minutes based on the performance contract between the director-surgical services of KNH and the head of department-anaesthesia and theatres of KNH [61]. There is need to follow up the TAT parameter through studies and compare it to the desired TAT agreed in the performance contract. This can be used as a performance indicator on whether the anaesthesia department is meeting its target objectives.

#### **2.2 Personnel Factors Affecting TAT**

The staff working in main theatres are contributors to theatre efficiency. The staff that may influence TAT in theatre include porters, cleaners, TSA, nurses, anaesthetists and surgeons. The following are the major personnel factors affecting TAT;

##### **2.2.1 Inadequate Staffing and Staff Collaboration**

Inadequate staffing influences TAT and operation room turnover time. A collaborative workflow is needed from staff from all cadres to enhance timely performance of all the procedures [12]. Increasing the number of staff involved in surgical procedures is an effective modality in the overall reduction of TAT in operating theatres[13]. A study conducted in a healthcare facility setting in Malawi showed that having inadequate number of staff with a high patient work load made the medical staff overwhelmed and dissatisfied. 40% of the staff wanted to resign from the facility [14]. In some studies done on improvement of theatre efficiency, presence of a senior surgeon and anaesthesia consultant had a positive impact on TAT [15].

##### **2.2.2 Staff Motivation and Empowerment**

Staff motivation was shown to be directly associated with enhanced performance and reduction in TAT [29]. Giving incentives to OT staff, for example free meals was found to improve TAT [29].

A study done at Riverside County Regional Medical Center (RCRMC) in California by D Nina et al emphasized the importance of feedback and positive reinforcement to the staff by the hospital administrators as a way of reducing TAT [16]. Good communication and team work are essential in improving TAT in theatre. [4]. Team work ensures that all the involved staff deliver in timely fashion, thus avoiding delays[17].

### **2.2.3 Staff Capacity Building Through Training**

Capacity building of staff through adequate training is essential in improving theatre output. Therefore, training theatre staff is important in improving theatre efficiency [37] and has been shown to reduce TAT [19],[22].

### **2.2.4 Nursing Handover Time**

Nursing handover time (HOT) may significantly affect TAT. Patients needed in theatre during handover time may sometimes have to wait for the handover session to end before being transferred to theatre. This may result in significant delays resulting in increased TAT. Sharif et al showed that delayed movement of patients from the wards to OR was a significant contributor to increased TAT, accounting for 22.7% of the delays analyzed [3]. Poor patient preparation for theatre, miscommunication and incomplete patient hand-over during HOT may lead to increase in TAT [21], [55].

### **2.2.5 Lateness and Staff Absconding Work**

Staff absconding from work, lateness in the work place, overworked staff, and prolonged mealtime breaks all increase TAT. An audit done at Jai Prakash Narayan Apex Trauma Centre (JPNATC), All India Institute of Medical Sciences (AIIMS) to assess the causes of delay in theatre showed that lack of proper planning, deficiencies in team work, lateness of theatre staff, communication gaps and limited availability of trained support staff were responsible for increased TAT [22]-[25]. Some studies observed that TAT was significantly increased in the cases where the patient was in the operation room before staff meal-breaks [26].

## **2.3 Surgical Factors Affecting TAT**

Complex surgeries may affect theatre staff performance due to fatigue and stress, leading to delays in commencement of subsequent cases[30], [35]. Inadequate staffing may lead to compromised patient care and delays, and this is even more likely for complex surgeries. [31].

Pre-existing medical conditions in patients may also affect TAT. Geriatric patients fall in this category due to their increased prevalence of comorbidities and decreased physiological reserve. The ASA classification, need for ICU care post operatively and patient's neurological state also have an impact on TAT. Luedi et al., noted that operating theatre TAT is difficult to estimate in the geriatric population and high-risk patients. The study evaluated TAT for 13,632 OR procedures with respect to various variables like surgical list, age, ASA physical status, duration of the procedure and duration of the preceding procedure. It was observed that TAT could be estimated through assessment of the patient age and ASA physical status [59].

Inadequate preoperative patient preparation may have a significant effect on the TAT. Poor patient preparation for surgery may lead to theatre cancellations, post-operative complications and need for unplanned intensive care unit admission [41]. It may also result in increased healthcare costs, increased length of stay in hospital and reduced patient satisfaction [42]. A study conducted in Rwanda by Muhompundu et al., showed that the main cause of delay in surgeries was inadequate preoperative patient preparation [43]. Proper preoperative patient preparation optimizes the surgical process and reduces the chances of delays occurring [44].

The urgency of surgery may have a significant impact on TAT. Emergency procedures are associated with reduced TAT compared to elective surgeries [60] due to the perceived need to "save life or limb". Essena et al., did a study in Netherlands with the aim of reducing the waiting time for emergency surgeries. This resulted in 10% reduction in emergency surgeries waiting time compared to the normal schedule [60].

Cleaning of theatre in between surgical procedures is an important aspect of sterility measures for theatre environment [58]. This usually takes six to ten minutes [17]. However, the cleaning process may be prolonged after particularly dirty or complex procedures [17].

Unavailability of blood and blood products for surgery is a significant contributor to delays in starting surgeries and results in increased TAT [45], [46], [47]. Timely blood transfusion support should be available preoperatively to avoid increased TAT, morbidity and mortality [46].

## **2.4 Equipment and Consumables Factors Affecting TAT**

The installation of quality equipment and provision of consumables needed for surgical procedures is an effective way of improving TAT. This is made possible by resource planning and optimization[6].

Prior preparation of consumables and equipment reduces delays in theatre [48]. A study conducted in Muhimbili National Hospital (MNH) in Tanzania showed that many emergency surgeries were postponed due to faulty anaesthetic machines[33]. In addition, some laboratory machines were non-functional making it difficult to perform pre-operative tests. This affected patient preparedness for theatre and caused actual delays[33].

The irregular supply of anaesthetic drugs in theatre has impact on TAT. A study conducted in Zimbabwe focusing on the availability of anaesthetic drugs in both private and public hospitals showed statistically significant difference in these two set ups with a p value < 0.001[49]. Private hospitals were shown to have better and more consistent supply of anaesthetic drugs compared to public hospitals. Inadequate supply of anaesthetic drugs makes safe and quality anaesthesia delivery to patients a challenge [50].

Surgical procedures must be done under sterile conditions for patient safety. The supply of sterile drapes and gowns is essential for most surgical procedures to avoid possible infections and contamination of surgical sites [51]. Irregular provision of these protective gear can delay TAT in theatres.

A study conducted in Afghanistan showed oxygen supply for surgical cases was inadequate in a number of health facilities. This resulted in delays and an increase in TAT within the hospitals [52]. The availability of medical stretchers for wheeling patients from the wards to theatre and from operating theatre to PACU has significant impact on TAT [54].

## **2.5 Infrastructural Factors Affecting TAT**

Streamlined healthcare systems incorporate infrastructural development based on the needs of the health facility [6]. Surgical wards should as much as possible be sited near operating theatres to improve efficiency[55]. Ideally, the surgical ICU should also be located next to the theatre. In situations where surgical wards are distant from operating theatres, or theatre is not readily accessible from the wards, there may be

significant delays in delivery of patients to theatre. For example, in situations where access to theatre requires use of access lifts/elevators, there may be severe disruption in theatre operations if such lifts were to malfunction. This was shown in one study where lack of lifts to ferry patients to and from the operation rooms was a major cause of delay among 551 patients admitted to a tertiary care health facility [55] .

Surgical ICU is a scarce resource and an ICU slot may not always be available after surgery. Patients awaiting ICU admission after surgery are usually monitored in their respective theatres, and this may result in delayed TAT and theatre cancellations[56]. Similarly, the PACU should be of a sufficient size to accommodate patients arriving from theatre. A small PACU may get full and prevent further patients being received from theatre, resulting in delayed TAT. Thus, the availability of space in PACU affects the turnover of patients from the operation rooms[57].

All hospitals must have adequate infrastructure to meet increased demands for water, electricity, and oxygen during peak patient inflows. An illuminating study conducted in various hospitals within Uganda showed that severe shortage of water, electricity, and oxygen within the hospitals was a cause of severe operational inefficiencies[53]. An erratic supply of any of these essential items will result in theatre inefficiency and increased TAT.

## **2.6 Justification for the Study**

There is need to constantly evaluate how hospital resources are utilized, and find ways of maximizing the resources. The operating theatre in any hospital is a major consumer of available resources, and if inefficient, may result in severe wastage, increased hospital costs, poor patient outcomes, decreased funding from the exchequer, inappropriate diversion of resources, and staff demotivation. Efficient utilization of theatre is therefore very important, and measures such as turnaround time provide objective estimates of the overall efficiency of theatre.

This study is significant because there are no previously done studies in Kenya illustrating the factors influencing TAT in theatres. This research acts as a blueprint in many other hospitals in Kenya since majority of the aspects affecting TAT in a Kenyan setting were identified.

Identifying individual factors affecting TAT at KNH operating theatres may contribute to the improvement in other areas within the hospital as well.

## **2.7 Objectives**

### **2.7.1 General Objective.**

The primary objective of this study was to determine factors affecting turnaround time in Kenyatta National Hospital main theatres.

### **2.7.2 Specific Objectives.**

1. To establish personnel factors affecting the turnaround time for surgeries in KNH main theatres.
2. To determine the surgical factors affecting the turnaround time in KNH main theatres.
3. To determine the equipment and consumables factors affecting the turnaround time in KNH main theatres.
4. To determine infrastructural factors affecting turnaround time in KNH main theatres.

## **CHAPTER THREE.**

### **3.0 STUDY DESIGN AND METHODOLOGY**

#### **3.1 Study Design**

This study was an observational descriptive study where a proportionate stratified sampling method was utilized to select a fraction of the population from 840 persons working in the main theatres. The study used quantitative methods of analysis to give insights on the factors affecting TAT in the main theatres in Kenyatta National Hospital. It was a survey research method, which had both closed-ended, and some open ended questions, which were analyzed using quantitative and qualitative methods. The survey research technique was implemented through administration of questionnaires by the main investigator and research assistant to different staff working in theatres such as patient porters, cleaners, theatre service attendants, anaesthesia and surgical trainees, nurses, clinical officer anaesthetists, anaesthesiologists and surgeons. The study implementation was started by first conducting a pilot study in the maternity theatres and later the main study was carried out in the main theatres.

The staff included in the study were given a consent form for participation in the study. The data collection exercise was done in both paper-based methods by the research assistant, and digitally using the KoBo Toolbox application. The data was collected digitally using KoBo Toolbox for the cases where the staff were not available physically in the facility and later linked to the excel software. The data collection using the KoBo Toolbox was administered by sharing a link to the staff and registrars where they filled the questionnaires online. The data filled was automatically synchronized to the central repository in the tool and later exported to excel for further merging and analysis. The data obtained was analysed by statistical analysis software based on the quantitative or qualitative nature of the data. SPSS version 24.0 and STATA were used for analysis.

#### **3.2 Study Site**

The study was conducted at the Kenyatta National Hospital targeting healthcare workers working in the 12 main theatres of the facility. Kenyatta National Hospital (KNH) a public hospital in Kenya that was established in 1901 and operates as a State Corporation through Legal Notice No. 109 of 6th April 1987 [1]. It has a bed capacity of 1,800 beds and an annual average of 70,000 inpatients and 500,000 outpatients' attendance [2]. The hospital offers specialized health care to patients referred from other hospitals within the country, the



Great Lakes Region, Southern and Central Africa. It offers a variety of specialized surgical, medical, training, research and rehabilitative services[1].

KNH has 22 running theatres; 12 main theatres, 2 maternity theatres, 2 trauma theatres, 1 burns unit, 1 ENT satellite theatre, 2 KPCC theatres, 1 eye theatre and 1 Dental School theatre.

The main theatres are located on the first floor of the tower block. The theatres operate on different sub-specialities, for examples, ENT, Paediatric surgery, Orthopaedic, Maxillofacial, General Surgery, Urology and kidney transplant, Plastic Surgery, Ophthalmology, Neurosurgery, Gynaecology and Cardiothoracic and Vascular surgeries.

