EVALUATION OF THE LENGTH OF STAY OF PATIENTS AT THE KENYATTA NATIONAL HOSPITAL THEATRES POST-ANAESTHESIA CARE UNIT

A DISSERTATION SUBMITTED IN PART FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF M.MED ANAESTHESIA, UNIVERSITY OF NAIROBI

DR. LUCY WANGUI NG'ETHE

2012

DECLARATION

This dissertation is my original work and to my knowledge has not been presented for any award in this university.

Signature…… Date…….

Dr. Lucy Wangui Ng'ethe, MBChB {NAIROBI}

This dissertation has been submitted for examination with my approval as the supervisor.

Signature……. Date……..

Dr. V. Mark Gacii, MBChB; MMED anaesthesia {NAIROBI}

DEDICATION

This book is dedicated to my loving family who have walked with me this far.

My loving mum and dad, sister Wairimu, my love Nicholas and darling daughter Jasmine it is truly wonderful to be cherished by you.

ACKNOWLEDGEMENT

To my supervisor Dr. Mark Gacii, his assistance throughout the study is greatly appreciated.

To Dr. Kabetu for his support that made the writing and timely completion of this dissertation possible.

To my lecturers for their support and guidance, it has been an honor working alongside them.

To my classmates for their wonderful friendship that meant a lot throughout the years.

To Mr. Mutai who dedicated his time and skills in the handling and processing of results for this study.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ACLS- Advanced Cardiac Life Support

ASA- American Society of Anesthesiologists

ASPAN- American Society of Perianesthesia Nurses

ECG- Electrocardiogram

ICU- Intensive Care Unit

KNH- Kenyatta National Hospital

LOS- Length of Stay

PACU- Post Anaesthesia Care Unit

SPSS- Statistical Package for Social Scientists

LIST OF FIGURES **PAGE**

TABLES **PAGE**

OPERATIONAL DEFINITIONS

Actual PACU LOS- defined as the time duration from the patient's admission to PACU to the time that the patient left the PACU, as recorded by the PACU nurse.

Medically appropriate PACU LOS- the time required for the patient to achieve a medically stable condition for safe PACU discharge. This is determined by clinically assessing the patient throughout their stay in the unit. PACU nurses assess the consciousness, breathing pattern and motor function of the patient as well as the stability of the patient's blood pressure and the oxygen saturation levels. The parameters assessed to determine patients' fitness for discharge are based on the *Modified Aldrete scoring system*. N.B. there is no formal scoring is done at the KNH PACU as of now.

PACU- this is the area designated for the monitoring and care of patients who are recovering from the immediate physiologic effects of anaesthesia and surgery.

ABSTRACT

Background- Prolonged length of stay in PACU leads to patient congestion in the unit; this has been linked to delay in the handing over of new admissions to the PACU nurses and delay of the anaesthesia team in starting the next case resulting in under-utilization of the allocated theatre time

Objective- To determine the length of stay of post-operative patients at the Kenyatta National Hospital main theatres' Post Anaesthesia Care Unit.

Methodology - This was a cross-sectional observational descriptive study that involved 175 ASA I II and III category of post-operative adult patients who had been admitted to PACU following emergency or elective surgery. Following PACU admission the patients were monitored and nursed until found fit for discharge to the post-surgical wards, upon being found fit for discharge the relevant wards were informed so that they could pick up these patients. The time taken to achieve fitness for discharge was noted and the time taken to leave PACU was also noted. A cutoff of up to 2 hours was used as the appropriate duration of stay in PACU to achieve clinical fitness for discharge to the wards; those in the unit for > 2hours were grouped as having been delayed in discharge from PACU.

Results- The study participants were 175 in total. The average length of PACU stay was 124.5 minutes while the incidence of delayed discharge from the unit was found to be 44%. The factors associated with delayed discharge from PACU were mainly logistical with 81.8 % being due to non-availability of ward staff and 18.2% being due to non-availability of lifts for patients transport. A patient's age > 35 years was noted to be associated with delay in discharge from PACU.

Conclusion- This study found out that the average length of stay at the Kenyatta National Hospital theatre PACU is 124.5 minutes and that the incidence of delay in discharge from PACU was 44%. Logistical factors were the major contributors to this delay while age was the only patient variable that contributed to delay in PACU.

1.0 INTRODUCTION AND LITERATURE REVIEW

The first recorded description of a recovery room is from 1801 at the Newcastle Infirmary in England and predates modern anaesthesia. [2] [4]

The first original concept of a Postanaesthesia care unit is credited to Florence Nightingale; in 1863 she established that most small country hospitals had small rooms leading from the operating theatre in which postoperative patients would remain until they at least recovered from the immediate effects of the operation. [4]

In the 1920's and 1930's the complexity of surgical procedures increased and several PACU's were opened in the United States and abroad. In 1923, a three-bed neurosurgical unit was opened at Johns Hopkins Hospital by Dandy and Firor. [7] [8]

It was not until World War II however that a large increase in the number of PACU's occurred in the United States. The major reason for the increase was the shortage of nurses that existed in the United States. Hence PACU's were created so that an adequate level of nursing care could be provided for the immediate postsurgical patient. [9]

In 1947, the Anesthesia Study Commission of the Philadelphia County Medical Society issued a report that further stimulated the growth of PACU's. The commission found that in an 11 year period nearly one-half of the deaths that occurred during the first 24 hours of surgery were preventable.[10]They also found that at least one-third of those deaths could have been prevented by improved postoperative nursing care. [8] [11] Following this report many US hospitals opened postanaesthesia care units. [12] [13] [14]

In 1949, the Operating Room Committee for the New York Hospital established that an adequate recovery room service was a necessity to any hospital undertaking modern surgical therapy. [15]

The 1950's and 1960's witnessed the rapid growth of surgical intensive care and postoperative respiratory support. The increased use of invasive monitoring techniques in

the 1970's as well as a continued trend in postoperative ventilatory support required many PACU's to manage both routine recovery from anaesthesia and critically ill postoperative patients receiving respiratory and circulatory support. The late 1980's and 1990's have seen the emergence of outpatient surgery. The PACU staff must now also manage patients who will be going home following anaesthetic recovery and not to the hospital ward. [4]

Most procedure guidelines require that a patient be admitted to the PACU following all types of anaesthesia even monitored anaesthesia, except by specific order of the attending anaesthesiologist- ASA 2004. [1] [2] [3] [16]

The PACU should be staffed only by nurses specifically trained in the care of patients emerging from anaesthesia. They should have expertise in airway management and advanced cardiac life support- ACLS, as well as skilled in the prompt recognition of postoperative complications commonly encountered in surgical patients. [1] [3] [17] [36]

The management of the patients in PACU should reflect a co-ordinated effort among the PACU nurses, anaesthesiologist, surgeon and other consultants, this collaboration in PACU is linked to better patient outcomes including a reduction in mortality rates. [18] [19]

Following admission to PACU attention is directed to the monitoring of **oxygenation** {pulse oximetry}; **ventilation** {breathing frequency, airway patency, and capnography} and **circulation** {systemic blood pressure, heart rate, ECG}. Vital signs are recorded at least every 5 minutes for the first 15 to 30 minutes and then every 15 minutes thereafter into the patient's medical records. [1] [16] [20] [21]

While in PACU complications may occur, it is expected that these highly trained nursing staff will recognize and manage them as they arise as well as involve other clinicians in the overall management of the postoperative patients. [17] [22] [23] [24]

A study by Roberta et al showed an overall PACU complication rate of 23% with Nausea and vomiting at 9.8%; the need for upper airway support at 6.9%; and hypotension

requiring treatment at 2.7% as the most frequently encountered PACU complications. [23] Greater ASA physical status; anaesthesia duration between 2-4 hours; emergency procedures; orthopedic and abdominal procedures had the highest incidence of complications and are potential predictors of PACU complications [23] [24] [25]

A comparative study by Chikophe Idris (MMed Anaesth 2010) between KNH and Kenyan provincial hospitals showed that pain was the commonest PACU complication as compared to post-operative nausea and vomiting and the need for airway support.

Standards of care in PACU require that 2 nurses be in the unit at all times. [26] [28] Inadequate staffing was found as a contributing factor in 24% of all unanticipated events that resulted in patient death, injury or permanent loss of function –ASPAN 2005. [27] [28]

Patients are observed and stabilized in PACU until they become awake and alert, with stable vital signs. They are then discharged from PACU and are transferred to the relevant postsurgical ward for further postoperative care and monitoring or were even discharged home directly.

