

**TIMING OF EMERGENCY SURGERY AT THE
KENYATTA NATIONAL HOSPITAL**

**A DISSERTATION SUBMITTED IN PART FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF MASTER OF MEDICINE
DEGREE IN ANAESTHESIA OF THE UNIVERSITY OF NAIROBI.**

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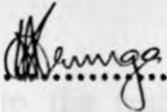


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DECLARATION

This dissertation is my original work and, to the best of my knowledge, has not been submitted for a degree in any other university.

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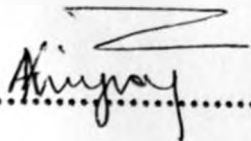
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DEDICATION

This study is dedicated to my family, for their patience and support. This was indispensable for the successful completion of this study.

And to the patients who make learning possible in Kenyatta National Hospital.

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ABBREVIATIONS

ASA	-	American Society of Anaesthesiologists
NCEPOD	-	National Confidential Enquiry into Perioperative Deaths
WJES	-	World Journal of Emergency Surgery
G A	-	General Anaesthesia
OR	-	Operating Room
TSSU	-	Theatre Sterile Supply Unit
KNH	-	Kenyatta National Hospital
TSA	-	Trained Subordinate Assistant (assists anaesthetist)
WSES	-	World Society of Emergency Surgery
CO	-	Registered Clinical Officer
NHS	-	National Health Service (Great Britain)
CEPOD	-	Confidential enquiry into perioperative deaths

ABSTRACT

OBJECTIVE: To establish the timing for surgical emergencies at the Kenyatta National Hospital and review the causes of delay where applicable

STUDY DESIGN: A prospective hospital based study

STUDY SETTING: The study was undertaken at KNH in the 12 main theatres as per inclusion criteria.

MATERIALS AND METHOD: Data relevant to the study was collected including patient's socio-demographic profile and diagnostic workup, arrival time, theatre notification and time operation began anaesthetist and rank, surgeon and rank, cause of delay where applicable. The data was recorded in the data collection tool.

RESULTS AND CONCLUSIONS: About 71.7 % of participants were subjected to waiting time over 4 hours with the commonest cause being occupation of theatre with another emergency. All NCEPOD classes were operated on at all times of the day with no statistical significance between classes when compared over 24 hours. Emergent cases were done faster than urgent and scheduled cases but no statistically significant difference was seen in mean waiting times between urgent and scheduled cases. Cases done within regular working hours experienced statistically significant shorter mean waiting times than those done after regular working hours. The presence of a senior surgeon or anaesthetist did not significantly influence mean waiting time.

RECOMMENDATIONS: Extra theatres need to be set aside for emergencies including independent orthopaedic and general trauma theatres.

Allocation and prioritisation of emergencies in theatre requires training and expertise and senior anaesthetists need to be involved. Protocols as laid down by NCEPOD would be of help in this regard.

1.0 INTRODUCTION

1.1 EMERGENCY SURGERY IN KNH

The patient follows a predetermined flow upon arrival in KNH as described below.

- i. Patient arrival at casualty receiving area where triage is done. Resuscitation is commenced if necessary and registration is carried out.
- ii. The diagnosis is made by the medical officer who orders relevant investigations. Resuscitation is an ongoing process.
- iii. The diagnosis is confirmed of by the surgical team who begin the preoperative process i.e. grouping and cross matching of blood, consent seeking, theatre list preparation, anaesthetist consultation or other subspecialty review. This can occur in casualty or in the surgical ward depending on urgency. Resuscitation and monitoring is carried out simultaneously.
- iv. Submission of emergency list to theatre
- v. Allocation of theatre by nursing team leader or anaesthetist in charge (consultant A)
- vi. Patient wheeled to theatre from the ward or directly from casualty
- vii. Anaesthetic review (in receiving area). This review usually occurs here but may occur in the proceeding steps.
- viii. Patient is wheeled to theatre by the porter.
- ix. Operation begins

The flow outlined above can vary depending on the urgency of the case and the time and place of diagnosis.

4 points on the pathway are usually recorded:

- Time 1 Patient arrival (registration) in casualty
- Time 2 Arrival in the ward
- Time 3 Theatre notification
- Time 4 Operation begins

This gives three time intervals:

A. 1 to 2 - the patient arrives at casualty and is triaged after which (or simultaneously) registration by the records department is done and consultation fees are paid or waived by the finance section. Resuscitation is done from triage onwards as required.

There is a period of waiting to be seen by the doctor who takes a history, examines the patient and makes a tentative diagnosis. Confirmatory investigations and laboratory works are ordered.

Specialist reviews are sought as required.

The patient is transferred to the ward or to theatre directly

B. 2 to 3 - patient arrives in the ward

The surgeon confirms the diagnosis though this may be done in casualty.

Preparation for theatre including writing of the theatre list, resuscitation, basic and appropriate blood, biochemical and radiological investigations, anaesthetic review.

C. 3 to 4 – theatre receives list – preparation for surgery. Allocation of theatre (prioritisation); necessary equipment ordered from TSSU; Relevant staff notified of emergency and the ward or casualty in charge is informed of readiness; patient is wheeled to theatre; patient received in theatre.