### **3.3 Study Population**

The subjects and the corresponding respondents were staff affiliated to KNH, UON and KMTC who were specifically involved in theatre activities. Surgical and anaesthesia post graduate students from the university of Nairobi (UON) were also included as participants since they are involved in daily theatre activities. The participants that were included were the patient porters, cleaners, theatre service attendants, registrars, nurses, clinical officer anaesthetists, anaesthesiologists and the surgeons.

### **3.4 Study Tools and Data collection**

Study was carried out over a period of 8 weeks (6th September 2021 to 25th October 2021). The data collection tool was a questionnaire that was administered to the selected staff at the facility. The questionnaire was formulated by the Principal researcher of the study and was later approved by the KNH-UON Ethics & Research Committee. The study started after the approval of the study tools and their appropriateness in achieving the objectives of the study by the Ethics and Research Committee. A pilot study was carried out at the maternity theatres before the commencement of the main data collection activities to assess the effectiveness of the data collection tool in different theatre departments of KNH. The research assistant was trained on the standard interviewing protocols, the significance of the study, all the sections and subsections of the questionnaire and then sensitized about ethical issues such as confidentiality.

### **3.5 Staff Inclusion and Exclusion Criteria**

**Inclusion Criteria:** All the staff working in the main theatre departments at Kenyatta National Hospital. These included the surgeons, anaesthesiologists, registered clinical officer anaesthetist, qualified nurses, theatre service attendants, cleaners and potters.

Lecturers from the University of Nairobi practising at the KNH main theatres were also included. These are the surgeons and anaesthesiologist. The post graduate students from UON were also included in the study. These are the surgical and anaesthesia registrars.

The participants selected had to be working in KNH main theatres and had to consent to participate in the study.

**Exclusion Criteria:** Staff working in KNH main theatres who did not consent to participate in the study were excluded. University of Nairobi lecturers (surgeons and anaesthetists) who did not consent to participate in the study.

Surgical and anaesthesia registrars from the UON who did not consent to participate in the study were excluded.

### **3.6 Sampling Technique**

The proportionate stratified sampling technique was used to recruit staff working in the main theatres department to the study. The members of staff were identified based on confirmation that they were actively involved in the theatre departments using their staff identification card or university identification card. The details about the study were articulately given both verbally and digitally to all the study participants.

### **3.7 Sample Size Determination**

Before the study implementation, there was total of 840 persons working at the KNH main theatres and this was used as the sampling frame of the study. They were subcategorized into different strata based on the staff specialty and level of qualification. Proportionate stratified sampling was used to get approximately

400 staff from the distinct groups to determine randomly the number of participants from each category that were to be included in the research. The staff were categorized into five groups. These included; consultants (surgeons, anaesthesiologists), clinical officer anaesthetists, qualified nurses, registrars (surgical and anaesthesia) and support staff (TSA, cleaners and porters). The actual number of the classifications aforementioned were 173, 40, 97, 468, and 62, respectively.

The following is the expression that was used to get the sample to be selected in each strata;

$$n_x = \frac{(N_x) * n}{N}$$

Where:

$n_x$ = The sample size of the  $x^{\text{th}}$  Stratum. (each stratum representing a job classification/ cadre of the study participants).

$N_x$ = The population size of the  $x^{\text{th}}$  Stratum.

$N$ = The size of the entire target population representing all the staff eligible for selection to participate in the study.

$n$ = The size of the entire sample needed for the study.

The sample size for the consultant stratum was given by;

$$n_x = \frac{(173) * 400}{840} = 82$$

The sample size for the nursing stratum was given by;

$$n_x = \frac{(97) * 400}{840} = 46$$

The sample size for the registrars' stratum was given by;

$$n_x = \frac{(468) * 400}{840} = 223$$

The sample size for the clinical officer anaesthetist stratum was given by;

$$n_x = \frac{(40) * 400}{840} = 19$$

The sample size for the support staff stratum was given by;

$$n_x = \frac{(62) * 400}{840} = 30$$

Therefore, the number of staff that was included in the consultant group is 82, nursing group was 46, registrars' strata was 223, clinical officer anaesthetist was 19, and support staff classification was 30 based on the proportionate stratified sampling calculation. The addition of the participants from each stratum gave the desired sample size of 400.

### **3.8. Data Analysis and Presentation**

The data collected from the KoBo Toolbox was exported to excel and was analyzed using the SPSS version 24 and STATA software, based on the specific analytics performed. Similarly, the data collected through physical administration of questionnaires was entered in excel and later imported into the statistical analysis tools, and was merged with the digitally collected data from the KoBo toolbox. The associations between TAT estimates and different factors such as the personnel factors, surgical factors and infrastructural attributes were initially assessed using bivariate analysis model, which is the Chi-square tests of association.

The multinomial regression model was used to identify each factor's significance to the TAT in the main theatres. A p-value of 0.05 was considered significant for all the tests. Results were presented in frequency tables, bar charts and pie charts to give clear insights on the factors influencing the TAT, both positively and negatively.

### **3.9 Ethical Considerations**

#### **3.9.1 Ethical Reviews and Approvals**

Prior to commencement of the study, approval for the scientific and ethical clearance was obtained from the Ethical Research Committees (ERC) at the KNH and the University of Nairobi.

The administration from the facility was also sensitized on the research and its rationale to improving systems at KNH.

### **3.9.2 Informed Consent**

The post graduate students, KMTC, UON and KNH staff recruited for the study were required to sign a consent form to show acceptance to participate in the study. The consent forms were in both English and Swahili language but the research assistant helped the participants to understand the form's contents before signing.

### **3.9.3 Associated Risks**

The observational survey research method through administering questionnaires to the people working in the central theatre departments of KNH did not pose any challenges to the activities in the hospitals or the patients under care in the facility. The research did not entail direct interaction with the patients, hence there were no risks to the patients since there was no interruption in their treatment and care at the facility.

Confidentiality measures were maintained in this research, and all the participants were given anonymous codes for identification which implies that personal identifier information was not disclosed at any specified stage of the study. The physical questionnaires were kept in a locked locker that was accessible to only the principal investigator and research assistant. The data collected was entered into computers, which were encrypted in passwords and backed up regularly to avoid data loss and breach of confidentiality.

This study was carried out by filling in a questionnaire that was administered to post graduate (masters) students, KMTC, UON and KNH staff, and consequently, the main risk was the failure to get information sought from the target population.

### **3.9.4 Outcomes and Expected Application of Research Output.**

1. The main factors affecting the TAT in KNH main theatres were determined.
2. Recommendations to improve the TAT in main theatres will be submitted to the hospital administration.

### **3.10 Anticipated Benefits of this Research**

The results of this study will be useful in informing the areas that need to be maintained or improved in the main theatres of KNH to improve patient care and hospital revenue. The results and recommendations of this study will be disseminated to KNH stakeholders and administrators and to the University of Nairobi, Department of Anaesthesia. This may assist in maintenance or improvement of the theatre activities in

ensuring patient satisfaction, optimization and maximum utilization of hospital resources and revenues generation.

This study will also be used as a partial fulfilment of the requirement for the degree of Master of medicine (Anaesthesia) of the University of Nairobi.

## CHAPTER FOUR.

### 4.0 STUDY RESULTS

#### 4.1 Introduction

A total of 420 questionnaires were filled. After cleaning the data (name filled on the questionnaire, a questionnaire with multiple responses) 400 questionnaires' responses were selected, representing 100% of the expected sample target size.

The major objective of the study was to determine the factors affecting TAT in KNH main theatres. Different statistical methods were used to analyze variables corresponding to the aforementioned factors.

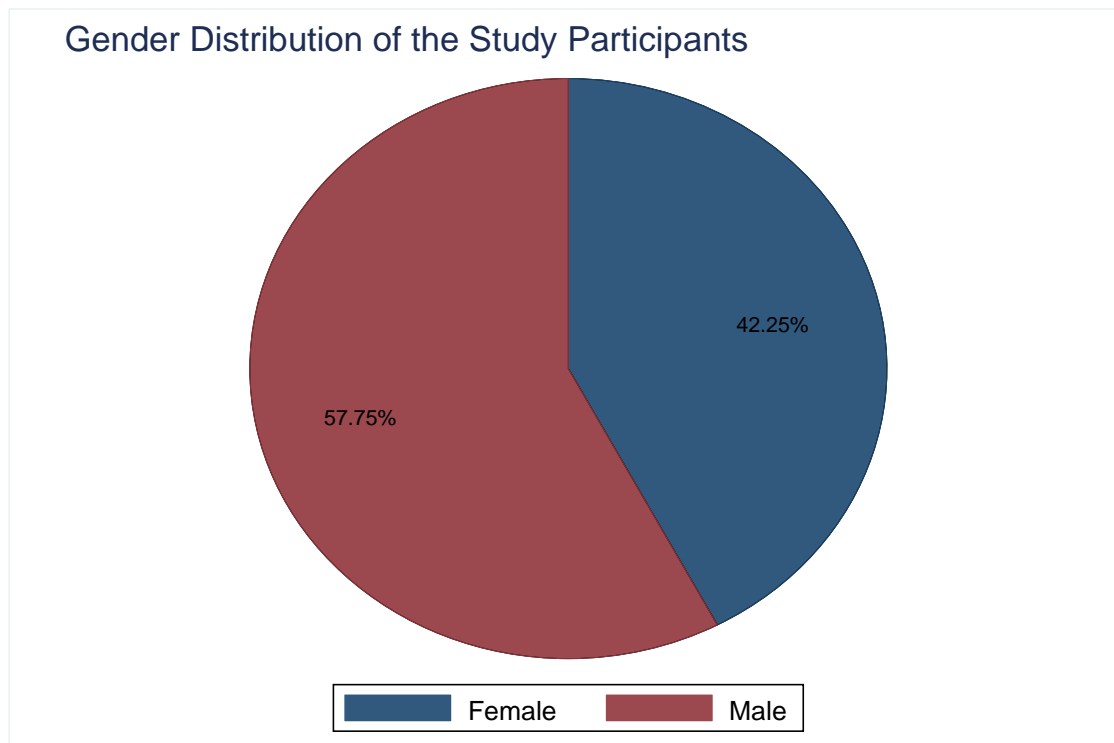
#### 4.2 Demographic Characteristics of the Participants.

##### 4.2.0. Biodata Analysis:

##### 4.2.1. Gender Distribution

A total of 400 participants were voluntarily recruited into the study, where N= 231, 57.75% were male, while N=169, 42.25% were female as illustrated on Figure 4.1.