Waddle et al demonstrated that most patients are stabilized immediately after surgery in a postanaesthesia care unit until their discharge to a hospital bed. [5]

In some centers, ambulatory care patients are discharged home directly from PACU, while other centers have a separate PACU and outpatient area. Thus 2 main phases of recovery may be recognized for ambulatory care surgery. **Phase 1** is the immediate intensive care level recovery of patients during emergence and awakening from anaesthesia and continues until standard criteria are met. **Phase 2** is at a lower level of care that ensures that the patient is ready to go home. There is also a **phase 3** extended care level for patients who have met criteria to leave phase 1 but are unable to go to another place mainly due to lack of floor bed. [1] [2] [29] [30]

In most settings discharge of patients from PACU has been shown to be delayed. Appropriate Length of Stay may be related primarily to anaesthetic factors while non-medical organizational issues account for a significant amount of Actual PACU Length of Stay. [5] [29] [30] [31] [32]

The slow process of patient discharge from PACU is usually due to logistical problems in transferring PACU patients to the next stage in their care. [34] [41] [42] [43]

The development and use of postanaesthesia discharge criteria has aided in the reduction of discharge delays in PACU.[33] [34] [35] [37] [38] A study by Brown et al showed that the use of predetermined discharge criteria resulted in a 24% decrease in PACU time. [33]

The postanaesthesia patient trajectory describes the journey of patients from a state of unconsciousness and potential cardiovascular instability to consciousness; cardiovascular stability; maintenance of airway and pain control. [36] Indeed this trajectory is the basis on which discharge criteria have been developed.

In 1970, Aldrete and Kroulik developed a postanaesthesia scoring system to monitor recovery from anaesthesia. The **original Aldrete score** assigned a number of 0, 1 or 2 to five variables: activity; respiration; circulation; consciousness and colour. A score of 9 out of 10 was considered adequate for discharge from the PACU. [37] Over the years, this system has been modified to keep up with advances in technology. In 1995, pulse oximetry replaced visual assessment of oxygenation and additional assessments were added to accommodate patients undergoing ambulatory surgery. [38]

The **modified Aldrete score** and the **Post-anesthesia discharge scoring system** (PADSS) are commonly used systems for patient assessment and attempt to simplify and standardize patient discharge criteria and assessment for home readiness. [20] [39] Typically a modified Aldrete score of 9 out of 10 is needed to discharge a patient [38] Typically a PADSS of 9 out of 10 is needed to discharge a patient. [39]

At time of discharge from PACU, the patient should be alert or their mental status returned to baseline; vital signs should be stable and within acceptable limits; have written instructions on their postoperative care in the ward or at home. [40]

2.0 STUDY RATIONALE

Delay in discharge of patients from PACU is a common problem globally. [30] [31] [32] [34] [41] [42] [43] *A comparative study by Chikophe Idris(MMed Anaesth 2010)* showed that the Kenyatta National Hospital PACU Length of Stay was the longest in comparison to the provincial hospital PACU's in Kenya.

This study intended to look into the factors that affected PACU length of stay at the Kenyatta National Hospital main theatres and also to give recommendations that could be of use in the improvement of patient discharge from PACU.

3.0 OBJECTIVES

3.1 Broad objective

Determine the PACU Length of Stay of postoperative patients at the Kenyatta National Hospital theatres.

3.2 Specific objectives

1. Determine the PACU length of stay of post-operative patients at the KNH theatres.
2. Determine what patient factors affect the medically appropriate length of stay.
3. Determine what logistical factors contribute to prolonged PACU length of stay.

3.3 Research Question

What is the average Length of Stay of post-operative patients at the Kenyatta National Hospital theatres PACU and what are the patient and logistical factors that contribute to the length of stay?

4.0 METHODOLOGY

4.1 Study design

This was a cross-sectional observational descriptive prospective study.

4.2 Site of study

The study was carried out at the PACU of the Kenyatta National Hospital main theatres.

4.3 Study population

ASA 1, 11 and 111 categories of adult patients admitted to the post-anesthesia care unit.

4.4 Sample size

The sample size adequate for this study was calculated according to:

$$n = \frac{Z_{1-\alpha/2}{}^2 \sigma^2}{d^2}$$

n – Sample size

$Z_{1-\alpha/2}$ - Two-sided significance level (1-alpha)-95% = 1.96

σ – Estimated standard deviation of the length of stay in PACU after surgery = 54 minutes (Tessler et al., 1999).

d – Precision error = ±8 minutes

Substituting into the formula

n was **175**

4.5 Sampling Procedure

Convenience sampling procedure was used. This technique involved non-random selection of patients while in PACU based on the availability of patients meeting the inclusion criteria, patients were consecutively enrolled into the study until the desired sample size was achieved.

4.6 Inclusion/exclusion criteria

Inclusion criteria

1. Patients > 18 years of age admitted to theatre for emergency or elective surgery.
2. ASA I, II and III categories of patients.

Exclusion criteria

1. Patients planned for admission to the ICU or to other specialized post-surgical units post-operatively.
2. Patients < 18 years.
3. Those not consenting to the study.

4.7 Data Collection Procedure

The researcher collected the data personally.

The researcher was located in PACU throughout the study duration so as to be present during the admission and discharge of patients into and from PACU. It was necessary for the researcher to be in PACU during patients' admission and discharge so as to capture the patients' to nurse ratios at the time of admission, any incidences of complications occurring in PACU as well as to observe the process of patient discharge by the PACU nurses so as to ascertain how the decision to discharge patients from the unit was arrived at.

Once the study participants were admitted into PACU following anaesthesia and surgery, the data pertaining to the study was filled into the questionnaire by the investigator from: the patients' medical records; observation of the patients in PACU for any complications that arose; observation and interviewing of the nurses as they discharged patients from the unit.

The data required in this study included: the patient's biodata; the study participants intraoperative course, the duration of surgery and anesthesia; PACU data including the time of admission to the unit and the patients' to nurse ratios at the time of patients admission, complications arising in PACU, time when the study participant was found fit for discharge and the actual time the patient left PACU- ***Appendix 6***

Data for this study could only be collected once the patient had been admitted to PACU as cancellation of the scheduled surgery does happen at any stage preoperatively.

The Medically appropriate Length of Stay corresponds to the time when the patient was found fit for discharge from PACU by the nursing staff.

The Actual PACU Length of Stay is the time that the patient is transferred out of PACU.

This being an observational study, the researcher did not intervene in the management of the study participants in PACU unless the participant required a life-saving intervention.

4.8 Data Management and Analysis

At the end of data collection, data was coded and entered into Microsoft Access database. Data cleaning was performed before the data was exported to SPSS version 17.0 for analysis.

Using SPSS statistical software, data was analyzed while the categorical and the continuous variables were summarized into proportions and means/medians respectively.

Statistical tests were performed appropriately using Chi-square test for associations between categorical variables and Student's t test for comparing means. All tests of significance were interpreted at p value of ≤0.05 (95% confidence level).

The findings of the study have been presented using tables, charts, graphs and narratives.

4.9 Ethical Considerations

1. The study was only carried out following approval by the Kenyatta National Hospital and the University of Nairobi Ethics and Research committee.
2. Informed consent was obtained from the study participants.
3. There were no penalties for those not wishing to participate in the study.
4. There were no additional costs or incentives to the study participants.
5. The study respected the decision of those who wanted to withdraw from the study.
6. Information obtained from the study has been treated with utmost confidentiality.
7. Data obtained by the investigator that was beneficial to the patients was communicated to the PACU staff.
8. All data obtained by the investigator was entered correctly and truthfully.
9. Those not consenting to the study were not denied any services.

5.0 RESULTS

The study involved 175 adult patients of ASA I, II and III classes, the ages of the study participants ranged from 18- 64years.