Emergencies are usually reviewed by the anaesthetist in charge before operation at the receiving area in theatre where quick assessment of volume status and other physiological variables is done. Availability of grouped and cross matched blood is also ascertained.

Allocation of theatre time to the two designated emergency theatres is done (by the nursing team leader) after the request is presented by the surgeon.

Priority is given to more urgent cases. However this is subjective because no system or protocol exists to determine which cases are more urgent. A senior anaesthetist referred to as 'consultant A' is available during the day to assist in the decision making process. This is not always the case after 1700 hrs when the senior anaesthetist is only available on consultation basis.

Elective lists have been occasionally interrupted in order to accommodate acute and dire emergencies during the day. After completion of elective lists within regular working hours the various elective theatres are expected to take over "Emergency Patients" still pending from the regular designated acute care theatres.

These pending cases are likely to have experienced some delay which could hypothetically be caused by an overwhelming number of cases in the two emergency theatres necessitating expansion of this facility or inefficient use of theatre, or a combination of the two.

Data relating to these four steps will be collected and analysed to give an indication of the efficiency of the process leading to emergency surgery in KNH.

1.2 CONDUCT OF EMERGENCY ANAESTHESIA

Several factors need to be considered preoperatively in emergency anaesthesia. As outlined in Aitkenheads' Textbook of Anaesthesia⁴, emergency patients present with uncertain diagnoses and may have uncontrolled coexisting medical disease with associated cardiovascular, respiratory and/or metabolic derangements.⁴

It further states that the major principle is to be prepared for all potential complications including gastric regurgitation, hypovolemia, hemorrhage, drug reactions etc. in the presence of electrolyte disturbances and renal (or other organ) impairment.

Factors to be considered include ascertaining the diagnosis, possible extent of surgery and how urgently the surgery is required.

A pertinent history and physical exam directed at determining the cardio respiratory reserve of the patient is required.

Evaluation of the airway with the aim of rapid airway access in theatre is done.

Assessment of volume status is important because the drugs used are cardio depressant. Any volume deficit therefore needs urgent correction.

The anaesthetist reviews relevant laboratory investigations.⁴

Induction

This is usually achieved with an intravenous induction agent during the rapid sequence intubation maneuver.

This minimizes the risk of vomiting/ gastric regurgitation.

Anesthetists must balance the risk of losing control of the airway with use of a muscle relaxant in this technique against the risk of regurgitation of gastric contents.

The Sellick's maneuver (cricoid pressure) is applied by a skilled assistant to prevent regurgitation. This is done either before or as soon as consciousness is lost.

The induction agent is given followed by a paralyzing dose of succinylcholine.

Intubation of the trachea is done as soon as the jaw begins to relax.

Tracheal tube placement is confirmed.

Alternatives to RSI include 'awake intubation' or fiberoptic intubation.

Maintenance of anesthesia

A balanced anaesthetic technique is preferred in emergency anaesthesia. This comprises analgesia, hypnosis and muscle relaxation to minimize the side effects of individual drugs.

Regional anaesthesia is a useful alternative in extremity surgery.

Postoperative management

Analgesia is required but doses should be reduced where there is concern about the metabolic or volaemic state of the patient.

Abnormal fluid losses should be taken into account.

Need for blood replacement is assessed.

Postoperative ventilatory assistance is required in the following circumstances: ⁴

1. Prolonged shock
2. Massive sepsis (fecal peritonitis, cholangitis, septicemia)
3. Extreme obesity
4. Overt gastric acid aspiration
5. Previously severe pulmonary disease.

2.0 LITERATURE REVIEW

2.1 DEFINITION

In 1940 when the ASA classification first came into being, it defined an emergency as a surgical procedure which, in the surgeon's opinion should be performed without delay.³

This definition was thought to be subject to manipulation by the surgeon.

An emergency is now defined by ASA as existing when delay in treatment would lead to a significant increase in the threat to life or body part.³

According to WJES, emergency surgery is defined as polyspecialistic surgery performed for trauma injuries or for non traumatic acute disease during the same admission in hospital.²

CEPOD classification (1985) divides surgical procedures into 4 groups¹:

Emergency – immediate life saving operation, resuscitation simultaneous with surgical treatment (e.g. trauma, ruptured aortic aneurysm). Operation is usually performed within one hour.

Urgent - operation carried out as soon as possible after resuscitation (e.g. irreducible hernia, intussusception, Oesophageal atresia, intestinal obstruction, major fractures. Operation within 24 hours,

Scheduled – An early operation but not immediately lifesaving (e.g. malignancy) operation within 3 weeks.

Elective – operation at a time to suit both patient and surgeon (e.g. cholecystectomy, joint replacement)

The definition above was adopted by NCEPOD on its formation in 1998.¹

The reason for allocating such a classification to each case is to define the urgency of the patient's intervention in order to:

- inform clinicians and managers responsible for preparing procedures lists and allocating theatres
- check that patients are operated on within the time frame appropriate for their condition.
- Check that medical personnel are operating out-of-hours only when it is appropriate.
- review the allocation of types of patient to types of theatre session (split into daytime and out-of-hours) in order to take appropriate corrective action within the current organization of surgical/radiological/cardio logical services and to aid further development of these services (organization and planning)

A new revised NCEPOD classification¹ divides surgery into 4 classes:

Immediate - divided into 2 groups:

a) Lifesaving

b) Other - limb or organ saving surgery.