**Figure 4.1: Distribution of the Study Participants by Gender**

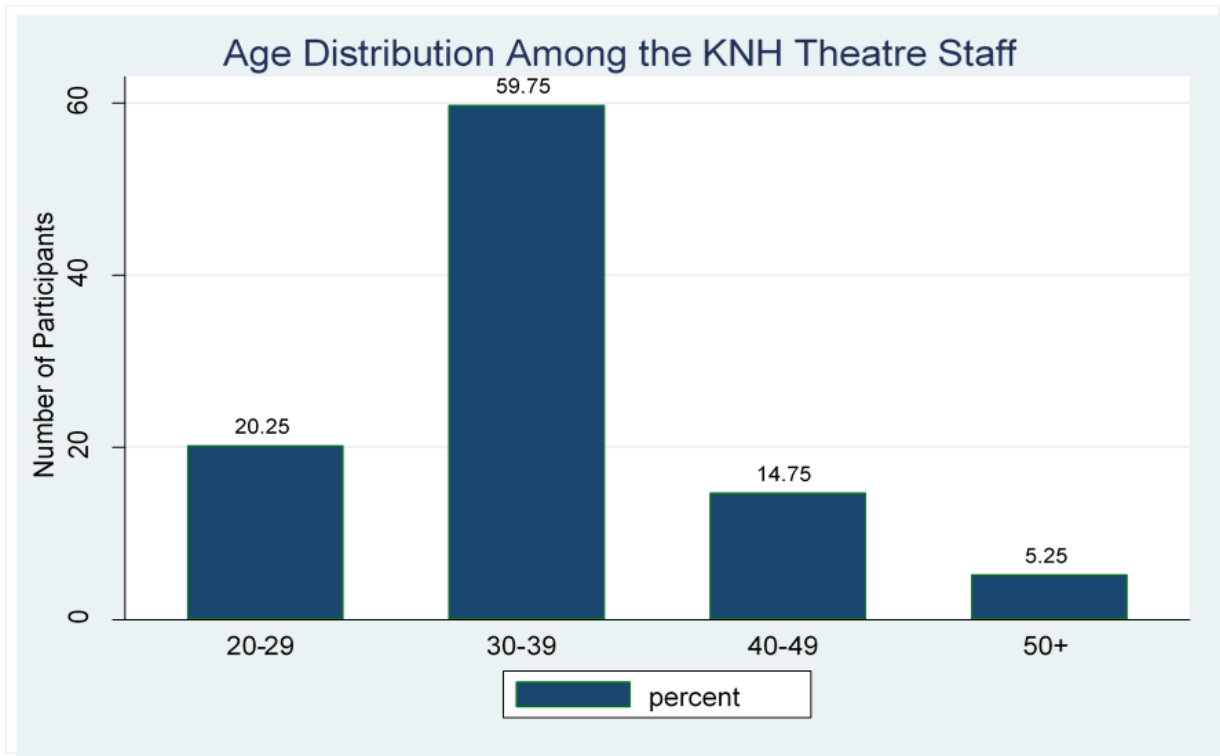


The majority of the respondents were male implying that the females were least represented.

#### 4.2.2. Age-Group Distribution

Majority of KNH main theatres staff are from 30-39 age-groups which represents N=239, 59.75% of the total staff included in the study. This was closely followed by the 20-29 age group N=81, 20.25%, and age-group 40-49 which was represented by N=59, 14.75% of the total responses in the study. The 50+ age-group is the least represented in the study with a representation of N=21, 5.25% of the total.

**Figure 4.2: Percentage Distribution of the Age Groups Among Theatre Staff**



The following frequency table showcases the distribution of the staff age-groups:

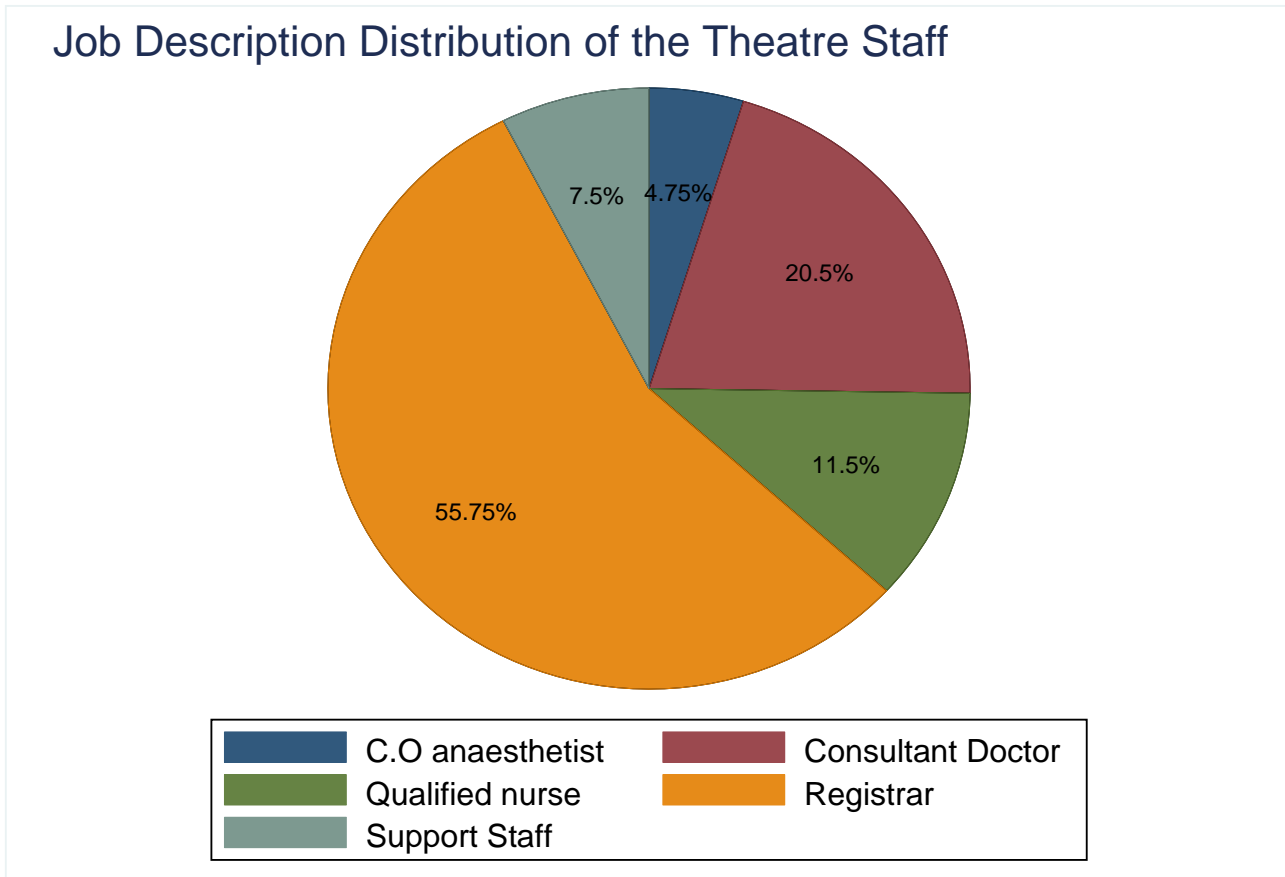
**Table 4.1: Frequency Table on the Participant's Age-Groups**

Age in Years	Number of Participants	Percentage Distribution (%)
20-29	81	20.25
30-39	239	59.75
40-49	59	14.75
50+	21	5.25
<b>Total</b>	<b>400</b>	<b>100</b>



### **4.2.3. Job Description Analysis**

The next demographic variable analyzed was the job description of the staff, which is visually depicted on Figure 4.3;



**Figure 4.3: Percentage Distribution of KNH Main Theatre Staff by Different Cadres**

The participants were grouped into 5 categories based on their specialty and level of qualification.

The Registrars' category, which comprised of resident doctors in training, was the most represented in the study with N=223, 55.75% as indicated on Figure 4.3. The other job categories are represented as; clinical officer anaesthetist N=19, 4.75%, consultant doctors, N=82, 20.50%, qualified nurse N=46, 11.50%, and support staff (inclusive of the cleaners, TSA and patient porters) N=30, 7.5%.

### **4.2.4. Institutional Affiliation Analysis**

The institutional affiliation differed substantially as indicated on Table 4.2 with the majority of the staff coming from the University of Nairobi, N= 228, 57%. KNH staff were the second most represented in the selected sample size represented by N=156, 39%, and lastly KMTC was the least represented with N= 16, 4%.

#### **4.2.5. Years of Experience Analysis: Duration Worked in KNH Main Theatres**

In terms of the staff work experience, majority of the staff had worked at KNH for more than one-year N=356, 89%, while the rest had worked at the KNH main theatres for less than one-year N=44, 11%, as elucidated on table 4.2. Majority of the participants having more than one year of experience was vital as it implies that they understood better the operations and functionality of operating theatres, hence having informative insights of the TAT at the KNH main theatres.

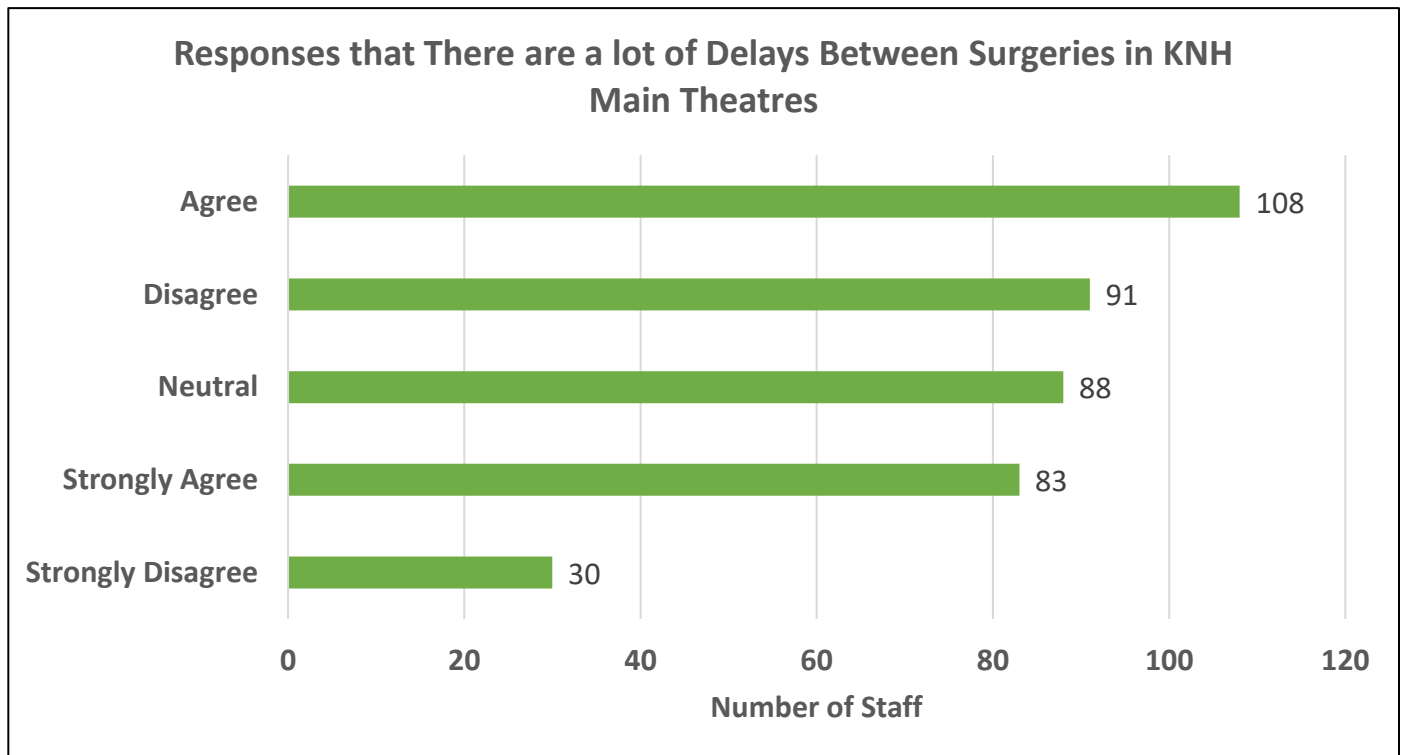
**Table 4.2: Frequency Tables on Institutional Affiliation, Job Description, and Number of Years Worked in KNH Main Theatres.**

	<b>Frequency of the Number of Staff (N=400)</b>	<b>Percentage Distribution (%)</b>
<b>JOB DESCRIPTION</b>		
C.O anaesthetist	19	4.75
Consultant Doctor	82	20.50
Qualified nurse	46	11.50
Registrar	223	55.75
Support Staff	30	7.50
<b>INSTITUTIONAL AFFILIATION</b>		
KMTC	16	4.00
KNH	156	39.00
UON	228	57.00
<b>NUMBER OF YEARS WORKED IN KNH MAIN THEATRES</b>		
Less than one year	44	11.00
One year or more	356	89.00
<b>Total</b>	<b>400</b>	<b>100</b>

#### **4.3 Analysis of Variables Associated with TAT in KNH Main Theatres.**

This section will illustrate the perceptions of the staff towards different factors believed to affect TAT in KNH main theatres. The general expression of the staff indicating whether they think that there exist major delays between surgeries was the major response variable in the study. The respective factors such as the personnel factors, surgical factors, equipment and consumable factors and infrastructural factors were used as the explanatory variables.