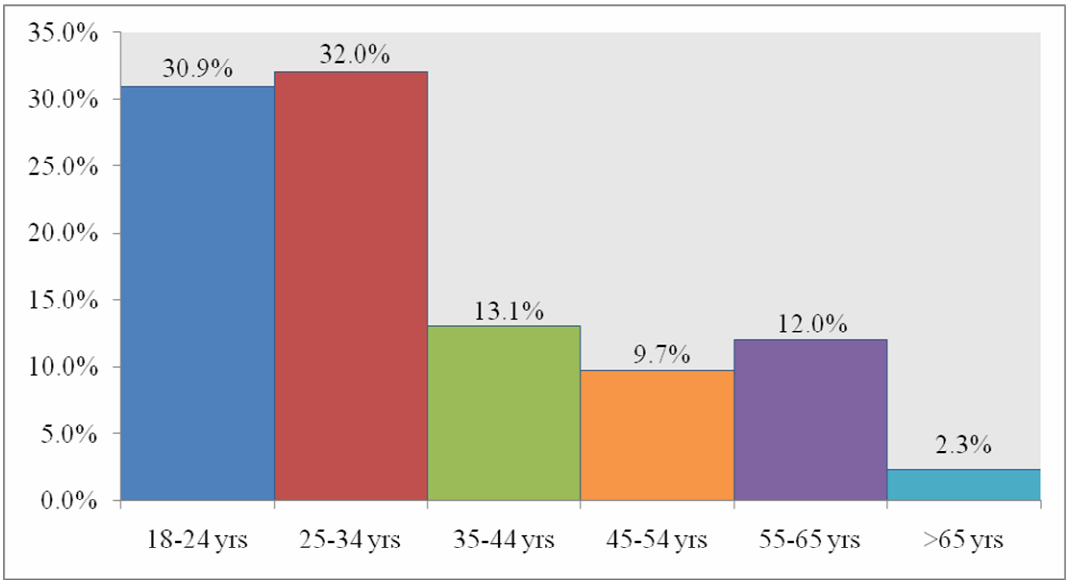
The study participants had either undergone elective or emergency surgery at the Kenyatta National Hospital main theatres.

Study participants underwent either general anaesthesia or spinal anaesthesia.

Following anaesthesia and surgery these patients had been admitted to the Post Anaesthesia Care Unit for monitoring and stabilization prior to their discharge to the post-surgical wards.

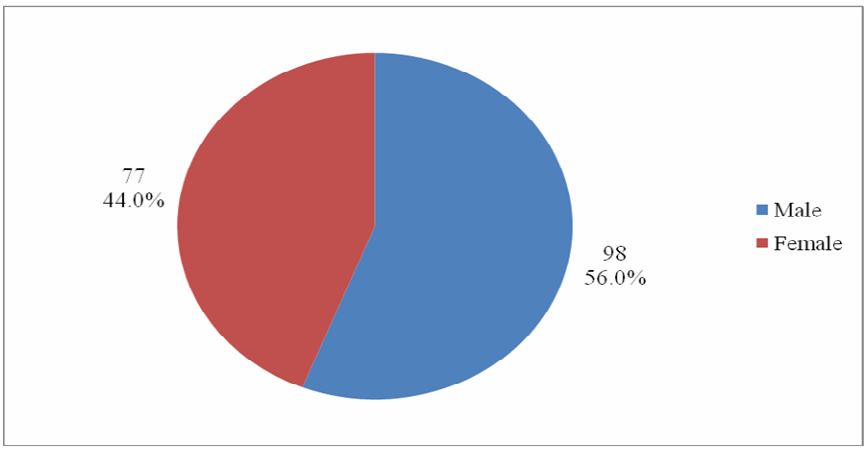
Majority of the study participants – 62.9% were between 18-34 years of age as shown in figure 1 below.

Figure 1- Age distribution



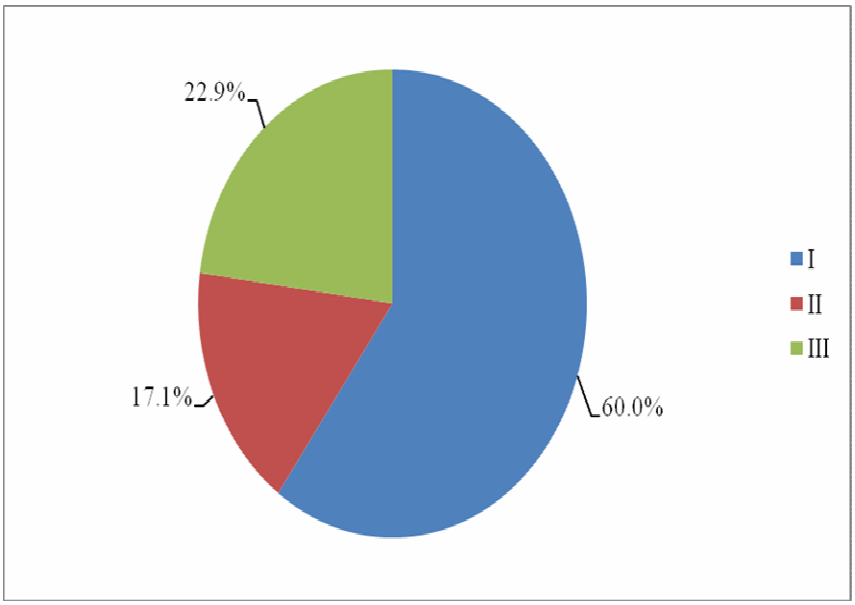
Male patients were 56.0 % (98) of the study participants as illustrated in the pie-chart below.

Figure 2- Sex Distribution



60% of the study participants were of ASA category as shown in the figure below.

Figure 3 – ASA score distribution



Patient categories were as follows;

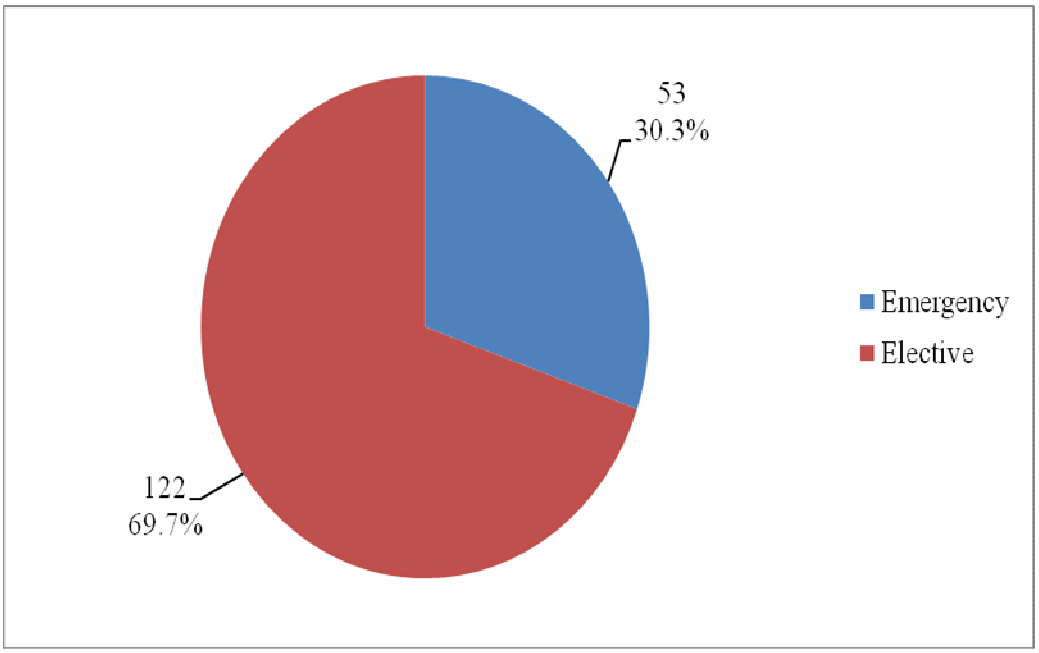
ASA I- made up 60% (105) of the study participants.

ASA II- was 17.1 % (30) of the study participants.

ASA III- made up 22.9% (40) of the study participants.

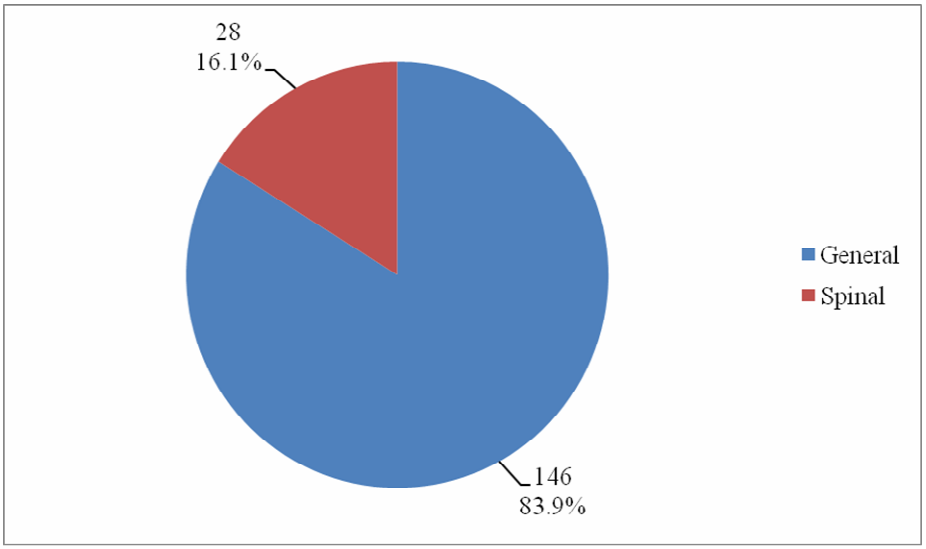
Elective surgical cases made up 69.7% of the study population while emergency cases were 30.3% as shown in the figure below.