- Operation is done within minutes of decision to operate

Urgent – interventions for acute onset or clinical deterioration of potentially life threatening conditions, for those conditions that may threaten the survival of limb or organ, for fixation of many fractures and for relief of pain or other distressing symptoms.

- Operation within hours of decision to operate.

Expedited - patient requiring early treatment where the condition is not an immediate threat to life, limb or organ survival. Normally surgery is done within days of decision to operate.

Elective – planned or booked in advance of routine admission to hospital.

The NCEPOD classification¹ helps to consider the consequences of a delay between the decision that an operation is required and surgery taking place.

Allocation and prioritization of emergency theatre is not a simple matter. Depending on presentation, the same operation could be undertaken on patients falling into all four of the categories e.g.

Splenectomy: immediate – for life threatening traumatic bleeding

Urgent – for ongoing bleeding post splenic injury

Elective – done for malignant or hematologic disease.

It is therefore not possible to group operations within categories to make allocation easier.¹

The NCEPOD classification for emergency surgery which divides surgery into emergent, urgent, scheduled and elective was applied in this study.

2.2 GUIDELINES FOR BEST PRACTICE

Peden, C. (2006)⁶ outlined guidelines for best practice in emergency anaesthesia.

Grade of anaesthetist and consultation for emergency cases

The skills of the anaesthetist should be matched to the physiological and pathological status of patient.

Studies have shown that high risk patients (ASA 4 or 5) anaesthetized or operated on out- of- hours by junior trainees have a poor outcome.⁴⁵ This may be due to inappropriate decision to operate or failure to appreciate when senior help is required.

Timing of emergencies on 24 hour clock

NCEPOD has suggested that all emergency patients should have prompt access to theatres, critical care facilities and appropriately trained staff, 24 hours a day every day of the year, whereas non emergency cases should be managed within the standard or extended working day.

Out-of-hours operating, particularly after midnight, may result in poorer outcomes for patients. Senior surgical and anaesthetic involvement is reduced.

Emergency operating during the day can allow excellent supervision and therefore greater training opportunities.

Proposed standards for best practice (NCEPOD) ^{6, 43}

100% of cases started after midnight should fit the NCEPOD definition for urgent or emergent status. A consultant or senior registrar should be present or have been consulted in 100% of cases

60 % or more of emergency cases should be done between 0800 to 1800 hrs.

5 % or fewer emergency cases should be done between 2400 to 0800 hrs.

100 % of cases started after 2400 hrs should be classified as 'emergency' as defined by NCEPOD.

2.3 ANALYSIS OF PROCESS

Little information is available regarding perioperative organizational problems.⁵

Jawaid, M. et al. (2005)⁸ did a performance audit involving 45 patients and found that 73.3% were subjected to a delay of more than 3 hours for emergency surgery after the decision to operate had been made.

The reason given for delay in 21.2% of cases was 'late night admissions'. 18% was due to non availability of cross matched blood. In 15.1% theatre was busy or more critical patients arrived.

The same authors subsequently carried out a follow-up study after introducing improvement guidelines which showed an improvement in

waiting time. Delay of more than 3 hours was evident in 43.5% of the study sample.⁹

This is an example of a study leading to implementation of guidelines which improved quality of care.

Studies relating delay to outcome measures are more abundant in literature. These studies show that early intervention improves outcome variables and that delay in emergency surgery increases mortality and morbidity.

Wyatt, M. et al (1990)¹¹ prospectively examined the problem of delay in a district hospital over a 16 week period using a sample size of 204. He found that median delay in emergency general surgical patients was 3 hours. 88 patients waited for more than 1 hour with 15% experiencing a delay of over 6 hours.

In only 10% of cases was a theatre required after midnight, yet 26% of all emergency general surgical operations were done between midnight and 8am.

Of the delays, theatre delay accounted for 47%, anaesthetic delay 30% and overrunning of routine list 14%.

These results suggested that unnecessary theatre delays resulted in a high number of emergencies occurring after midnight.

This emphasizes another consequence of delay in surgery; it often results in most emergency procedures overrunning the daytime emergency list into the night.

'Anesthetists also all 'know' that operating after midnight is associated with increased morbidity and mortality(NCEPOD) and that fatigue reduces our ability to be vigilant' (Jorm.C 2003 anaesthesia journal, 58 (9) 833).¹⁰

Sleep deprivation and accompanying fatigue are ubiquitous components of many anesthesiologists' lifestyle¹⁶. Several studies have substantiated the claim that fatigue or continuous wakefulness has a deleterious effect on many physical and cognitive functions.

A study by Gravenstein¹⁷ found that an error in anaesthetic management was attributed to fatigue by 64% of participants.

Vigilance is paramount in anaesthesia. Fatigue leading to 'medical error' increases perioperative risk.