#### 4.3.1. Perception That There are a Lot of Delays Between Surgeries in KNH Main Theatres.



**Figure 4.4: Distribution of Responses on the Delays Between Surgeries in KNH Main Theatres**

As indicated on figure 4.4, there are diverse responses toward the statement that there are a lot of delays between surgeries in KNH main theatres. Majority of the staff N=108, 27.00% agreed with the statement, while N=83, 20.75% strongly agreed with the fact that there are a lot of delays between surgeries in KNH main theatres. Approximately N=88, 22.00% of the respondents neither disagreed nor agreed with the statement. However, 91 respondents, representing 22.75% disagreed with the statement and a small percentage of the staff N=30, 7.50% strongly disagreed that there are a lot of delays between surgeries in KNH main theatres.

#### 4.3.2. Perception That Delays Between Surgeries Adversely Affect Service Delivery to Patients.

The delays between surgeries have various consequences to the staff and the patients involved. In this case, most of the staff N= 157, 39.25% agreed that delays between surgeries adversely affected the service delivery to patients while the least N=20, 5.00% strongly disagreed with the statement.

**Table 4.3: Delays Between Surgeries Adversely Affect Service Delivery to Patients**

<b>Response</b>	<b>Frequency of the Number of Staff (N=400)</b>	<b>Percentage Distribution (%)</b>	<b>Cumulative Percentage (%)</b>
Agree	157	39.25	39.25
Disagree	51	12.75	52.00
Neutral	78	19.50	71.50
Strongly Agree	94	23.50	95.00
Strongly Disagree	20	5.00	100
<b>Total</b>	<b>400</b>	<b>100</b>	<b>100</b>

**4.3.3. Factors Affecting Theatre TAT in KNH Main Theatres.**

Table 4.4 to Table 4.7 indicates the responses for the variables representing personnel factors, surgical factors, equipment and consumable factors, and infrastructural factors, respectively. There were 5 categorical responses and the participants were to pick only one. The participants were to agree, disagree, be neutral, strongly agree or strongly disagree with the statements corresponding to different variables.

Table 4.4 indicates how the responses were different based on various statements corresponding to personnel factors affecting TAT. 50.76% of the KNH main theatre staff agreed that KNH staff are sufficiently qualified for their jobs while 34.85% strongly agreed with the statement; implying that KNH staff are well trained for their jobs.

32.00% of the study participants agreed that the staff training needs are adequately met while 24.00% disagreed with the same.

37.50% of the participants agreed that prolonged nursing handover times causes increased delays between surgeries.

Most of the participants, 34.50% were neutral to the statement that KNH theatre staff are highly overworked while 27.75% agreed.

47.22% agreed that lateness to the workplace causes delays between surgeries. 41.25% of the total respondents agreed that absconding duties by staff causes delays in the theatres.

54.80% of the total participants agreed that there was good teamwork among the KNH staff, while 8.33% disagreed with the statement.

34.00% of the total participants neither agreed nor disagreed that the staff are highly motivated.

25.88% of the responses disagreed that there is a major staff shortage at KNH main theatres.

**Table 4.4: Responses for Personnel Factors Affecting TAT**

<b>Personnel Factors</b>	<b>Agree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Strongly Agree (%)</b>	<b>Strongly Disagree (%)</b>
KNH Theatre Staff are Sufficiently Qualified for their Jobs	50.76	2.02	11.36	34.85	1.01
Staff Training Needs in KNH Main Theatres are Adequately Met	32.00	24.00	35.00	4.00	5.00
Prolonged Nursing Handover Time During Shift Change is a Contributor to Theatre Delays.	37.50	18.25	23.75	16.25	4.25
KNH Theatre Staff are Highly Overworked	27.75	21.00	34.50	9.50	7.25
Lateness to the workplace Contributes to Delayed Patients Care in KNH Main Theatres.	47.22	16.41	20.00	10.06	6.31
Absconding From Work by Staff Contributes to Delayed Patient Care in KNH Main Theatres.	41.25	22.50	20.00	8.00	8.25
There is Good Teamwork Amongst KNH Main Theatre Staff	54.80	8.33	15.15	19.19	2.53
Theatre Managers are Supportive	45.84	13.10	27.20	9.82	4.03
KNH Theatre Staff are Highly Motivated in their Work.	18.50	25.25	34.00	6.75	15.50
There is a Major Staff Shortage in the Main Theatres.	22.86	25.88	22.36	11.81	17.09

Table 4.5 indicates the responses based on various statements corresponding to different variables on surgical factors affecting TAT.

33.25% of the KNH main theatre staff agreed that there are adequate number of surgical sets for surgeries in the main theatres, 21.75% disagreed, while 4.25% strongly disagreed on the same statement.

47.00% of the KNH main theatre staff agreed that patient being received in KNH main theatres are usually well prepared for surgery preoperatively, while the least of them represented by 3.00% strongly disagreed with the statement. Similarly, the majority represented by 39.25% agreed that preparing a theatre for emergency surgery is usually faster than preparing for elective surgery in KNH Main theatres.

The majority of the KNH main theatre staff represented by 33.50% of the total disagreed that the blood transfusion unit is reasonably efficient and adequately responsive to the theatre’s blood transfusion requests.

**Table 4.5: Responses for Surgical Factors Affecting TAT**

<b>Surgical Factors</b>	<b>Agree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Strongly Agree (%)</b>	<b>Strongly Disagree (%)</b>
There is an Adequate Number of Surgical Sets For surgeries in KNH Main Theatres	33.25	21.75	34.00	6.75	4.25
Patient Being Received in KNH Main Theatres are Usually Well prepared for Surgery.	47.00	13.25	28.75	8.00	3.00
Preparing a Theatre For Emergency Surgery is usually Faster than Preparing for Elective Surgery in KNH Main Theatres.	39.25	19.25	26.25	8.75	6.50
The Blood Transfusion Unit is Reasonably Efficient and Adequately Responsive to the Theatre’s Blood Transfusion Requests.	21.75	33.50	27.25	3.50	14.00

In equipment and the consumables factors, as indicated on Table 4.6, majority of the staff represented by 54.25% agreed that there are enough anaesthesia machine to cater for patients at the main theatre.

37.75% of the staff agreed that laboratory support is adequate and reliable. The majority of the staff, 58.04% agreed that there is reliable and adequate supply of anaesthetic drugs. The same applies to the supply of drapes and gowns, and adequate number of wheelchairs and stretchers for patient’s transport represented by 51.75% and 48.25% of the total respondents, respectively.

**Table 4.6: Responses for Equipment and Consumable Factors Affecting TAT.**

<b>Equipment and Consumable Factors</b>	<b>Agree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Strongly Agree (%)</b>	<b>Strongly Disagree (%)</b>
There are Enough Anaesthesia Machines to Cater for Patients in KNH Main Theatres.	54.25	14.50	14.50	10.50	6.25
Laboratory Support for Patients in Main Theatre is Adequate and Reliable.	37.75	21.25	31.75	4.00	5.25
The Supply of Anaesthetic Drugs in KNH Main Theatres is Reliable and Adequate.	58.04	8.54	22.86	8.29	2.26
The Supply of Drapes and Gowns is Reliable and Adequate.	51.75	15.75	24.00	5.00	3.50
There is Adequate Number of Stretchers and Wheelchairs for Patient Transport.	48.25	17.50	20.75	8.50	5.00

**Table 4.7: Responses for Infrastructural Factors Affecting TAT**

<b>Infrastructural Factors</b>	<b>Agree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Strongly Agree (%)</b>	<b>Strongly Disagree (%)</b>
The Water Supply in KNH Main Theatres is Reliable and Adequate.	42.00	6.50	8.50	42.50	0.50
The Electricity Supply in KNH Main Theatres is Reliable and Adequate.	48.25	5.50	10.50	34.50	1.25
The Oxygen Supply in KNH Main Theatres is Reliable and Adequate.	42.46	16.58	25.38	11.31	4.27
KNH Main Theatres are Easily and Quickly Accessible from the Surgical Wards and ICU.	38.75	27.00	12.75	11.00	10.50
There is Usually Adequate ICU Space Available for Deserving Surgical Patients.	15.00	36.75	18.50	2.25	27.50
The Post Anaesthesia Care Unit (PACU) in KNH Main Theatres is Sufficiently Large to Accommodate Patients Post Operatively.	45.50	17.25	24.50	6.25	6.50

According to Table 4.7, 168 staff, represented by 42.50% of the total respondents strongly agreed that there is a reliable and adequate water supply in KNH Main theatres, while very few, N=2, 0.50% of the total disagreed with the statement. This implies that the water supply is enough for KNH main theatres.

48.25% of the respondents agreed that the electricity supply in KNH main theatres is reliable and adequate while 34.50% strongly agreed.

42.46% of the KNH main theatre staff agreed that there was reliable and adequate oxygen supply in the theatres while minority, 4.27% strongly disagreed.

38.75% of the staff agreed that KNH main theatres are easily and quickly accessible from the surgical wards and ICU while 27% of them disagreed.



36.75% disagreed that there is usually adequate ICU space available for deserving surgical patients while 27.50% of the total staff strongly disagreed with the same. This implies that there is no adequate ICU space available for deserving patients postoperatively.

Lastly, 45.50% of the participants agreed that the post anaesthesia care unit (PACU) in KNH main theatres is sufficiently large to accommodate patients post operatively.

The differences in the responses indicated the need for use of other statistical methods to ascertain whether the various factors had overall significant effects on TAT in KNH Main theatres.

#### **4.4. Bivariate and Multivariate Analysis of Variables Associated with TAT in KNH Main Theatres using Chi-Square Tests of Association and Multinomial Regression Model, Respectively.**

The chi-square tests were used since we were dealing with categorical variables; to help determine the significance of the relationships between the TAT between surgeries at KNH and other factors such as the personnel factors. This method involves comparisons between two categorical variables. The main response variable in this study for both of the analysis methods is the delays between surgeries in KNH main theatres. The multinomial regression analysis indicated the significance of the relationship between one categorical response variable and multiple explanatory variables in the model.

Table 4.8 indicates the chi-square tests results for the various factors affecting TAT and delays between surgeries is the response variable.

##### **4.4.1. Chi-Square Tests Results on Factors Affecting TAT**

###### **4.4.1.1. Personnel Factors.**

All the personnel factors are associated with delays between surgeries as the p-values are less than the statistical significance level 0.05 for all the correspondence. These factors are:

- Theatre staff sufficient qualification for their jobs.
- Staff training needs being adequately met.
- Prolonged nursing handover time during shift change.
- Highly overworking of staff.

- Lateness to the workplace.
- Absconding from work by staff.
- Good teamwork amongst theatre staff.
- Theatre managers being supportive.
- Theatre staff being highly motivated in their work
- Major staff shortage.

#### **4.4.1.2. Surgical Factors.**

All of the surgical factors have a significant association with TAT, which is associated with delays between surgeries in KHN main theatres. Specifically, adequate number of surgical sets, efficiency and adequacy of response of blood transfusion unit to the theatre's blood transfusion request is substantially related ( $X^2(16) = 58.746, p=0.000, <0.05$ ), ( $X^2(16) = 98.794, p=0.000, <0.05$ ), ( $X^2(16) = 63.323$ ), respectively. Patient being prepared well for surgery pre-operatively, and theatre preparation for emergency surgery being usually faster than preparing for elective surgery are significantly associated with delays between surgeries in KNH main theatres ( $X^2(16) = 55.191, p=0.000, <0.05$ ), ( $X^2(16) = 55.191, p=0.000, <0.05$ ).

#### **4.4.1.3. Equipment and Consumable Factors.**

All the equipment and consumable factors make a significant impact on the delays between surgeries as indicated on Table 4.5. There exists a relationship between the availability of enough anaesthesia machines to cater for patients and the adequacy and reliability of supply of anaesthetic drugs with TAT at KNH ( $X^2(16) = 63.827, p=0.000, <0.05$ ), ( $X^2(16) = 47.571, p=0.000, <0.05$ ). This indicates possible implications that are associated with increased or decreased TAT in the theatres.