Figure 4- Category of surgery



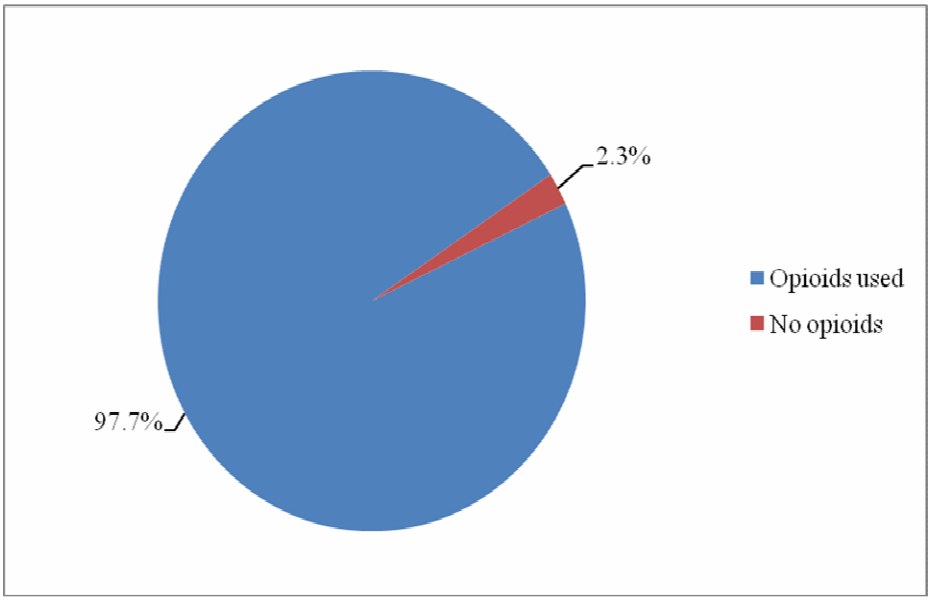
General anaesthesia was used in 83.9% (146) of the patients while spinal anaesthesia was used in 16.1% (28) of the cases as shown in the figure below.

Figure 5- Type of anaesthesia



Opioids were used in 97.7% (171) of the patients, both in the general anaesthesia and the spinal anaesthesia groups as shown in the figure below.

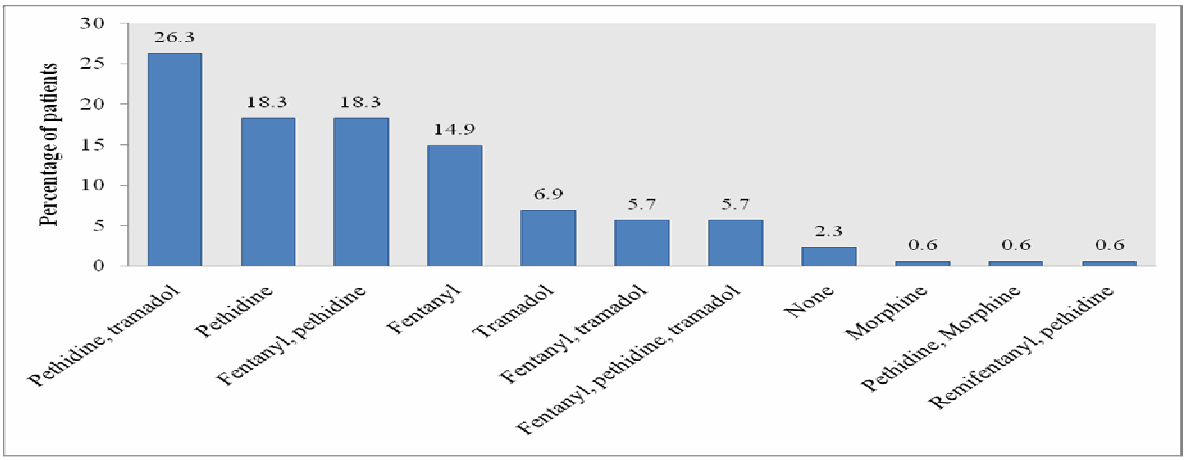
Figure 6- Opioid use



Only 2.3% (4) of patients did not get any opioid during surgery.

Pethidine was the main opioid of choice for the general anaesthesia group while Fentanyl was the choice is the spinal anaesthesia group as shown in the figure below.

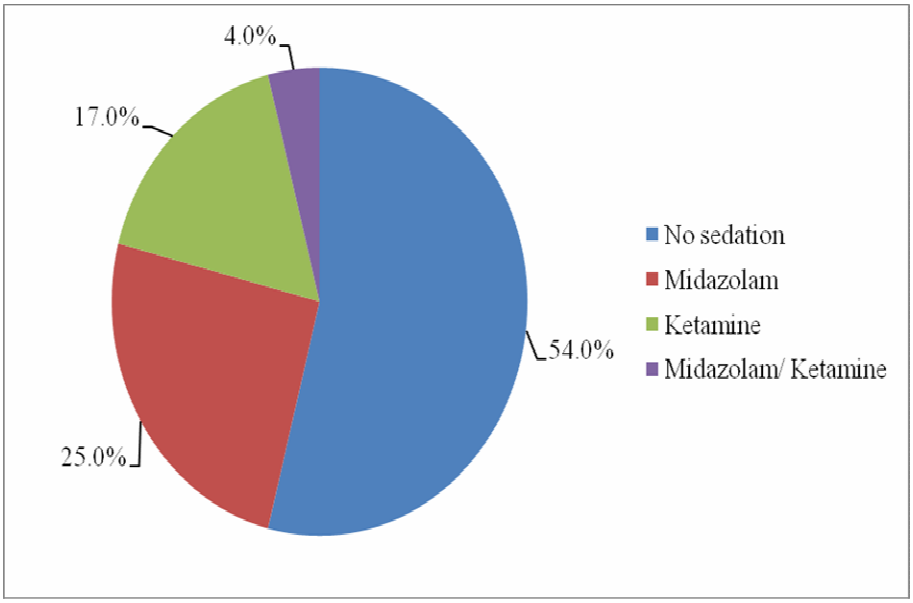
Figure 7- Type of Opioid



Pethidine alone or in combination with other opioids is the most commonly used drug for intraoperative pain control following general anaesthesia.

Sedation was used only for the spinal anaesthesia group of patients as shown in the figure below.

Figure 8- Sedative use



Sedatives were used in 46% of this group of patients.

The sedatives used were as follows;

- Midazolam- 25% (7) of patients
- Ketamine – 17% (5) of patients
- Midazolam- Ketamine combination- 4% (1) patient.

Muscle relaxants were administered to 91% (133) of all general anaesthesia patients (146) as shown in the table below.

Table 1- Other drugs used

Drug administered	**%(frequency)**
Muscle relaxant given	**76.0(133)**
Reversal given	**76.0(133)**
Doses of reversal given, median (IQR)	**(1-1)**

The average Nurse: Patient ratio was 1 nurse to 4 patients as shown in the table below.

Table 2- Nurse to patient ratio at admission

Nurse- patient ratio	**Time**		
	Morning (8-11AM)	**Afternoon (12-3PM)**	**Evening (4-8PM)**
Nurse-patient ratio	**1:2**	**1:3**	**1:5**
Postoperative complications	**0**	**2**	**3**

Morning ratio- 1:2

Afternoon ratio- 1:3

Evening ratio- 1.5

Only 2.9% (5) of patients had postoperative complaints or complications as shown in the table below.

Table 3: Post-operative complications

Variable	%(Frequency)
Postoperative complications/ complaints	
Yes	2.9(5)
No	97.1(170)
Complaint/ Complications	
Nausea and vomiting	2
Hypotension	1
Pain	2

The mean time taken to achieve stability was 16.5 minutes as shown in the table below

Table 4– Time taken to achieve stability

Variables	Results in minutes	
	Mean(SD)	Range
Time to achieve stability	16.8(14.2)	70
Spinal Anaesthesia	15.9(12.4)	70
General Anaesthesia	19.6(16.1)	65

The average length of stay of patients in PACU was 124.5 minutes as shown in the table below.