There is strong scientific evidence linking fatigue and a drop in performance among junior doctors and residents.¹³

Night time emergency surgery carries greater risk because of scarcity of consultant anesthetists, surgeons and other cadres of staff. This compromises theatre efficiency which per se is a cause of delay.²⁴

In this setting of depleted human resource, reduced vigilance, and less supervision, a patient presenting for emergency surgery at night is more susceptible to complications.

Daytime emergency lists should therefore not over-run into the night. Furthermore, cases presenting at night which are not urgent can wait for daylight since daytime operating is considered best practice.⁵

Efficient use of theatre facilities thus minimizing the time between cases, and time within cases will ensure that patients are not unnecessarily delayed.²⁴

The association of Anesthetists of Great Britain and Ireland in a recent publication outlined the key elements in the efficient use of emergency theatres as follows:

- Effective management and good communication, trained staff, appropriate facilities, equipment, and operative layout are required.

The article further states that good utilization depends upon a complex interaction between the availability of personnel and resources and on the attitudes and good practice of all staff involved.²⁴

Efficiency in theatre is influenced by a wide range of surrounding resources such as preoperative planning and assessment, beds, theatre sterile supply unit (TSSU) capacity and staffing levels in other disciplines.

A good system of planning and scheduling will enable more work, including emergencies to be carried out at a reasonable time, improve patient experience and improve employee satisfaction and morale.

Only cases that cannot be delayed for good clinical reason should be operated on at night i.e. after 2100 hrs.⁴³

One reason for cancellation of elective cases continues to be inadequate provision of theatre space and staff during the day for emergencies.²⁵

Provision of an exclusive daytime emergency and trauma list will enable as many as 80% of all emergencies to be dealt with during the normal working day.¹³

Higher patient turnover results in reduced waiting time for patients on a theatre list.

Various methods have been tried to improve theatre efficiency in order to minimize delay.

In one example, Paulus T et al. (2005)²², did a prospective study on OR times for 5 weeks where anaesthesia induction was done concurrently i.e. in an adjacent room as another operation is nearing completion.

A team of two nurses and one anesthesiologist was added to one OR to perform parallel anesthesia induction in a separate induction room. The mean non operative time was reduced by 45.6%, whereas surgery time remained unchanged. The time savings were attributed to the concurrent anesthesia induction and the cut down in delays between the phases. The new model allowed one additional case to be performed during the 7 hour working day.

The study concluded that anesthesia induction outside the OR can increase the number of surgical cases performed during a regular workday.

In a number of studies, introduction of dedicated emergency theatres has been shown to reduce waiting time for emergency operations.^{12, 24, and 37.}

Calder, F. et al, (1998)¹² studied the effect of introducing a dedicated 24-hour emergency theatre facility on operating patterns in a 500-bed district general hospital. The total amount of emergency general surgery performed after 22.00 hours was reduced from 37.2 to 13.1%, with a concomitant increase in emergency day-time operating from 22.1 to 51.2%. The majority

of the workload was previously performed by the junior grades (anesthesia and surgical trainees), and this remained unchanged.

Operative experience was not diminished with the reduction in night-time surgery, and senior supervision was enhanced.

Pearse M. et al. (2001)⁵ studied the incidence and nature of organizational failure before urgent and emergency surgery in a district general hospital prospectively in 159 cases over a 30-day period.

Organizational failure affected more than half of the cases overall, but varied in both its incidence and its complexity between surgical disciplines. Various causative factors were identified, e.g. 8% of cases were subject to delay due to clinical emergencies. The median [range] time required to rectify the problems was 115 [5–750] min. A consultant anesthetist and surgeon were present in 30 and 20% of cases, respectively. Difficulty with the preparation of patients for emergency surgery was found to be an important but under evaluated cause of medical error that may put patients at risk.

Jonnalagadda R. et al.(2005)²⁰ carried out a prospective study in Queen Elizabeth hospital in Barbados on all patients scheduled to have elective and emergency surgery during a period of 6 weeks. This was to determine the starting times, completion times, causes of delay and cancellations of the above procedures.

It was found that many avoidable causes of delay could be attended to and minimized for the effective utilization of operating theatre time.

The most common cause of delay was due to the late arrival of patients from the admitting ward to the operating theatre (17%)

The anesthetist, nurse or surgeon not being available on time accounted for 24% of delays.

Unavailability of recovery room bed - 4% of delays

Unavailability of linen - 3% of delays

Equipment failure - 5% of delays

Other emergency or surgery accounted for - 3% of delays.

2.4 OUTCOME MEASURES

Adverse outcome associated with delay in emergency surgery is evident in many studies.

A study by Ditillo M. et al. (2005) concluded that in adult patients with acute appendicitis, the risk of developing advanced pathology and postoperative complications increases with time; therefore, delayed appendicectomy is unsafe.⁴⁴

Fang, J. et al, (1999) evaluated the relationship between treatment delay and outcome of small bowel perforation after blunt abdominal trauma. He found that delay in surgery for more than 24 hours did not significantly increase the mortality with modern method of treatment; however, complications increased dramatically. Hospital stay and time to resume oral intake increased significantly when surgery was delayed for more than 24 hours.¹⁴

Bottle, A. (2006)¹⁵ did an observational study in 151 NHS trusts in England and out of 129,522 admissions for fractured neck of femur, there were 18 508 deaths in hospital (14.3%). Delay in operation was associated with an increased risk of death in hospital, which was reduced but persisted after adjustment for co morbidity. For all deaths in hospital, the odds ratio for more than one day's delay relative to one day or less was 1.27 (95% confidence interval 1.23 to 1.32) after adjustment for co morbidity.