Similar observation is made with the adequacy and reliability of laboratory support for patients, adequacy and reliability of supply of drapes and gowns, and the adequacy in number of stretchers and wheelchairs for patient transport ( $X^2(16) = 66.423, p=0.000, <0.05$ ), ( $X^2(16) = 37.302, p=0.000, <0.05$ ), ( $X^2(16) = 47.571, p=0.000, <0.05$ ) and ( $X^2(16) = 64.789, p=0.000, <0.05$ ), respectively.

**Table 4.8: Chi-Square Tests of Association Results on Factors Affecting TAT**

Variable	Chi-Square Statistic ( $X^2$ )	Degrees of Freedom (DF)	P-Value
<b>INFRASTRUCTURAL FACTORS</b>			
Adequacy and Reliability of Water Supply	22.862	16	0.117
Adequacy and Reliability of Electricity Supply	27.627	16	0.035*
Adequacy and Reliability of Oxygen Supply	60.974	16	0.000***
Ease of Accessibility of Main Theatres from the Surgical Wards and ICU	117.725	16	0.000***
Availability of ICU Space for Deserving Surgical Patients.	81.031	16	0.000**
PACU Sufficiency for Accommodation of Patients Post Operatively.	29.777	16	0.019**
<b>EQUIPMENT AND CONSUMABLE FACTORS</b>			
Availability of Enough Anaesthesia Machines to Cater for Patients	63.827	16	0.000***
Adequacy and Reliability of Laboratory Support for Patients	66.423	16	0.000***
Adequacy and Reliability of Supply of Anaesthetic Drugs	47.571	16	0.000***
Adequacy and reliability of Supply of Drapes and Gowns	37.302	16	0.002**
Adequacy in Number of Stretchers and Wheelchairs	64.789	16	0.000**
<b>SURGICAL FACTORS</b>			
Adequacy in Number of Surgical Sets for Surgeries.	58.746	16	0.000***
Patient Being Prepared Well for Surgery	55.191	16	0.000***
Theatre Preparation for Emergency Surgery Being Usually Faster than for Elective Surgery	55.191	16	0.000***
Efficiency and Adequacy of response of Blood Transfusion Units to the theatre's Blood Transfusion Requests.	98.794	16	0.000***
<b>PERSONNEL FACTORS</b>			
Staff Training Needs Being Adequately Met	33.575	16	0.006*
Prolonged Nursing Handover Time During Shift Change	147.618	16	0.000**
Theatre Staff Sufficient Qualification for their Jobs	28.976	16	0.024*
Highly Overworking of Staff	36.297	16	0.003*
Lateness to the workplace	44.936	16	0.000**
Absconding from Work by Staff	46.674	16	0.000***
Good Teamwork Amongst Staff	67.306	16	0.000***
Theatre Managers Being Supportive	73.828	16	0.000***
Theatre Staff Being Highly Motivated in their Work	75.379	16	0.000***
Major Staff Shortage	71.371	16	0.000***

\*\*:  $p < 0.01$    \* :  $p < 0.05$ ,   \*\*\*:  $p < 0.0001$  Response (Dependent) Variable: A lot of Delays Between Surgeries.

#### **4.4.1.4. Infrastructural Factors.**

The chi-square results for various infrastructural factors illustrates significant association with TAT in KNH main theatres. The Chi-square analysis results between the adequacy and reliability of water supply in KNH main theatres and delays between surgeries is ( $\chi^2(16) = 22.862, p=0.117, >0.05$ ). This implies that there exists no significant relationship between the adequacy and reliability of water supply and TAT in KNH main theatres.

The other infrastructural factors elucidate significant association with delays between surgeries, which are often associated with increased TAT. The Chi-square analysis results between the electricity and oxygen supply in KNH main theatres and delays between surgeries are ( $\chi^2(16) = 26.627, p=0.035, <0.05$ ), and ( $\chi^2(16) = 60.974, p=0.000, <0.05$ ), respectively which highlights significant relationships between these variables. Similarly, the accessibility of main theatres from the surgical wards and ICU and delays between surgeries are significantly associated ( $\chi^2(16) = 117.725, p=0.000, <0.05$ ), implying that the distance between the main theatres, surgical wards and the ICU causes substantial influence on the TAT in theatres.

Availability of ICU space for deserving surgical patients and PACU sufficiency for accommodation of patients post operatively also have a considerable association ( $\chi^2(16) = 81.031, p=0.000, <0.05$ ), ( $\chi^2(16) = 29.777, p=0.019, <0.05$ ), respectively.

These results show that all the infrastructural factors except the adequacy and reliability of water supply are significantly associated with TAT. These are attributed to by delays between surgeries in KNH main theatres.

#### **4.4.2. Multinomial Regression Test Results on Factors Affecting TAT.**

The multinomial regression analysis further describes the nature of the relationships between various factors associated with TAT, whether it is increasing or decreasing TAT. The variable with a positive co-efficient means that it was increasing TAT with that factor. On the other hand, the variable with negative co-efficient means that it was decreasing TAT with that factor.

#### **4.4.2.1. Personnel Factors.**

Prolonged nursing handover time during shift change is one of the personnel factors that has a significant influence on the delays between surgeries ( $P=0.000$ ,  $<0.05$ ). Major staff shortage as indicated on table 4.8 also has a significant influence on TAT ( $p=0.039$ ,  $<0.05$ ). Similarly, lack of support from the theatre managers had a considerable impact causing increased TAT ( $p=0.020$ ,  $<0.05$ ). All the other personnel factors which include theatre staff insufficient qualification for their Jobs, staff training needs not being adequately met, lack of staff motivation, lack of highly overworking of staff, lack of lateness to the workplace, absconding from work by staff and good teamwork amongst staff, had no conclusive significant impact on TAT. The p-values corresponding to the aforementioned variables were all greater than the statistical significance level 0.05.

#### **4.4.2.2. Surgical Factors.**

The surgical factors have diverse influence on the delays between surgeries based on the multivariate analysis illustrated on Table 4.9. The adequacy in numbers of surgical sets and patient being prepared well for surgery preoperatively had no significant association with the delays between surgeries ( $p=0.836$ ,  $>0.05$ ) ( $p=0.404$ ,  $>0.05$ ), respectively.

The urgency of surgery had a significant effect on theatre preparation hence on the delays between surgeries. Theatre preparation for emergency surgeries compared to elective surgeries had significant influence to the overall delays between surgeries at KNH ( $p=0.025$ ,  $<0.05$ ). Efficiency and adequacy of response of blood transfusion units to the theatre's blood transfusion requests also had significant influence on TAT ( $p=0.000$ ,  $<0.05$ ).

#### **4.4.2.3. Equipment and Consumable Factors.**

There is a significant influence on the availability of enough anaesthesia machines to cater for patients to the delays between surgeries in KNH ( $p=0.019$ ,  $<0.05$ ). Other equipment and consumable factors that have influence with delays between surgeries are the adequacy and reliability of supply of anaesthetic drugs ( $p=0.041$ ,  $<0.05$ ) and adequacy in number of stretchers and wheelchairs ( $p=0.022$ ,  $<0.05$ ). They are associated with decrease in TAT in KNH main theatres. The supply of drapes and gowns also influence delays between surgeries by increasing TAT in KNH main theatres ( $p=0.019$ ,  $<0.05$ ). The adequacy and reliability of laboratory support for patients does not have a significant influence on the delays between surgeries ( $p=0.355$ ,  $<0.05$ ).

#### 4.4.2.4. Infrastructural Factors.

There exists no significant influence of the adequacy and reliability of water supply with delays between surgeries at KNH ( $p= 0.412, >0.05$ ). The same observation is seen in the case of availability of ICU space for deserving surgical patients ( $p=0.401, >0.05$ ) and PACU sufficiency for accommodation of patients post operatively ( $p=0.577, >0.05$ ).

This implies that there exists no significant association between adequacy and reliability of water supply, ICU space availability and PACU space; and TAT in KNH Main theaters. However, a different observation is made for the case of adequacy and reliability of electricity supply. There exists a significant influence of this attribute to the delays between surgeries at KNH ( $p=0.011, <0.05$ ). This is associated with decrease in TAT in KNH main theatres.

With every unit increase in the adequacy and reliability of electricity supply, the delays between surgeries decreases with -0.351 units. Therefore, adequacy and reliability of electricity supply positively affects TAT by reducing the possible delays between surgeries.

The adequacy and reliability of oxygen supply have implications on TAT ( $p=0.023, <0.05$ ). Its levels have effects on the delays between surgeries by increasing TAT in KNH main theatres. Lack of ease of accessibility of the main theatres from the surgical wards and ICU also have implications on the delays between surgeries at KNH ( $p=0.000, <0.05$ ) by increasing TAT.

**Table 4.9: Multinomial Regression Analysis Results on Factors Affecting TAT**

Variable	Coefficient ( $\beta$ )	Standard Error (SE)	95% Confidence Interval(CI)	P-Value
<b>INFRASTRUCTURAL FACTORS</b>				
Adequacy and Reliability of Water Supply	0.112	0.136	[-0.156 to 0.379 ]	0.412
Adequacy and Reliability of Electricity Supply	-0.351	0.137	[-0.620 to -0.082]	0.011*
Adequacy and Reliability of Oxygen Supply	0.133	0.134	[-0.131 to 0.397]	0.023*
Ease of Accessibility of Main Theatres from the Surgical Wards and ICU.	0.444	0.119	[0.211 to 0.678]	0.000**
Availability of ICU Space for Deserving Surgical Patients.	0.093	0.11	[-0.124 to 0.309]	0.401
PACU Sufficiency for Accommodation of Patients Post Operatively.	0.07	0.126	[-2.718 to -0.622]	0.577
<b>EQUIPMENT AND CONSUMABLE FACTORS</b>				
Availability of Enough Anaesthesia Machines to Cater for Patients	-0.35	0.15	[-0.643 to -0.056]	0.019*
Adequacy and Reliability of Laboratory support for Patients	0.136	0.147	[-0.152 to 0.425]	0.355
Adequacy and Reliability of Supply of Anaesthetic Drugs	-0.103	0.157	[-0.411 to 0.204]	0.041*
Adequacy and Reliability of Supply of Drapes and Gowns	0.107	0.154	[-0.196 to 0.409]	0.019*
Adequacy in Number of Stretchers and Wheelchairs	-0.252	0.15	[-0.545 to 0.041]	0.022**
<b>SURGICAL FACTORS</b>				
Patient Being Prepared Well for Surgery Pre-Operatively	-0.118	0.141	[-0.395 to 0.159]	0.404
Urgency of Surgery: Theatre Preparation for Emergency Surgery Being Usually Faster Than for Elective Surgery	0.29	0.129	[0.036 to 0.543]	0.025*
Efficiency and Adequacy of Response of Blood Transfusion Units to the Theatre's Blood Transfusion Requests.	0.534	0.128	[0.284 to 0.785]	0.000***
Adequacy in Number of Surgical Sets for Surgeries	-0.03	0.145	[-0.314 to 0.254]	0.836
<b>PERSONNEL FACTORS</b>				
Theatre Staff Sufficient Qualification for their Jobs	0.128	0.122	[-0.110 to 0.367]	0.291
Staff Training Needs Being Adequately Met	0.082	0.151	[-0.214 to 0.378]	0.585
Prolonged Nursing Handover Time During Shift Change	0.6	0.14	[0.326 to 0.874]	0.000***
Highly Overworking of Staff	-0.015	0.144	[-0.297 to 0.268]	0.918
Lateness to the workplace	-0.121	0.159	[-0.432 to 0.191]	0.448
Absconding from Work by Staff	0.002	0.156	[-0.303 to 0.307]	0.991
Good Teamwork Amongst Staff	-0.119	0.137	[-0.388 to 0.151]	0.387
Theatre Managers Being Supportive	0.345	0.148	[0.054 to 0.636]	0.020*
Theatre Staff Being Highly Motivated in their Work	0.181	0.126	[-0.066 to 0.427]	0.151
Major Staff Shortage	0.109	0.127	[-0.140 to 0.359]	0.039*

\*\* :  $p < 0.01$  \* :  $p < 0.05$ , \*\*\* :  $p < 0.0001$  Response (Dependent) Variable: A lot of Delays Between Surgeries (TAT).