Table 5- PACU Length of stay

Variable	Mean(SD)	Range(mins)
Time to leave PACU	124.5(84.6)	325
Total length of stay	141.8(89.0)	435

The PACU length of stay for majority of the patients was between 25- 200 minutes as shown in the figure below.

Figure 9- PACU length of stay patient distribution

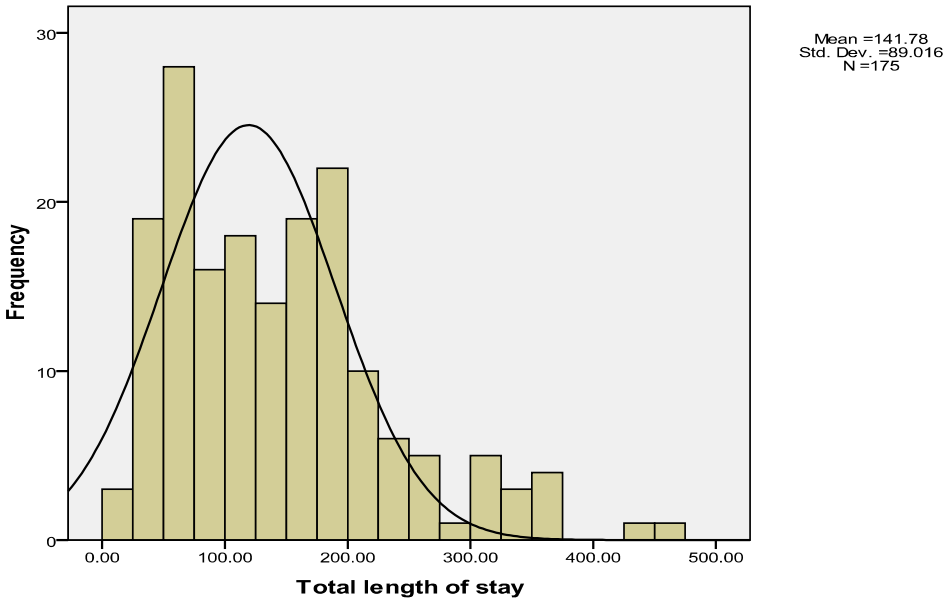


Figure 10- Patients' age in relation to PACU Length of Stay

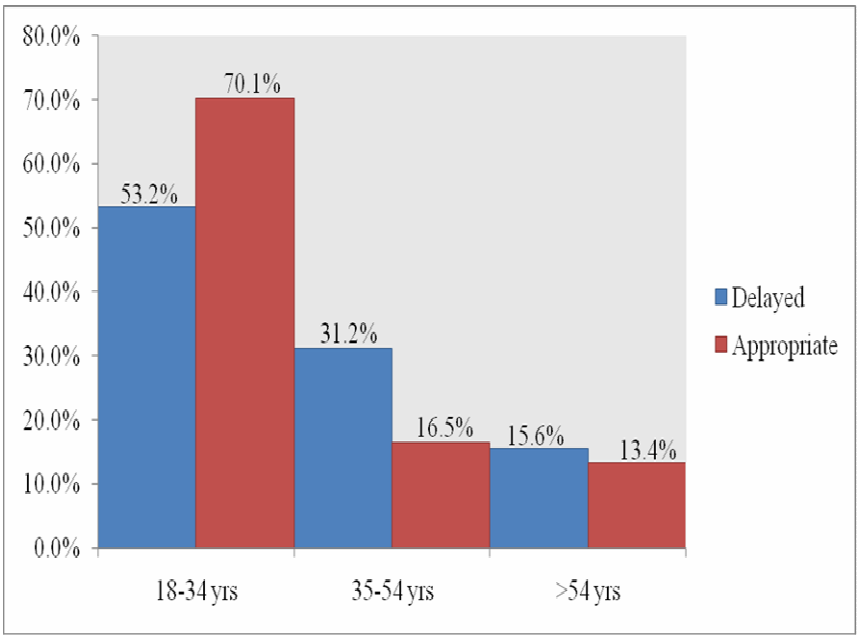


Table 6: Age in relation the length of stay

Variable	Length of stay		P value
	Delayed discharge >120 mins)	Appropriate discharge ≤120 mins)	
Age			
18-34 yrs	53.2% (41)	70.1% (68)	
35-54 yrs	31.2% (24)	16.5% (16)	0.047
>54 yrs	15.6% (12)	13.4% (3)	

Older age > 34 years was significantly associated with prolonged PACU stay (P=0.047).

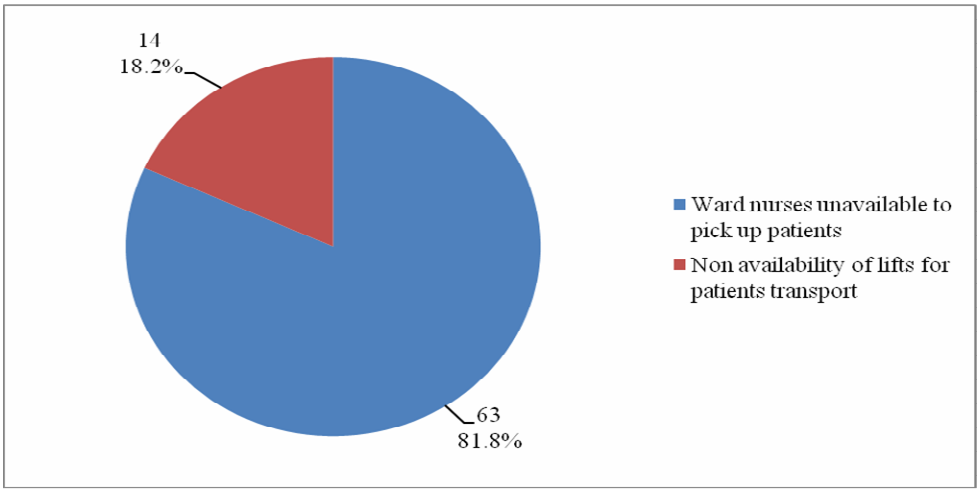
The younger age groups <_34 years were more likely to be discharged within the 2 hours.

Table 7: Patient variables in relation to length of stay

Variable	Length of stay		P value
	Delayed discharge (>120 mins)	Appropriate discharge (≤120 mins)	
Age 18-34 yrs 35-54 yrs >54 yrs	 41 (53.2) 24 (31.2) 12 (15.6)	 68 (70.1) 16 (16.5) 13 (13.4)	0.047
Gender Male Female	 43 (55.8) 34 (44.2)	 55 (56.1) 43 (43.9)	0.971
ASA classification I II III	 41 (53.9) 16 (21.1) 19 (25.0)	 63 (64.3) 14 (14.3) 21 (21.4)	0.322
Surgical procedure Emergency Elective	 15 (19.5) 62 (80.5)	 38 (38.8) 60 (61.2)	0.006
Duration of surgery	100 (60-140)	90 (60-130)	0.294
Surgery duration 0-60 61-120 121-180 >180	 23 (29.9) 31 (40.3) 19 (24.7) 4 (5.2)	 35 (35.7) 37 (37.8) 16 (16.3) 10 (10.2)	0.338
Type of anaesthesia General anaesthesia Spinal anaesthesia	 63 (82.9) 13 (17.1)	 83 (84.7) 15 (15.3)	0.749
Duration of anaesthesia (mins)	105 (75-150)	92.5 (60-140)	0.343
Anaesthesia duration 0-120 121-180 >180	 48 (62.3) 21 (27.3) 8 (10.4)	 67 (68.4) 19 (19.4) 12 (12.2)	0.463
Opioids Yes No	 75 (97.4) 2 (2.6)	 96 (98.0) 2 (2.0)	1.000
Postoperative complications Yes No	 4 (5.2) 73 (94.8)	 1 (1.0) 97 (99.0)	0.171

Logistical factors that contributed to PACU stay longer than 2 hours were two in number as shown in the figure below

Figure 11- Logistical factors affecting LOS



The two logistical factors were;

- Ward nurses few/ unable to pick up patients - 81.8%
- Lifts busy/not working hence not available for patient transport- 18.2%

6.0 DISCUSSION

The main aim of this study was to assess the length of stay of post-operative patients at the Kenyatta National Hospital main theatres' Post Anesthesia Care Unit. This study used the duration of 2 hours as the cut-off to determine whether a patient's stay in PACU was prolonged or not, this criteria was derived from previously published studies on PACU Length of Stay that had shown that majority of patients achieve a satisfactory discharge score during the first 2 hours after the conclusion of surgery [5] [25] [42]

The average length of stay at the KNH theatres' PACU was found to be at 124.5 minutes. A study by Waddle et al had a mean PACU length of stay at 95+_ 43 minutes, this shows that the Length of stay at KNH is prolonged [5]

Elective surgeries were the majority at 69.7% while emergencies were at 30.3%, this is in keeping with the trend of surgeries at KNH whereby majority are elective surgeries. The duration of surgery at KNH was between 10-240 minutes with the mean duration of surgery being at 90 minutes. The study by Waddle et al had a mean surgical time of 118+_ 83 minutes, thus showing that the duration of surgeries at KNH does compare to that found in this study.