The proportion with more than two days' delay ranged from 1.1% to 62.4% between trusts. If death rates in patients with at most one day's delay had been repeated throughout all 151 trusts in this study, there would have been an average of 581 (478 to 683) fewer total deaths per year.

There was little evidence of an association between delay and emergency readmission.

He concluded that delay in operation is associated with an increased risk of death but not readmission after a fractured neck of femur, even with adjustment for co morbidity, and there is wide variation between trusts.

Some studies have demonstrated negligible consequences of delay in particular cases e.g. orthopedic emergencies.^{31, 41}

Some of these cases can safely be postponed to be done during the day thus minimizing night time operating.

Yeatman, M et al (1994) did a 12-month retrospective study of emergency orthopedic operations in a district general hospital. There were 962 emergency admissions of whom 272 (17.7%) underwent emergency operation. The largest group consisted of those undergoing operation for femoral neck fractures (37.6% of the total). Despite 58.8% of the patients

presenting to the accident and emergency (A&E) department between 0800 and 1700 hours, the majority (66.2%) were operated on 'out-of-hours'. Those patients undergoing emergency operation out-of-hours were allocated to one of three categories (emergency, urgent, or scheduled) depending on the nature and severity of their presenting condition. In the authors' opinion, 81.9% of the patients could have been appropriately classified as scheduled cases and that all out-of-hours operations in this group of patients could have been deferred until the following morning. This would have reduced the number of orthopedic operations performed out-of-hours from 182 to 33. The operating time at night would have been reduced from 126.9 h to 15.8 h.³¹

The implications of this study are important in view of the dangers the patient is exposed to during night time operating and the standards of best practice as outlined by NCEPOD.^{5, 43}

Spencer J et al (2004)⁴² did a study whose objective was to determine whether a time delay of greater than 6 hours from injury to surgical debridement affected the infection rate in open long-bone fractures in a typical district general hospital in the UK. This was a prospective audit over 5 years. 142 open long-bone fractures in 130 patients were seen over a 5-year period between 1996 and 2001 at the hospital. 115 fractures in 103 patients were available for study. The data was collected prospectively in weekly audit meetings. Patients were followed until clinical or radiological union occurred or until a secondary procedure for non-union or infection was carried out.

Surgical debridement was carried out in less than 6 h from injury in 60% of cases and in greater than 6 h from injury in 40% of cases. Infection rates were 10.1% and 10.8%, respectively. They could not demonstrate a significantly increased infection rate in patients in whom surgical debridement was done greater than 6 hours after injury.

This emphasizes that some types of emergency surgery can be scheduled for the daytime emergency list despite presenting during the night.^{31, 42}

3.0 STUDY JUSTIFICATION

Pearce et al. (2001)⁵ showed that medical error is an important cause of morbidity and mortality and organizational failure in the pre-operative period has been associated with catastrophic outcomes⁵.

Delay in emergency surgery is a major contributor to perioperative morbidity and mortality, and as such is of particular interest to the anaesthetist.

On average, about 1000 operations are done in KNH every month. Emergencies contribute to about 320 operations per month. Most emergencies are performed in the 2 main emergency theatres. Theatre Mortality statistics for the period January 2007 to June 2007 indicate that emergency neurosurgical procedures were the most common cause of mortality²³. This was attributed to the delays associated with CT scanning of the head, waiting for neurosurgical review and theatre delay after the theatre list had been prepared.

Early intervention during the golden hour after trauma consists of adequate resuscitation and stabilization. If urgent surgery is required, resuscitation should be done simultaneously.

Organisational problems in theatre are multifactorial in origin. Patients are managed in different units starting in the accident and emergency unit, surgical, medical, and paediatric wards and different cadres of health workers are involved in their care. Moreover the various departments run separate protocols that make it difficult to coordinate the process leading to surgery.

Any weak link in the process can cause delay especially in a multidisciplinary institution like KNH resulting in sub-optimal care. This is because the individual patient has a personal risk of complications, which increases with delay.¹⁰

Measures of processes and outcomes are the lenses through which we can see the quality of care we provide.⁷

According to Jorm, C. (2003)¹⁰, more studies concerned with quality of service provided are needed. This means more clearly embracing qualitative research methods and making a place for quality improvement projects which can change the practice of others. He emphasized that attention to continuous improvements in process, rather than a preoccupation with objective evidence of improvements in outcome, is the key to successful quality improvement.

Similar views are expressed by an article in the New England Journal of Medicine²⁷

It states that quality of care can be evaluated on the basis of structure, process and outcome.

Structural data are characteristics of the service provider (e.g. specialty) and the hospital.

Process data are the components of the encounter between the health provider and the patient.

Outcome data refer to the patients' subsequent health status.