#### **4.5. Analysis of Other Factors Not Listed in the Variables.**

Participants had open ended questions whereby they were asked to give opinions on other factors not listed in the variables that they think increases or decreases TAT in KNH main theatres.

The personnel factors identified was few number of patient porters causing delays in (moving patients to and from) theatres.

The staff also expressed that the consultant surgeons delay surgeries by taking time in joining the junior surgeons/registrar during complicated procedures. This was associated with increase in TAT at the main theatres.

Staff collaboration and co-ordination was suggested to improve the success of the department.

The major observation on the additional comments that recurred among many participants corresponding to infrastructural factors was the issues of lifts/elevators. Different staff working in KNH main theatres specified that there are inadequate number of lifts to ferry patients to and from the theatre. The other observation was the pre-existing lifts had habitual malfunctions, which causes delays in surgeries.



## **CHAPTER FIVE.**

### **5.0 DISCUSSION**

#### **5.1 Introduction**

The major aim of this study was to determine factors affecting TAT in KNH main theatres.

The analysis has elucidated the dynamics in different factors believed to have an impact on TAT in KNH main theatres. The aspects that include personnel factors, surgical factors, equipment and consumable factors and infrastructural factors are associated with increased or decreased TAT in KNH main theatres.

TAT is a quality marker for theatre efficiency. Previous studies on TAT have shown that personnel factors, surgical factors, equipment and consumable factors and infrastructural factors affected TAT in theatres [3], [13], [17].

#### **5.2 Personnel Factors Affecting TAT in KNH Main Theatres**

The personnel factors have been depicted to have a significant relationship with delays between surgeries in KNH main theatres. Inadequate staffing is a major challenge observed in the analysis of the responses in this study. The significant association and influence of staff shortage was found to have impact on the delays between surgeries ( $p\text{-value}=0.039, <0.05$ ); hence causing increased TAT. This is similar to studies conducted by Bradley et al., in a health care facility in Malawi where there were few staff and too many patients with over 40% of the staff wanting to resign [14]. This may be associated with substantial impact on patient service delivery and job satisfaction [14].

In addition, in open ended responses, it was observed that there are few number of patient porters causing delays in moving patients to and from theatre. This result is consistent with the findings of Haldar et al; who concluded that one of the causes of patient transportation delays to the operating theatre was patient porter related [55].

There was a significant influence of lack of supportive theatre managers and delays between surgeries (p-value=0.020, <0.05) in this study. This was dissimilar to previous studies where the staff collaboration and teamwork between staff and management were associated with decreased delays in theatres [14], [15].

Similarly, study done in California by D Nina et al., emphasized the importance of feedback and positive reinforcement to the staff by the hospital administration as a way of reducing TAT [16].

The finding that KNH theatre managers are not supportive could be related to the fact that there is major staff shortage in the main theatres hence the staff reflecting it to lack of support from the managers.

Prolonged nursing handover time during shift change increased delays between surgeries (p-value=0.000, <0.05). Current studies on delays caused in theatres by nurses emphasizes on miscommunication and incomplete handover during handover time among the nurses as the major problem [55]. Study conducted by Sharif et al., in Aga Khan University Hospital, Karachi, showed that delayed movement of patients from the wards to OR was a significant contributor to increased TAT, accounting for 22.7% of the delays.

In open ended response, increased TAT in theatre were associated with delays in consultant surgeons joining junior surgeons/ registrars during complicated procedures. According to Wong et al., complex surgeries may affect surgeons' performance due to stress and fatigue, leading to delays in commencement of subsequent cases [54]. In contrast, study done by W. Ang et al., in London, showed that presence of a senior surgeon and anaesthesia consultant was associated with decreased TAT [15].

In this study, it was observed that the staff are not highly motivated in their work, but this finding had no significant influence on the delays at KNH based on the regression analysis (p-value=0.151, >0.05). This means that we cannot conclude that staff's performance is affected by lack of motivation in KNH main theatres. This is dissimilar to a study conducted by Kumar and Malhotra, [17] whereby giving incentives like free meals motivated staff, improved performance and reduced delays in theatre. Similarly, study done in California by D Nina et al., emphasized the importance of feedback and positive reinforcement to the staff by the hospital administration as a way of reducing TAT [16].

In addition, a study done by Bradley et al in Malawi stipulated that insufficient staffing led to staff demotivation with over 40% workers wanting to resign [14].

Lack of lateness to workplace and absconding work by staff were significantly associated with delays between surgeries ( $p=0.000$ ,  $<0.05$ ) using the chi-square tests of association, but its significant impact was not identified in the regression analysis ( $p=0.448$ ,  $0.991$ ,  $>0.05$ ). Good team work amongst staff ( $p=0.387$ ,  $>0.05$ ) and theatre staff not being sufficiently qualified for their jobs ( $p=0.291$ ,  $>0.05$ ) also had no influence on TAT. This means that we cannot conclude that staff's performance is affected by lack of staff lateness to work place, absconding work, good team work amongst staff or theatre staff insufficient qualification for their jobs in KNH main theatres. These contrast an audit done at Jai Prakash Naraya Apex trauma Centre in India to assess the causes of delay in theatre [25]. Lateness of theatre staff, deficiencies in team work and limited availability of trained support staff were responsible for increased TAT [25].

According to the regression analysis, the staff capacity building by meeting the staff training needs had no influence on TAT in KNH ( $p=0.585$ ,  $>0.05$ ). This study is dissimilar to studies conducted by Weller and Boyd et al., where staff empowerment through training proved to have positive impact on performance and improving theatre output due to the reduced delays [19]. This could be due to the fact that KNH is a training centre, therefore, the staff in theatres are continuously trained on day to day running of their jobs.

Theatre staff are not highly overworked in KNH main theatres. However, this finding had no significant influence on the delays in KNH main theatres based on the regression analysis ( $p=0.918$ ,  $>0.05$ ). This is dissimilar to study done by Bradley et al in Malawi which showed that there were too few staff with too many patients with over 40% of the staff wanting to resign [14].

The personnel attributes are significant contributors to the success of theatres in terms of service delivery to patients and staff satisfaction. The optimization of the human resources to ensure enough workforce and support from the management will therefore be essential in reducing TAT in KNH main theatres.

### **5.3 Surgical Factors Affecting TAT in KNH Main Theatres**

There was a major association between surgical factors and delays between surgeries in KNH.

The urgency of the surgery had a significant impact on TAT where theatre preparation for emergency surgeries compared to elective surgery was associated with increased delays ( $p=0.025$ ,  $<0.05$ ). This reflects

on a study conducted by Essena et al., with the aim of reducing the waiting time for emergency surgeries. This resulted in 10% reduction in emergency surgeries waiting time compared to the normal schedule [60].

Blood supply in theatre: In this study, inefficiency and inadequacy of blood transfusion units during surgeries had an increase in TAT ( $p=0.000$ ,  $<0.05$ ). Similarly, a study conducted by Kajja et al., indicated the increased delays in the surgery in cases where higher amount of blood units was needed intraoperatively [46]

Based on the analysis output in KNH main theatres, adequate preoperative patient preparation did not significantly influence TAT ( $p=0.404$ ,  $>0.05$ ). This is in contrast with a study conducted by Kluger et al. Inadequate patient preparation preoperatively caused delays in theatres because 10% of the patients had not undergone preoperative assessments by the anaesthetists [41]. Similarly, a study conducted by Muhimpundu et al., in Rwanda, showed that the main cause of delays in surgeries was inadequate preoperative patient preparation.

This study result in KNH could be due to the finding that KNH theatres is adequately stocked with reliable anaesthesia machines, reliable supply of anaesthetic drugs and adequate numbers of stretchers and wheel chairs.

This implies that KNH main theatre is prepared to handle patients who are well prepared preoperatively and those who may not be well prepared too.

Adequate number of surgical sets had no significant influence on TAT [ $p=0.836$ ,  $>0.05$ ). This could be due to the finding that there is no adequate and reliable supply of drapes and gowns in KNH main theatres. These are essential for most surgical procedures to avoid infections and contaminations of surgical sites [51]. Therefore, having adequate number of surgical sets may not significantly impact on TAT where there is irregular provision of drapes and gowns.

#### **5.4 Equipment and Consumable Factors Affecting TAT in KNH Main Theatres**

The equipment and consumable factors also had a substantial influence on the theatres TAT in KNH.

In this study, lack of adequate and reliable supply of drapes and gowns were observed to have increased delays in theatres ( $p=0.019$ ,  $<0.05$ ). Drapes and gowns are essential in theatres to ensure sterility during

surgical procedures [51]. This finding in KNH is consistent with the study done by Kieser et al., which showed that irregular supply of drapes and gowns can cause delays between surgeries [51].

According to the analysis conducted on the responses from KNH staff, there is adequate numbers of anaesthesia machines to cater for patients in KNH main theatres. This significantly reduces the delays between surgeries ( $p=0.019$ ,  $<0.05$ ). This is in contrast to a study conducted by Mbembati et al., at the Muhimbili National Hospital in Tanzania, which illustrated that 29% of the scheduled surgical operation were postponed due to faulty anaesthesia machines [33].

There is adequate and reliable supply of anaesthetic drugs in KNH main theatres ( $p=0.041$ ,  $<0.05$ ). Availability of adequate supply of drugs is essential in providing safe anaesthesia to patients. In contrast, Charana et al did a survey on outreach of anaesthesia services in selected surgical camps in Kenya. There was a challenge in delivering safe anaesthesia in those selected surgical camps due to inadequate anaesthesia drugs supply [50]. KNH, being a major referral hospital, it's important that it has adequate and reliable supply of anaesthetic drugs. This finding could be due to the good planning and resource allocation by the KNH hospital administration.

Similarly, there is adequate number of stretchers and wheelchairs reducing delays in KNH main theatre ( $p=0.022$ ,  $<0.05$ ). This reduces delays pre and post-operatively [54]. A similar observation was made on study conducted by Wong et al; that was investigating modalities of optimizing the theatre environment and the increased number of wheelchairs would contribute to the decreased delays in theatres [54]

However, lack of adequate and reliable laboratory support for patients in main theatre had no significant associations with TAT in KNH main theatre ( $p=0.355$ ,  $>0.05$ ). This study is in contrast with a study conducted by Mbembati et al in Tanzania., where there was postponement of cases due to lack of equipment in the laboratory to do preoperative tests [33].

This results could be due to the findings that KNH theatres is adequately stocked with reliable anaesthesia machines, reliable supply of anaesthetic drugs and adequate numbers of stretchers and wheelchairs. Therefore, lack of adequate and reliable laboratory support for patients had no influence on delays between surgeries.

This implies that KNH main theatre is prepared to handle patients who are well prepared preoperatively and those who may not be well prepared too.

### **5.5 Infrastructural Factors Affecting TAT in KNH Main Theatres**

The oxygen supply in KNH main theatre is inadequate and unreliable therefore increasing TAT ( $p=0.023$ ,  $<0.05$ ). This is similar to a study conducted in Afghanistan by Contini et al., which indicated that oxygen supply for surgical cases was inadequate in a number of health facilities. This resulted in delays and increase in TAT within the hospital [52].

However, the surge in Covid-19 pandemic in the month of April, 2021, leading to shortage of oxygen supply in Kenya, and hence KNH main theatres, could have led to the finding that oxygen supply is not adequate and is unreliable.