There were only two modalities of anaesthesia given to these patients, general anaesthesia at 83.9% of the patients while spinal anaesthesia was used in 16.1% of the patients. The duration of anaesthesia was between 15-270 minutes with a mean duration of 100 minutes. The study by Waddle had a mean anaesthetic time of 181+_ 96 minutes, showing that the mean duration of anaesthesia is comparable to that found in this study.

Intra-operative opioid use was at 97.7%. Pethidine alone or in combination with other opioids was the most commonly used drug in the general anaesthesia group with Morphine and Remifentanyl being the least used opioids. Fentanyl was the only opioid given to the spinal anaesthesia group; it was used in combination with bupivacaine. In the Waddle study Narcotics were used by themselves without inhalation agents as a general anaesthetic technique as well as for intra-operative analgesia purposes [5]

Sedatives were only given to the spinal anaesthesia group of patients; their use was at 46% (13) in this group. Midazolam was the most used agent given to 25% (7) of these patients followed by Ketamine at 17% (5) and the least used mode of sedation was the Midazolam-Ketamine combination in 4% (1) of these patients. The use of sedation following successful regional anaesthesia is mainly for the awake patient who may be too anxious during the surgery. This is also the practice in other setups.

It is noted from this study at KNH that age was the only patient variable that significantly contributed to the length of stay of post-operative patients at PACU, all other patient variables that included length of anaesthesia and surgery, opioid and sedative use, PACU complications did not contribute to prolonged stay at the unit. In a study by Roberta et al complications did cause prolonged stay in the unit [23]

The Nurse: Patient ratios at PACU were noted to worsen as the day progressed. This was due to patients' congestion at PACU as theatre activity progressed while the discharge of patients from PACU slowed down. This resulted in a longer process of handing over of patients to the PACU nurses with delay of the anaesthesia team and resultant delay in starting the next case. The ratios were optimum in the morning at 1:2, while at afternoon there was an increase in nurse: patient inequality at 1:3, they were worst in the evening at 1:5. The mean nurse: patient ratio was 1:4. This shows that our PACU practice of patient nursing is below the recommended nurse: patient ratios [28] and the current situation should be corrected urgently to ensure safe and efficient patient stabilization; it will also ensure early recognition and handling of post-operative complications. A study by Cohen et al showed that higher numbers of adverse effects require higher numbers of PACU staff [27]

Post-operative complications were reported in 2.9% (5) of the study participants, these data was gotten from the patients records, which were mostly incomplete. Roberta et al had showed that PACU complications were at 23%, whereby nausea and vomiting was the commonest complication, the study further showed that general anaesthesia was associated with higher rates of complications and also that abdominal and orthopaedic surgeries had increased overall PACU complication rates compared to other procedures.

In this study 80% (4) of these patients had received general anesthesia, while 20% (1) of these group had received spinal anaesthesia. 3 patients had undergone abdominal surgeries, 1 patient had undergone an orthopaedic procedure while 1 other patient had undergone a urologic/ pelvic procedure, and this is in keeping with the findings of the study by Roberta et al.

The complications were under-reported in this study due to inequality of the nurse: patient ratio, they were noted to increase as the nurse: patient inequality worsened ,this is also the case in other studies that showed that inadequate staffing was a contributing factor in all unanticipated events that resulted in patient death, injury or permanent loss of function [27] [28]

The time taken to achieve patient stability was between 4-90 minutes with an average of 16.5 minutes. The spinal anaesthesia group of patients took an average of 15.9 minutes, while the general anaesthesia group's average was at 19.6 minutes. The patient who took 90 minutes to achieve stability was of ASA III category and had undergone osteotomy and excision of the left foot, the patient's stay in PACU was uneventful, no complications or complaints were reported by the patient. All the study participants were stabilized within 2 hours of completion of surgery; this is also the case in other setups as shown by Waddle et al [5]

The entire time taken for patients to leave PACU was between 15-440 minutes with an average of 124.5 minutes. Majority of the patients were in PACU for between 25-200 minutes. There were 4 patients who stayed in PACU for 15 minutes before their discharge from the unit, 1 patient was in the unit for 440 minutes (7 hours 20 minutes). The patient in PACU for the 440 minutes had undergone dynamic hip screw fixation and PACU stay had been smooth with no complaints or complications, the time taken to achieve stability by this patient was 50 minutes after which the patient was declared fit for discharge to the post-surgical wards, the patients' prolonged stay in PACU was due to ward staff being few and unable to pick up this patient. Delay in the discharge of post-operative patients at the Kenyatta National Hospital theatres' PACU was found to be at

44%, this delay was caused mainly by logistical factors and is noted to be less than that demonstrated by Waddle whose study showed a PACU delay of 68%.

Patient's age was found to contribute to prolonged PACU length of stay, an older age of 35 years or older was associated with prolonged PACU length of stay (*P=0.047*) The results show that the younger the patients the less likely to be delayed as shown by a smaller proportion (53.2%) contributing to the patients who were delayed compared to 70.1% contributing to those who stayed for an appropriate duration. Similarly, a higher proportion (31.2% and 15.6%) of older patients (35-54 yrs and >54 yrs) contributed to patients who were delayed compared to a smaller proportion (16.5% and 13.4%) in the same age group who contributed to patients in appropriate stay duration. This is in keeping with a study by Seago et al whereby the study showed that patient's age affected PACU length of stay [30]

All other patient factors such as gender, ASA classification, type of anaesthesia, duration of anaesthesia and surgery, opioids and post-operative complications were not associated with the length of stay at PACU in this study.

Logistical factors were found to be the main reason for the prolonged stay of post-operative patients in the KNH PACU beyond the 2 hours, these factors were only two in this study. The study by Waddle et al showed that multiple logistical factors contributed to the delayed discharge of patients, the logistical factors included; awaiting physicians' release, bed unavailability, nurse unavailable for patient transport.

Staff shortage in the post-surgical wards and hence inability to pick up patients on time caused 81.2% of delays, while non-availability of lifts for the transportation of patients to the post-surgical wards contributed 18.2% of these delays. The non-availability of lifts was found to be a major cause of delay especially during visiting hours from around 9.00AM to 5.30PM. This resulted in longer patients' stay and congestion in PACU as the day progressed; resulting in delayed handing over of patients by the anaesthesia teams and eventually delay in the start of next cases in the operating rooms, this is similar to findings by Franklin et al [41]

7.0 CONCLUSIONS

1. The average length of stay of post-operative patients at the Kenyatta National Hospital theatres' PACU is prolonged at 124.5 minutes beyond the 120 minutes recommended by most other hospitals. [5] [25] [42]
2. Age >35yrs was the only patient variable associated with a prolonged PACU length of stay in this study.
3. Logistical factors were the major contributors to delayed discharge from PACU with staff shortage contributing to 81% of the delays.
4. Delay in the discharge of post-operative patients at the Kenyatta National Hospital theatres' PACU was found to be at 44% and worsened as the day progressed.
5. Patient congestion in PACU increased as the day progressed and contributed to worsening of Nurse: Patient ratios from 1:2 in the morning to 1:5 by the evenings.

8.0 RECOMMENDATIONS

1. The Kenyatta National Hospital Post anaesthesia care unit requires a formal protocol for patient discharge to the post-surgical wards.
2. The development of discharge protocols for same-day cases may help to decongest the PACU.
3. PACU nurse numbers need to be tailored according to the patient load in the unit, whereby larger patient numbers will require larger nurse numbers.
4. The Kenyatta National Hospital management needs to look into the issue of staff shortages in the wards as this was the major hindrance in the discharge of post-operative patients from PACU.
5. The Kenyatta National Hospital management should put into place mechanisms that ensure that patient transportation gets priority to mitigate the current situation of delayed discharge of post-operative patients from PACU during visiting hours.
6. A larger study is required to assess the impact of delayed PACU discharge on theatre time utilization.