If quality-of-care criteria based on structural or process data are to be credible, it must be demonstrated that variations in the attribute they measure lead to differences in outcome. If outcome criteria are to be credible, it must be demonstrated that differences in outcome will result if the processes of care under the control of health professionals are altered.

It was concluded that assessment of quality should depend much more on process data than on outcome data, especially when those systems are used to compare health plans.²⁷

According to Schwartz's Principles of Surgery (2005)²³, "Medical errors" is a commonly used term in quality improvement dialogue in the past few years. The concept of medical errors has received abundant attention due to an Institute of medicine 2000 report on the subject which showed approximately 98,000 medical error related deaths annually including unnecessary delays in provision of health care in the Un The concept of medical errors has received abundant attention due to an Institute of medicine 2000 report on the subject which showed approximately 98,000 medical error related deaths annually including unnecessary delays in provision of health care in the United States.^{18, 45}

The focus in surgical textbooks has traditionally been on complications of surgery as opposed to the process that may have led to the complications.

Improvement in processes of care can lead to a decrease in complications.

Although complications do occur that are related to a surgical disease, it is also important to analyze the process of care in an effort to decrease complications related to the treatment of disease. These processes of care are

being increasingly recognized as the etiology for error and not the diseases or treatments themselves.¹⁸

No study has so far been done at the Kenyatta National Hospital to define the time related issues in planning emergency surgery and the analysis of any delays or hindrances to the access of the facility once the decision to operate has been made.

This study assessed the timing of emergencies in Kenyatta National Hospital as a gauge of quality of perioperative care.

The analytical process was aimed at improving standards of care in⁷:

1. Training (professional education and development, self regulation, recertification) and adequate number of motivated staff.
2. Evidence based medicine, practice guidelines, decision aids.
3. Assessment and accountability, feedback, accreditation, public reporting.

4.0 OBJECTIVES

4.1 MAIN OBJECTIVE

To establish the timing for surgical emergencies at The Kenyatta National Hospital and review the causes of delay where applicable

4.2 SPECIFIC OBJECTIVES

1. To establish the time interval between decision to operate as an emergency and actual operative time at KNH.
2. To ascertain the causes of delay in operating surgical emergencies where applicable.
3. To ascertain when emergencies are done in the 24 hour clock at KNH.
4. To determine the outcome of current time management in theatre scheduling and allocation at KNH.
5. To apply the NCEPOD classification to the emergency surgical patients seen at KNH.

5.0 MATERIALS AND METHODS

5.1 STUDY SETTING

- The study was conducted in KNH a 2000 bed national referral and teaching facility.
- Its 12 main theatres were the focus of the study, specifically the 2 dedicated emergency theatres.

5.2 STUDY POPULATION

All patients scheduled to undergo emergency surgery at KNH who met the inclusion criteria during the study period.

5.3 STUDY DESIGN

A prospective hospital based study.

5.4 SAMPLE SIZE DETERMINATION

Since the factor of interest was to estimate the mean timing of emergency surgery, the formulae below was used.²¹

$$n = \frac{4\sigma^2 (Z_{crit})^2}{D^2}$$

Where;

n = is the sample size of the single study group

σ = assumed standard deviation (SD) for the group (3 hours)

$D =$ is the total width of the expected Confidence Interval (CI
– 30 minutes)

The Z_{crit} is the cut off points along the x-axis of the standard normal probability distribution that represents probabilities matching the 95% confidence interval (1.96).

Substituting the following in the formulae above we get;

$$= 276.596$$

= 277 therefore applying a 95% sampling error we get

$$= 264 \text{ patients.}$$

The sample above will be proportionately divided between the two main emergency theatres i.e. 132 cases per theatre.

Sampling Method – consecutive sampling until sample size is achieved.

5.5 STUDY PERIOD

Five months. December 2007 to May 2008.

5.6 INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

1. Adults and children scheduled for emergency surgery at the Kenyatta National Hospital.
2. Written informed consent from the anaesthetist.

EXCLUSION CRITERIA

1. Elective surgical cases as per the definition outlined.
2. Patients who required prolonged (over 3 hrs) resuscitation.
3. Obstetric emergencies.
4. Declined consent

5.7 METHODS

After approval by the hospital's ethics committee, patients on the emergency list who met the criteria for emergency surgery and merited inclusion as outlined were recruited into the study.

Consent from the anaesthetist in charge was obtained once the emergency list arrived in theatre.

Age, sex and other bio-data were recorded by the anaesthetist in charge of the case and/or researcher on the data collection tool (appendix 1).

The initial time when the decision to operate was made was obtained from the theatre list.

The onset of the operation was recorded by the anaesthetist in charge of the case or obtained by the researcher from the anaesthetic charts and confirmed from the patient's records.

The patients' registration at casualty was obtained from the casualty notes and recorded.

Reason for delay (in theatre) was obtained by the researcher/ anaesthetist in charge and confirmed by the questionnaire which forms part of the patient's records (not part of anaesthetist's notes).