Lack of ease of accessibility of main theatres from the surgical wards and ICU was significantly associated with delays in KNH ( $p=0.000$ ,  $<0.05$ ). In addition, the respondents in the open-ended responses specified the need for additional lifts and renovation of the dysfunctional lifts to avoid delays when ferrying patients to and from the theatres. Similarly, a study conducted by Haldar et al., indicated the existence of significant delays caused during patient transportation since the theatres, wards and ICU were not located near one another. In addition, the lifts for patient transportation were inadequate [55].

There is adequate and reliable supply of electricity in KNH main theatres decreasing TAT ( $p=0.011$ ,  $<0.05$ ). This contrasts study done by Lindan et al., which indicated that the insufficient supply of electricity in Ugandan public hospital affects surgical services delivery [53].

However, this study showed no significant association between adequacy and reliability of water supply; and delays between surgeries in KNH main theatres ( $p=0.412$ ,  $>0.05$ ). This finding also contrasts study by Lindan et al., which indicated that insufficient supply of water affects adequate and safe surgical services at the public hospitals in Uganda [53].

Similarly, it was observed that there exists no significant association between availability of ICU space ( $p=0.401$ ,  $>0.05$ ), PACU sufficiency for accommodation of patients post operatively ( $p=0.577$ ,  $>0.05$ ), and the

theatre TAT in KNH Main theatre. These contrast previously done studies. Study conducted by Van Tunen et al., indicated that the availability of space in PACU affects the turnover of patients from the operation rooms [57].

This could indicate that KNH main theatre is well equipped and adequately planned to take care of patients post operatively thus decreasing the turnover time after completion of a surgical procedure.

## **CHAPTER SIX.**

### **6.0 SUMMARY, CONCLUSIONS AND STUDY RECOMMENDATIONS.**

#### **6.1. INTRODUCTION**

The main aim of the study was to determine factors affecting turnaround time in Kenyatta National Hospital main theatres. This chapter gives the summarized details of the findings indicating whether each factor affected TAT positively or negatively.

The KNH hospital administration will be praised on the outcome of this study and hopefully utilize the study recommendations to improve and optimize the pre-existing systems and enhance overall efficiency in the theatre.

#### **6.2. SUMMARY**

Upon approval of the study by KNH-UON ethics committee, the targeted 400 participants consented to participate in the study and the data collection process took place for a period of 7 weeks. Data collection was both paper based using physical questionnaires and electronic using the KoBo Tool box. The descriptive statistics analysis (Frequency tables and charts), bivariate association methods (Chi-square tests), and multivariate method (Multinomial regression) were used to analyze different factors affecting TAT. In this study, personnel factors, surgical factors, equipment and consumable factors, and infrastructural factors each indicated a significant influence on TAT in KNH main theatres.

For personnel factors, prolonged nursing handover time during shift change, lack of supportive theatre managers, major staff shortage, delays by consultant surgeon in joining junior surgeons/registrar during complicated procedures increase the TAT in KNH main theatres. There exists no significant association between staff insufficient qualification for their jobs, inadequately met staff training needs, staff not being highly overworked, lack of lateness to workplace, absconding from work by staff, good teamwork among staff, staff demotivation and TAT in KNH main theatres.



For the surgical factors, the variables that caused increased TAT include: nature of the urgency of the surgery (theatre preparation for emergency surgery versus elective surgery) and lack of efficient and adequate blood transfusion units to the theatres. There exists no significant association between adequate number of surgical sets for surgery, patient being prepared well preoperatively and TAT in KNH main theatres.

The equipment and consumable factors that caused increased TAT at KNH include, inadequacy and unreliability of drapes and gowns. The variables that caused decreased TAT include: availability of enough anaesthesia machines to cater for patients, adequate and reliable supply of anaesthetic drugs and adequate number of stretchers and wheelchairs for patient transport. Inadequacy and unreliability of laboratory support for patients had no significant influence on TAT.

The infrastructural factors that caused increased TAT include: lack of adequacy and reliability of oxygen supply, and lack of ease of accessibility of main theatres from the surgical wards and ICU. There exists no significant association between availability of ICU space for deserving surgical patients, PACU space sufficiency to accommodate patients post operatively and adequacy and reliability of water supply; and theatre TAT in KNH main theatres.

Each of these factors had specific variables that were significantly associated with TAT ( $p < 0.05$ ), while the rest of the variables indicated no statistically significant evidence of association ( $p > 0.05$ ), despite them increasing or decreasing TAT.

The coefficients tell whether there is increase or decrease in the delays while the P-values indicate the significance of these relationships.

Therefore, the various factors displayed a diversified influence on TAT as seen in the results, despite their specification.

### 6.3. CONCLUSIONS

The study established that prolonged nursing handover time during shift change, lack of supportive theatre managers, major staff shortage, delays by consultant surgeon in joining junior surgeons/registrars during complicated procedures increase the TAT time in KNH main theatres. These are the personnel factors affecting the turnaround time for surgeries in KNH main theatres.

The surgical factors that significantly affected the turnaround time in KNH main theatres include: nature of the urgency of the surgery (theatre preparation for emergency surgery versus elective surgery) and lack of efficient and adequate blood transfusion units to the theatres. These increases TAT in KNH main theatres.

The equipment and consumable factors that caused increased TAT at KNH include, inadequacy and unreliability of drapes and gowns. The variables that caused decreased TAT include: availability of enough anaesthesia machines to cater for patients, adequate and reliable supply of anaesthetic drugs and adequate number of stretchers and wheelchairs for patient transport.

The infrastructural factors that significantly affected TAT were lack of adequacy and reliability of oxygen supply, and lack of ease of accessibility of main theatres from the surgical wards and ICU. These variables increased TAT.

The personnel factors, surgical factors, equipment and consumable factors, and infrastructural factors all were associated with delays in TAT with a specification of the main variables affecting TAT positively (decreasing TAT) or negatively (Increasing TAT).

#### 6.4. STUDY RECOMMENDATIONS

The KNH theatre management should implement strategies based on individual factors affecting TAT which contribute to the eradication of increased TAT in KNH main theatres, namely:

- The number of staff in the theatres should be increased to improve the TAT in the main theatre.
- Feedback and positive reinforcement by theatre managers to the theatre staff
- Collaboration and teamwork between Blood transfusion unit and KNH main theatre to ensure timely blood transfusion requests.
- Ensuring adequate and reliable oxygen supply in the theatres.
- Further investments in the infrastructure in order to reduce the effects of distance between main theatre, surgical wards and ICU by building theatres next to these units or on each surgical floor.
- Availing enough and functional lifts will help reduce delays in KNH main theatres.
- In-depth analysis of the everyday running of theatre operations will enhance the identification of further factors and gaps that contribute to increased TAT.
- There is also need to consider the consumables and equipment factors in KNH. Theatres should be well stocked with sufficient drapes and gowns to avoid delays between surgeries caused by these factors.

This study illuminates the need for aligning all processes associated with these factors to ensure that activities are optimized from personnel, infrastructural to hospital management. This will significantly contribute to the reduction of TAT in KNH main theatres. This could lead to improvement of patient service delivery and more job satisfaction to the staff.

## **6.5. STUDY LIMITATIONS**

The study focussed on the main theatres only. Satellite theatres that operate on day cases mostly were excluded. Maternity theatres, which mainly operate emergency cases, were excluded from the main study. This implied that factors affecting TAT in day case surgeries and emergencies in KNH were not truly reflected in this study.

Staff working in other departments who may have knowledge on main theatre processes were not considered to participate in this study.

Covid-19 pandemic may have contributed to (skewed) findings in some factors like oxygen supply leading to bias.

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## **APPENDICES**

### **APPENDIX 1: Prior Informed Consent Form: English Version**

#### **Introduction**

Theatre departments are some of the essential departments at KNH, and the activities there significantly contribute to the improvement of patient care and quality of life. This observational study seeks to investigate the efficiency in KNH main theatres by identifying factors causing reduction or increase in TAT in these departments. Tracking these factors by carrying out a survey through questionnaire administration to the staff will be informative to the systems at KNH.

#### **Telephone Contact on Consent**

This consent form gives you information about the study and the risks will be explained to you. Once you understand the study, you will be asked to verbally give consent for participation in the study.

Kindly know that participation as a respondent in this study is entirely voluntary. The same case applies to answering questions whereby you will only answer the questions you are comfortable with.

#### **Study Population**

The main study participants will be KNH, UON and KMTC staff and the post graduate students from UON training at the facility.

#### **Risks and Precautions**

There are no expected risks in this study. In case you feel uncomfortable answering any of the questions, feel free to inform the research assistant.

#### **Privacy and Confidentiality**

The information collected will be very confidential and no identifiable information will be presented after data analysis. The information will be safeguarded in computer system with encrypted algorithms to allow access to only the authorized personnel.

**Benefits of the Study**

There are no direct benefits to you as an individual for providing us with the information we require. However, we will be able to provide any advice you may need or answer any questions you may have.

**Costs to You**

There is no cost to you for participating in the study.

**Problems and Questions**

If you ever have questions about this study, kindly contact the principal investigator **Dr. Belinda Adda Namisi** on the telephone number: **0722998493**.

**Your Consent**

If you agree to participate, and you have been working in KNH main theatres and or training at KNH, I will require you to sign this consent. (Tick where appropriate)

- I agree to take part in this study
- I do not agree to take part in this study
- Any concerns raised .....

Name of the participant: .....

Signature: .....

Date: .....

## **APPENDIX 2: Prior Informed Consent Form: Swahili version.**

### **Fomu ya Idhini**

#### **Utangulizi**

Ukumbi wa upasuaji katika hospitali ni idara muhimu katika hospitali kuu ya Kenyatta, na shughuli huko zinachangia sana uboreshaji wa utunzaji wa mgonjwa na maisha bora. Utafiti huu wa uchunguzi unatafuta kuchunguza ufanisi katika ukumbu wa upasuaji kwa kubainisha sababu za upungufu au kuongezeka kwa muda unaotumika kati ya oparesheni katika idara hizi. Kufuatilia mambo haya kwa kufanya utafiti kupitia usimamizi wa dodoso kwa wafanyikazi kutaarifu mifumo katika hospitali kuu ya Kenyatta.

#### **Idhini kwa Mawasiliano ya Simu**

Fomu hii inakupa habari juu ya utafiti huu. Mara tu utakapoelewa utafiti huu, utaulizwa kupeana idhini ya kushiriki katika utafiti. Tafadhali jua kwamba kushiriki kama mhojiwa katika utafiti huu ni kwa hiari yako. Jibu tu maswali ambayo unahisi vyema nayo.

#### **Watu Wahusika**

Washiriki wakuu wa utafiti watakuwa wafanyikazi wa KNH, UON, KMTC na wanafunzi kutoka UON wanaofanya kazi katika kituo hicho.

#### **Hatari na Tahadhari**

Hakuna hatari zinazotarajiwa katika utafiti huu. Ikiwa unahisi tashwishi kujibu maswali yoyote, jisikie huru kumjulisha msaidizi wa utafiti.

#### **Faragha na Usiri**

Habari itakayokusanywa itakuwa ya siri sana na hakuna habari inayotambulika itakayowasilishwa baada ya uchambuzi wa utafiti. Habari hiyo italindwa katika mfumo wa kompyuta na haitaruhusu upatikanaji wa huo ujuzi kwa wafanyikazi wasioidhinishwa.

#### **Faida za Utafiti**

Hakuna faida za moja kwa moja kwako kama mtu binafsi kwa kutupatia habari tunayohitaji. Lakini, tutaweza kutoa ushauri wowote utakaohitaji au kujibu maswali yoyote ambayo unaweza kuwa nayo.

## Gharama kwako

Hakuna gharama kwako kwa kushiriki kwenye huu utafiti.

## Shida na Maswali

Ikiwa una maswali juu ya utafiti huu, wasiliana na mpelelezi mkuu Daktari Belinda Adda Namisi kwenye nambari ya simu **0722998493**.

## Idhini Yako

Ikiwa unakubali kushiriki nitahitaji idhini yako. (Tiki mahali panapofaa)

- Ninakubali kushiriki katika utafiti huu
- Sikubali kushiriki katika utafiti huu
- Masuala yoyote yaliyotolewa .....