9.0 LIMITATIONS

1. Complications in PACU are under-reported in this study as this data was retrieved from the patients' files most of which were not completely filled.

REFERENCES

1. Dorre Nicholau. The Postanesthesia Care Unit in Miller's Anesthesia 7th Edition 2009; chapter 85, pg 2708-2729.
2. Michael Murray. The Post Anesthesia Care in Clinical Anesthesiology 4th Edition 2007; chapter 48, pg 909-924.
3. Bruce Penning. The Postanesthesia care unit in Critical Care 3rd edition 2009; chapter 35, pg 1220-1232.
4. Nightingale F: Notes on Hospitals. London, Longman, Green 3rd edition 1863; pg 171-178.
5. Waddle JP, Evers AS and Piccirillo JF. Postanesthesia care unit length of stay: Quantifying and assessing independent factors. *Anesthesia Analgesia* 1998; 87: 628-633.
6. Short TG, Chan M, OH TE. Correspondence – Clinical indicators: What does a stay in recovery for longer than two hours indicate? *Anaesthesia Intensive care* 1995; 25: 253-254.
7. Harvey A M: Neurosurgical genius: Walter Edward Dandy. *John Hopkins Medical Journal* 1974; 135: 358- 370.
8. Hilberman M: The evolution of intensive care units. *Critical Care Medicine* 1975; 3: 159-164.
9. Dunn FE, Shupp M G: The recovery room, a wartime economy. *American Journal Nursing* 1943; 43:279- 290.
10. Ruth HS, Hangen FP, Grave DD: Anesthesia study commission: findings of eleven years of activity. *Journal of American Medical Association* 1947; 135: 881-884.
11. Carahan JM: Recovery room for patients. *American Journal Nursing* 1949; 49: 58- 60.
12. Conboy CE: A recovery room. *American Journal Nursing* 1947; 47: 686- 692.

13. Anderson CD, Miller EG: Postanesthesia Unit in private hospitals. *Anesthesiology* 1949; 10: 351

14. Charbon GA, Livingston HM: Planning recovery room for adequate care. *Hospitals* 1949; 23: 35- 38.

15. Wiklund PE: Intensive Care Units: Design, Location, staffing ancillary areas, equipment. *Anesthesiology* 1969; 31: 122- 123.

16. American society of Anesthesiologists. Standards for postanesthesia care. Park Ridge, IL: Author 2004.

17. Clarke & Aiken. Failure to rescue. *American journal Nursing* 2003; 103(1): 42-47.

18. Wheelan S, Burchill C & Tillin F. The link between teamwork and patients outcomes in intensive care units. *American journal nursing* 2003: 103(1), 42-47.

19. Huddlestone J, Long K, Naessens J et al. Improving patient care. Medical and surgical co-management after elective hip and knee arthroplasty: A randomized, controlled trial. *Annals of Internal Medicine* 2004; 14(1), 28-38.

20. Michael A Fowler. Post Anesthesia Recovery in Clinical Anesthesia Barash 6th edition 2009; chapter 55, pg 1422-1427.

21. ASA Practice guidelines for Postanesthetic care: A report by the American Society of Anesthesiologists Task Force on Postanesthetic care. *Anesthesiology* 2002; 96: 742-752.

22. Tarrac S. A description of intraoperative and postanesthesia complication rates. *Journal of perianesthesia Nursing* 2006; 21(2): 88-96.

23. Roberta H, Paul GB, Gail W et al. Complications occurring in the Postanesthesia care unit: A survey. *Anesthesia Analgesia* 1992; 74: 503-509.

24. Chung F et al. Adverse outcomes in ambulatory anaesthesia. *Canadian Journal of Anaesthesia* 1999; 46(5): R18-R26.

25. Chung F et al. Pre-existing medical conditions as predictors of adverse events in day-case surgery. *British Journal Anaesthesia* 1999; 83(2): 262-270.

26. Sullivan EE: Standards of perianesthesia nursing practice. *Journal of Perianesthesia Nursing* 2002; 17: 275-280.

27. Cohen MM, O'Brien- Pallas LL, Copplestone C et al: Nursing workload associated with adverse events in the postanesthesia care unit. *Anesthesiology* 1999; 91: 1882-1887.

28. American Society of Perianesthesia Nurses (ASPAN). A position statement on minimum staffing in Phase 1 PACU 2005.

29. Tessler MJ, Mitmaker L, Wahba RM, Covert CR. Patient flow in the Post Anesthesia Care unit: An observational study. *Canadian Journal of Anesthesia* 1999; 46(4): 348-351.

30. Seago JA, Weitz S, Walczac S. Factors influencing stay in the postanesthesia care unit: A prospective analysis. *Journal Clinical Anesthesia* 1998; 10(7): 579-587.

31. Edler AA, Mariano ER, Goliann B et al. An analysis of factors influencing postanesthesia recovery after pediatric ambulatory tonsillectomy and adenoidectomy. *Anesthesia Analgesia* 2007; 104(4): 784-789.

32. Kiekkas P. Is Postanesthesia care unit length of stay: Increased in hypothermic patients? *Association of Recovery Nursing Journal* 2005; 81(2): 379-382; 385-392.

33. Brown I, Jellish WS, Kleinman B et al. Use of postanesthesia discharge criteria to reduce discharge delays for inpatients in the postanesthesia care unit. *Journal Clinical Anesthesia* 2008; 20(3) 175-179.

34. Troung L, Moran JL, Blum P. Postanesthesia care unit discharge: A clinical scoring system versus traditional time-based criteria. *Anaesthesia Intensive care* 2004; 32(1): 33-34.

35. Cohen SE, Hamilton CL, Riley ET et al. Obstetric Postanesthesia care unit stays: Re-evaluation of discharge criteria after regional anesthesia. *Anesthesiology* 1998; 89(6): 1559-1565.

36. Prowse M & Lyne P. Clinical effectiveness in the postanesthesia care unit. How nursing knowledge contributes to achieving intended patient outcomes. *Journal of Advanced Nursing* 2000; 31(5): 1115-1124.

37. Aldrete JA, Kroulik D. A Postanesthetic recovery score. *Anesthesia Analgesia* 1970; 49: 924-934.

38. Aldrete JA. The postanesthesia recovery score revisited. *Journal Clinical Anesthesia* 1995; 7: 89-91.

39. Ead H. From Aldrete to PADSS: Reviewing discharge criteria after ambulatory surgery. *Journal of Perianesthesia Nursing* 2006; 21(4): 259-267.

40. Wu CL, Bernholtz SM, Pronovost PJ et al: Systemic review and analysis of postdischarge symptoms after outpatient surgery. *Anesthesiology* 2002; 96: 994-998.

41. Franklin D, Donald H, Penning MS et al. Statistical Analysis by Monte-Carlo: Simulation of the impact of administrative and Medical Delays in Discharge from the Postanesthesia care unit on Total Patient care hours. *Anesthesia Analgesia* 2001; 5: 1222-1225.

42. Khalid Samad, Mueenullah K, Hameedullah et al. Unplanned Prolonged Postanesthesia care Unit Length of Stay and Factors affecting it. *Journal Pakistan Medical Association*. 2006; 56: 108-111.

43. Dara B, David L, Marie H. Delayed Discharge from the Post Anesthetic Care Unit. An ongoing Improvement Process. *Anesthesiology* 2011; 99: A 1305

APPENDIX 1

PATIENT'S DATA SHEET

DATE……

PATIENT'S BIODATA

PATIENT'S NUMBER……

PATIENT'S AGE.

a) 18- 24 yrs	
b) 25-34 yrs	
c) 35-44 yrs	
d) 45-54 yrs	
e) 55- 65 yrs	
f) > 65 yrs	

PATIENT'S GENDER: MALE [ ] FEMALE [ ]

ASA CLASSIFICATION: ASA ……

DIAGNOSIS……..

INTRAOPERATIVE DATA

CATEGORY OF SURGICAL PROCEDURE

a) Emergency	
b) Elective	

TYPE OF SURGERY……

DURATION OF SURGERY……

TYPE OF ANAESTHESIA……

i. Were Opioids used?

a) Yes	
b) No	

If yes, which one (s)?

……

……

……..

ii. Was a sedative added?

a) Yes	
b) No	

If yes, which one?

…….

iii. Was a muscle relaxant given?

a) Yes	
b) No	

If yes, which one?

……

iv. Was Reversal given?

a) Yes	
b) No	

a) If yes, what was given?

……

……

b) How many doses of reversal were given? …….