Causes of delay were divided into 2 groups:-

- a. Staff related - shortage/absence - surgeon, anaesthetist, others (nurse, TSA, pottering), fatigue.

b. Organisational delays

- I. Availability of theatre i.e. lack of theatre space due to other emergency or elective,
- II. Equipment – shortage of sets, linen from TSSU, anaesthetic apparatus etc,
- III. Poor Patient preparation -delay waiting for blood works/blood, consent issues, full stomach, etc.

The qualification of the anaesthetist was indicated.

The data was reconciled in the data collection tool (appendix 1).

Analysis was done with help from my supervisors and statistician.

5.8 DATA COLLECTION AND ANALYSIS

The data was collected using a structured questionnaire (appendix 1). This was coded cleaned and verified before being computer designated in MS Access(TM) which allowed the researcher to set controls and validation of the variables. On completion of the data entry exercise the data was exported into a Statistical Package (SPSS – Version 12.0) for analysis.

The data was presented in tables and figures. Parametric tests were used to examine the association between the continuous variables like patient age, time of arrival in casualty/ward, time theatre notified and time operation began. After establishing that the parameters were normally distributed, the

'one-sample T-test' was employed to examine whether the parameters of interest differed significantly.

In instances where the distribution did not assume any known distribution (Non-parametric), the Mann Whitney - U statistics was used. This tested the distribution about the median point of the data and eliminated the bias introduced by the skewed mean.

A multiple regression was used to determine the significant factor which explains the waiting time. The response factor was taken as the waiting time of the patient. The explanatory factor was taken to be age, diagnosis, time of the day theatre notified, presence/absence of a consultant etc.

Odds Ratios and its associated 95% Confidence interval (CI) were employed to assist in determining the factors that were more likely to explain the explanatory variable (mean time). P-value of less than 5% was considered statistically significant.

5.9 ETHICAL CONSIDERATIONS

This study valued ethics as an imperative part of research, and as such, the following was ensured:-

1. The study was purely observational and there was no deviation from the normal theatre routine.
2. The study therefore possessed no harmful effects to the participants largely because it was non invasive.
3. The purpose and nature of the study was explained to the anaesthetist and an informed consent sought before any data was collected.

4. Confidentiality of information was maintained at all times.
5. The study was done after approval by the hospital ethical and research committee. (Appendix IV)



6.0 RESULTS

A total of 285 patients were recruited into the study as per protocol. 65.6% were male and 34.4% were female with age distribution between 3 days and 85 years. Mean age was 36.11 years while standard deviation was 17.08 as seen in figure 1.

Figure 1 : Distribution by Age (n = 285)