Jina la mshiriki: .....

Sahihi: .....

Tarehe: .....

**APPENDIX 3: Questionnaire: English Version**

**A Questionnaire on Investigating Factors Affecting TAT in KNH Main Theatres.**

**Serial Number:** .....

**Date:** .....dd/mm/yyyy

**INSTRUCTIONS**

- 1) Please do not write your name anywhere in the questionnaire.
- 2) Put a tick (✓) in the box next to the right response.
- 3) Please write the response in the spaces provided.

**1. Biodata.**

**Gender:** Male

Female

**Age:** .....years

**2. Job description:**

Patient porter

Cleaner

TSA

Resident doctor in training

Qualified nurse

C.O. anaesthetist

Consultant doctor



**3. Institutional affiliation**

KNH

UON

KMTC

Other (specify).....

**4. Duration of time worked in KNH main theatres.**

less than 1 year

1 year or more

**5. Questions concerning KNH main theatres**

	<b>Question</b>	<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Strongly agree</b>
1.	There are a lot of delays in between surgeries in KNH main theatres					
2.	The delays in between surgeries in KNH main theatres adversely affect service delivery to patients.					
3.	The water supply in KNH main theatres is reliable and adequate					
4.	The electricity supply in KNH main theatres is reliable and adequate.					
5	The oxygen supply in KNH main theatres is reliable and adequate					
6.	KNH main theatres are easily and quickly accessible from the surgical wards and ICU.					
7.	There is usually adequate ICU space available for deserving surgical patients.					
8.	The post anaesthesia care unit (PACU) in KNH main theatres is sufficiently large to accommodate patients post operatively					
9	There are enough anaesthesia machines to cater for patients in KNH main theatres					
10.	Laboratory support for patients in main theatre is adequate and reliable					
11.	The supply of anaesthetic drugs in KNH main theatres is reliable and adequate.					
12.	The supply of drapes and gowns is reliable and adequate					
13.	There is an adequate number of surgical sets for surgeries in KNH main theatres					
14.	There is adequate number of stretchers and wheelchairs for patient transport					

15.	There is major staff shortage in the main theatres					
16.	KNH theatre staff are highly motivated in their work					
18.	Patients being received in KNH main theatres are usually well prepared for surgery					
19.	Preparing a theatre for emergency surgery is usually faster than preparing for elective surgery in KNH main theatres					
20.	The blood transfusion unit is reasonably efficient and adequately responsive to the theatre's blood transfusion requests					
21.	KNH theatre staff are sufficiently qualified for their jobs					
22.	Staff training needs in KNH main theatres are adequately met.					
23.	Prolonged nursing handover during shift change is a contributor to theatre delays					
24.	KNH theatre staff are highly overworked					
25.	Lateness to the workplace contributes to delayed patient care In KNH main theatres					
26.	Absconding from work by staff contributes to delayed patient care in KNH main theatres					
27.	There is good teamwork amongst KNH main theatre staff.					
28.	Theatre managers are responsive to the needs and welfare of their workers					

6. Are there any other factors not listed above, that affect turnaround time in KNH main theatres?

Indicate whether it increases or decreases TAT

i)

ii)

iii)

iv)

v)

**THE END.**

**THANK YOU FOR YOUR PARTICIPATION.**

## APPENDIX 4: Questionnaire: Swahili Version

### Utafiti Kuhusu Maswala Yanayoathiri Muda Kati ya Oparesheni Kwenye Vyumba vya Upasuaji vya

#### Hospitali Kuu ya KNH.

Nambari ya kipekee ya dodoso .....

#### MAELEZO

- 1) Tafadhali usiandike jina lako mahali popote kwenye dodoso.
- 2) Weka alama (v) kwenye kisanduku karibu na jibu sahihi.
- 3) Tafadhali andika majibu katika nafasi zilizotolewa.

#### 1. Utambulisho wa demografia

Jinsia: Kiume

Kike

Umri: Miaka .....

Tarehe: ..... siku/mwezi/mwaka

#### 2. Ajira:

Msafirishaji wa wagonjwa

Kuosha chumba cha upasuaji

Msaidizi wa mtaalamu wa nusukaputi (theater service attendant)

Daktari mwanafunzi wa uzamili (postgraduate doctor in training)

Muuguzi (nurse)

Afisa wa Kliniki wa nusukaputi (clinical officer anaesthetist)

Daktari mtaalamu (consultant)

**3. Shirika unayohusishwa nayo**

KNH

UON

KMTC

Nyingine (Taja).....

**4. Muda ulioajiriwa KNH.**

Chini ya Mwaka Mmoja

Mwaka mmoja au zaidi

**5. Maswali Kuhusu Vyumba vya Upasuaji Katika Hospitali Kuu ya KNH**

	<b>Swali</b>	<b>Sikubaliani kamwe</b>	<b>Sikubaliani</b>	<b>Sina Uhakika</b>	<b>Nakubaliana</b>	<b>Nakubaliana kabisa</b>
1.	Kuna upotezaji mwingi wa muda kati ya kumaliza upasuaji na kuanza upasuaji mwingine katika vyumba kuu vya upasuaji vya KNH.					
2.	Upotezaji huu wa muda huathiri huduma sana kwa wagonjwa wanaohudumiwa KNH					
3.	Uuwepo wa maji ya kunawa katika vyumba kuu vya upasuaji vya KNH ni wa kutegemewa na wa kutosha.					
4.	Uwepo wa umeme katika vyumba kuu vya upasuaji vya KNH ni wa kutegemewa na wa kutosha.					
5	Uwepo wa oksijeni katika vyumba kuu vya upasuaji vya KNH ni wa kutegemewa na wa kutosha					
6.	Umbali kati ya wodi za upasuaji na vyumba vya upasuaji vya KNH ni wa kuridhisha na wala sio mrefu.					
7.	Kawaida kuna nafasi ya kutosha kwenye ICU kwa wagonjwa wanaohitaji huduma ya ICU baada ya Upasuaji					
8.	Chumba cha kuwahudumia waliopasuliwa (PACU) katika vyumba kuu vya upasuaji vya KNH ni kikubwa na cha kutosha kuhudumia wagonjwa.					
9.	Kuna mashine za anesthesia za kutosha kuhudumia wagonjwa katika vyumba kuu vya upasuaji vya KNH.					
10.	Huduma ya maabara kwa wagonjwa katika vyumba kuu vya upasuaji ni ya kutosha.					
11.	Ugavi wa dawa za nusukaputi katika vyumba kuu vya upasuaji vya KNH ni wa kutosha.					
12.	Ugavi wa mavazi na gauni za kujikinga ni wa kuaminika na kutosha.					
13.	Kuna idadi ya kutosha ya seti za upasuaji katika vyumba kuu vya upasuaji vya KNH.					

14.	Kuna idadi ya kutosha ya machela na viti vya magurudumu kwa usafirishaji wa wagonjwa.					
15.	Kuna uhaba mkubwa wa wafanyikazi katika vyumba kuu vya upasuaji katika KNH.					
16.	Wafanyikazi wa vyumba vya upasuaji vya KNH wana motisha sana katika kazi zao.					
17.	Wagonjwa wanaopokelewa katika vyumba kuu vya upasuaji vya KNH kawaida huwa wameandaliwa vizuri kwa upasuaji.					
18.	Kuandaa chumba cha operesheni kwa upasuaji wa dharura huchukua muda mfupi kuliko kuandaa upasuaji wa kupangwa katika vyumba kuu vya upasuaji vya KNH.					
19.	Kitengo cha kutayarisha damu na viungo vyake kina ufanisi mkubwa na kinapea vyumba vya upasuaji upaombele wakati wa dharura.					
20.	Wafanyikazi wa vyumba vya upasuaji vya KNH wana utaalamu na maarifa ya kutosha kutekeleza kazi yao.					
21.	Mahitaji ya masomo ya wafanyikazi katika vyumba kuu vya upasuaji vya KNH yanatimizwa ipasavyo.					
22.	Wauguzi huchukua muda mrefu sana wakati wa kubadilisha shifti na kuchangia pakubwa kuchelewesha kaz kwenya vyumba vya upasuaji					
23.	Wafanyi kazi katika vyumba kuu vya upasuaji vya KNH mara mingi wanafanya kazi kupita kiwango kinachofaa.					
24.	Kuchelewa kufika kazini kunachangia pakubwa kuchelewesha huduma kwa wagonjwa Katika vyumba kuu vya upasuaji vya KNH.					
25.	wafanyikazi kutoripoti kazini bila sababu kunachangia kuchelewesha kwa utunzaji wa wagonjwa katika vyumba kuu vya upasuaji vya KNH.					
26.	Kuna ushirikianowa kuridhisha kati ya wafanyikazi wa vyumba kuu vya upasuaji vya KNH.					
27.	Wasimamizi wakuu wa vyumba vya upasuaji vya KNH wanakidhia maslahi na ustawi wa wafanyikazi wao.					



6. Je, kuna sababu zingine ambazo hazijaorodheshwa hapo juu, ambazo zinaathiri muda kati ya kumaliza upasuaji na kuanza upasuaji mwingine katika chumba kuu cha upasuaji cha KNH?

Onyesha ikiwa inaongeza au inapunguza muda huu.

i)

ii)

iii)

iv)

v)

**MWISHO.**

**ASANTE KWA KUSHIRIKI KATIKA HUU UTAFITI.**

**APPENDIX 5: STUDY TIMEFRAME**

Year	2021												2022		
Activity/ duration in months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Research Topic Development	■	■													
Proposal Writing and Development			■	■											
Proposal Presentation and Defense					■										
Ethics and research Committee approval						■	■								
Data Collection								■	■	■					
Data Analysis											■	■			
Thesis Development and Finalizing													■		
Thesis and Manuscripts submission/ Presentation														■	■

## APPENDIX 6: STUDY BUDGET

Description	Quantity/Unit Cost	Total Cost
<b>Stationery</b>		
HB Pencils	4 pieces @ 50/=	200/=
Eraser	2 pieces @ 50/=	200/=
Clipboard	2 Piece @ 300/=	600/=
Printing Papers	2 Rim @ 2000/=	4000/=
	<b>Sub-total</b>	<b>Kshs. 5,000</b>
ERC fee		2,000/=
Internet payment		3,000/=
Binding Proposal	3 Booklets @750/=	2,250/=
Binding of project	2 Piece @ 3000/=	6,000/=
Flash disk		2,500/=
Data entry and Coding	10,000	10,000
Data collection	1 @25,000	25,000
Data Analysis and software license	50,000	50,000
<b>Subtotal</b>	<b>Sub-total</b>	<b>Ksh. 100,750</b>
<b>Miscellaneous (10%) of total</b>		<b>Ksh.10,575</b>
<b>Grand total</b>		<b>Ksh.116,325</b>

## APPENDIX 7: KNH-UON ERC APPROVAL LETTER FOR THE STUDY.



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: 726300-9  
Fax: 725272  
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/290

19<sup>th</sup> August, 2021

Dr. Belinda Adda Namisi  
Reg. No. H58/33924/2019  
Dept. of Anaesthesia  
School of Medicine  
College of Health Sciences  
University of Nairobi



Dear Dr. Belinda

### RESEARCH PROPOSAL: A SURVEY OF THE FACTORS AFFECTING THEATRE TURNAROUND TIME IN KENYATTA NATIONAL HOSPITAL MAN THEATRES (P415/05/2021)

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH-UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 19<sup>th</sup> August 2021 – 18<sup>th</sup> August 2022.

This approval is subject to compliance with the following requirements:

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

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

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

Yours sincerely,



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

- c.c.     The Principal, College of Health Sciences, UoN  
          The Senior Director, CS, KNH  
          The Chair, KNH- UoN ERC  
          The Assistant Director, Health Information, KNH  
          The Dean, School of Medicine, UoN  
          The Chair, Dept. of Anaesthesia, UoN  
Supervisor:     Dr. Vernon Mark Gacii, Dept.of Anaesthesia, UoN

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