DURATION OF ANAESTHESIA……

PACU DATA

TIME OF ADMISSION……

AT TIME OF PATIENT ADMISSION,

i. What was the total number of patients in PACU? .....

ii. What was the total number of nurses in PACU? …….

DID THE PATIENT DEVELOP ANY POSTOPERATIVE COMPLICATIONS/ COMPLAINTS?

a) Yes	
b) No	

If yes, tick the appropriate box.

a) Nausea and vomiting	
b) Breathing difficulties	
c) Apnoea	
d) Hypotension	
e) Cardiac arrest	
f) Other (specify)……	

TIME WHEN PATIENT WAS FOUND FIT FOR DISCHARGE……

TIME WHEN PATIENT WAS DISCHARGED FROM PACU……

APPENDIX 2

Study information form- individual patient

Introduction

I am Dr Lucy Ng'ethe, a master's student in Anesthesiology at the University of Nairobi. I am conducting a study on the PACU Length of Stay of postoperative patients at the Kenyatta National Hospital main theatres' PACU.

Purpose of the study

This study aims at determining the patient factors that may contribute to long patient stay in this unit and also to establish the logistical factors that contribute to prolonged patient stay at the KNH main theatre PACU.

Voluntary participation

Patient participation is voluntary. Refusal to participate in the study will not result in any penalty. Should you choose to withdraw from the study, you will receive normal care and standard treatment entitled to you.

Risks and benefits

There are no additional risks that you will be exposed to by participating in this PACU study. You will not receive any compensation (monetary or otherwise) for participating in this study, participating in this study will not be of direct benefit to you. However the results may contribute to the improvement of PACU protocols.

Confidentiality

All information gotten shall be handled with utmost confidentiality and will be used for the study purposes only. Your name will not appear on any document; all data forms will be coded and will not be identified by name.

Whom to contact

If you have any questions about the study, please feel free to ask anytime during the study period by contacting;

Dr. Lucy Ng'ethe (researcher) 0722256627; email- ngethel@yahoo.com

Please confirm that you have agreed to participate in this study by signing the consent form provided to you.

Fomu ya kufafanua utafiti

Majina yangu kamili ni Daktari Lucy Ng'ethe, mwanafunzi wa chuo kikuu cha Nairobi. Nafanya utafiti utakao wahusu wagonjwa ambao wamefanyiwa upasuaji na wakaamka na kujielewa katika chumba cha PACU huku Hospitali Kuu ya Kenyatta.

Utafiti huu una lengo la kuchunguza wagonjwa ambao wamefanyiwa upasuaji baada ya wao kuamka na kujielewa wakiwa chumba cha PACU. Huko PACU mtafiti atawafuatilia wagonjwa ndio ijulikane sababu zile hufanya wagonjwa kuchelewa wakingoja kurudishwa wadi katika hiki chumba baada ya kuamka na kujifahamu.

Washirika watafanyiwa utafiti baada ya wao kutia sahihi ya kuonyesha wamekubali bila kulazimishwa kuwa washirika kwa utafiti huu. Yeyeto yule atabadilisha nia na kujiondoa kwa huu utafiti hatanyimwa haki yake ya kutibiwa au kusaidiwa.

Habari ile itakayo kusanywa kwako itatumika tu kwa utafiti pekee. Tafadhali tia sahihi yako kwa fomu ya idhini kudhibitisha kuwa umekubalia kuwa mshirika.

APPENDIX 3

Consent form- Individual patient

I……of ……..do hereby consent to be a participant in the ongoing PACU study, after having read the explanation form and having the study purpose explained to me by the researcher. My participation is voluntarily given.

I also understand that no harm shall come to me and no treatment will be denied me should I choose to withdraw from the study.

Participant's signature..... OR thumbprint……

Date ……

Witness/Translator's signature …….

Date …….

Researcher's signature……

Date ……

Idhini ya kushiriki katika utafiti

Mimi……
wa…… nakubalia kushiriki katika utafiti unaoendelea huku PACU ya chumba kikuu cha upasuaji hapa Hospitali Kuu ya Kenyatta. Nimejisomea fomu ya kufafanua utafiti huu na nikaelezewa umuhimu wa utafiti huu.

Nimeelewa ya kwamba sitadhulumiwa wala kunyimwa matibabu kamili nikiamua kujiondoa kwa utafiti.

Sahiihi ya muhusika…… AU kidole……

Tarehe…….....

Sahihi ya mtafsiri ……

Tarehe …….....

Sahihi ya mtafiti……

Tarehe…….

APPENDIX 4

American Society of Anesthesiologists Physical Status Classification

ASA 1	Healthy patient without organic, biochemical, or psychiatric disease
ASA 2	A patient with mild systemic disease, e.g., mild asthma or well-controlled hypertension. No significant impact on daily activity. Unlikely to have an impact on anesthesia and surgery
ASA 3	Significant or severe systemic disease that limits normal activity, e.g., renal failure on dialysis, or class 11 congestive heart failure. Significant impact on daily activity. Probable impact on anesthesia and surgery
ASA 4	Severe disease that is a constant threat to life or requires intensive therapy, e.g., acute myocardial infarction, respiratory failure requiring mechanical ventilation. Serious limitation of daily activity. Major impact on anesthesia and surgery
ASA 5	Moribund patient who is equally likely to die in the next 24 hours with or without surgery
ASA 6	Brain-dead organ donor

"E" added to the classification indicates emergency surgery.

APPENDIX 5

STANDARDS FOR POSTANESTHESIA CARE

Committee of Origin: Standards and Practice Parameters

(Approved by the ASA House of Delegates on October 27, 2004, and last amended on October 21, 2009)

These standards apply to postanesthesia care in all locations.

1. All patients who have received general anesthesia; regional anesthesia; or monitored anesthesia care should receive postanaesthesia management.
2. The patient should be transported to the PACU by a member of the anesthesia care team knowledgeable about the patient's condition.
3. Upon arrival in the unit, the patient should be re-evaluated and a verbal report should be provided to the nurse.
4. The patient shall be evaluated continually in the unit.
5. A physician is responsible for the discharge of the patient. In the absence of the physician responsible for the discharge, the PACU nurse shall determine that the patient meets the discharge criteria

APPENDIX 6- PATIENT ASSESSMENT TOOLS

MODIFIED ALDRETE SCORING SYSTEM		
Criterion		**Score** **Maximum Score: 10**
Source: Aldrete, 1998.		
Consciousness	Fully awake	**2**
	Aroused by verbal stimulus	**1**
	Not aroused by verbal stimulus	**0**
Breathing	Takes full breaths and can cough	**2**
	Takes only shallow breaths or has dyspnea	**1**
	Cannot breath without assistance (apnea)	**0**
Blood Pressure	Within 20 mm Hg of pre-op value	**2**
	20 to 50 mm Hg different from pre-op value	**1**
	≥50 mm Hg different from pre-op value	**0**
Oxygenation	>92% blood oxygen saturation (SpO_2) on room air	**2**
	Needs supplemental O_2 to maintain SpO_2 >90%	**1**
	SpO_2 ≤90% on supplemental O_2	**0**
Motor Function	Can move all 4 extremities on request	**2**
	Can move 2 extremities on request	**1**
	Cannot move any extremities on request	**0**

POSTANESTHESIA DISCHARGE SCORING SYSTEM (PADSS)		
Criterion		**Score** **Maximum Score: 10**
Blood Pressure and Pulse Rate	Within 20% of pre-op levels	**2**
	Between 20% and 40% of pre-op levels	**1**
	More than 40% different from pre-op levels	**0**
Ability to Walk	Has steady gait and no dizziness (or pre-op level)	**2**
	Requires assistance	**1**
	Unable to walk	**0**
Nausea and Vomiting	Minimal, controllable with oral meds	**2**
	Moderate, requires treatment with IM meds	**1**
	Continual despite meds	**0**
Pain Control with Oral Meds	Acceptable to patient	**2**
	Unacceptable to patient	**1**
Surgical Bleeding	Minimal, requiring no dressing changes in PACU	**2**
	Moderate, requiring ≤2 dressing changes	**1**
	Severe, requiring >2 dressing changes	**0**

APPENDIX 7

STUDY BUDGET ESTIMATES

ITEM	QUANTITY	COST
Biostatistician	1	25,000
Internet	-	3,000
KNH Ethics & Research Committee	-	1,000
Paper rims	2	2,000
Flash disks	2	1,000
Printing	-	3,000
Photocopying	-	2,000
Binding	-	1,000
Other consumables(pens, folders, airtime)	-	2,000
GRAND TOTAL		**40,000**