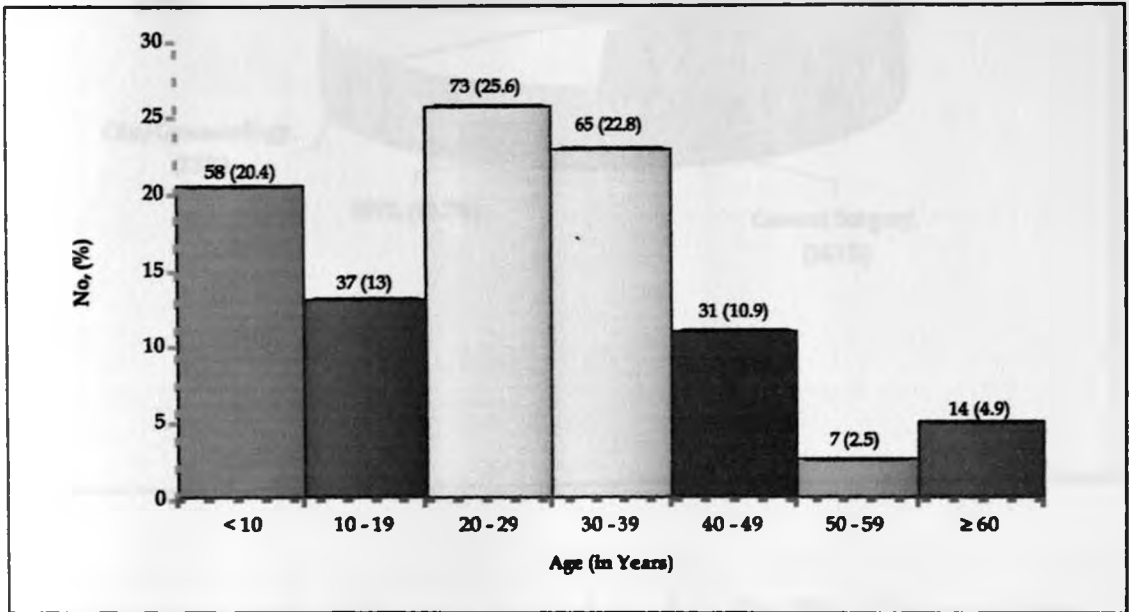
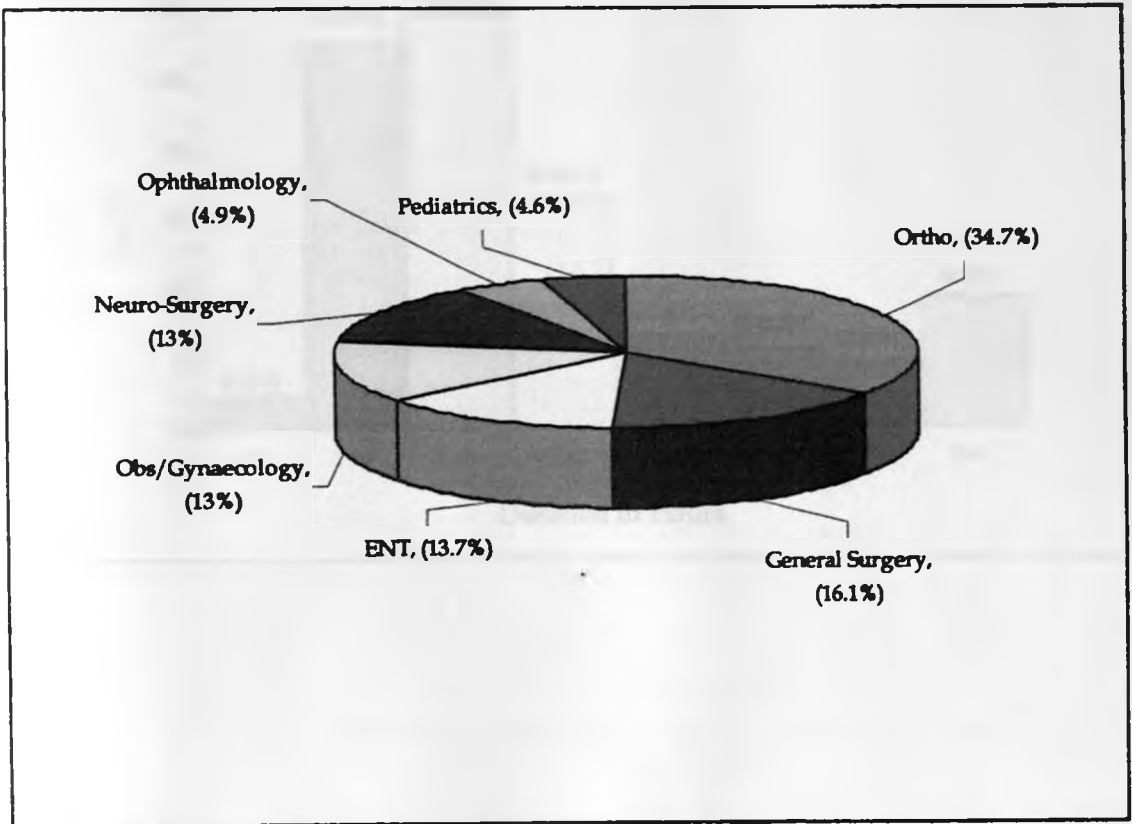
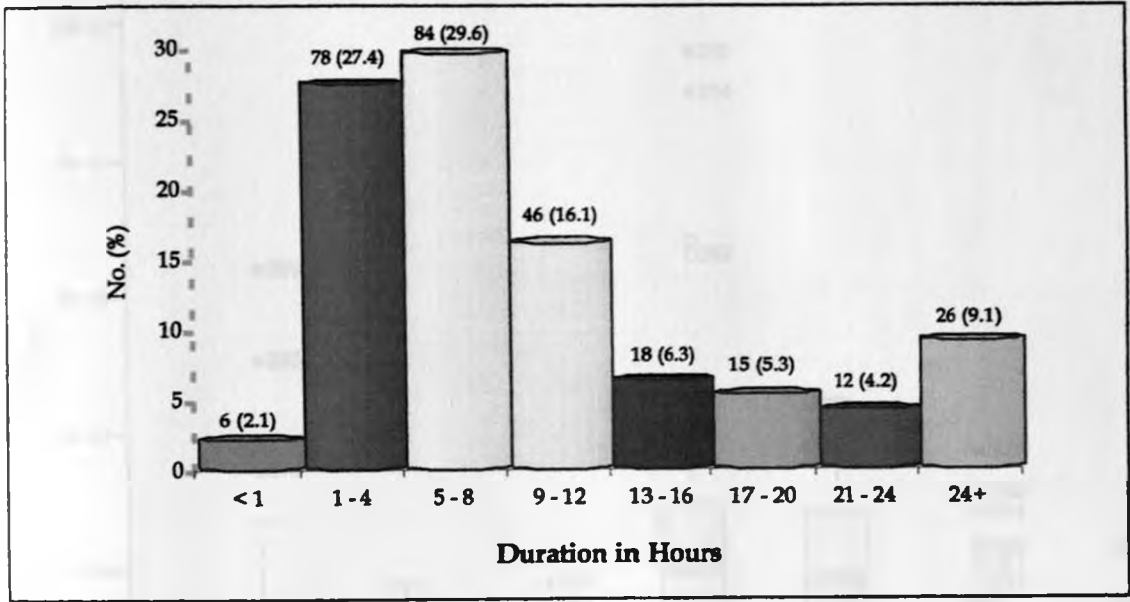


Figure 2: Distribution by Department (n = 285)



The department with most cases was orthopedics (34.7%). Other patients seen were general surgery (16.1%) ENT (13.7%), Gynecology (13%), Neurosurgery (13%), ophthalmology (4.9%), and pediatrics (4.6%), in descending order.

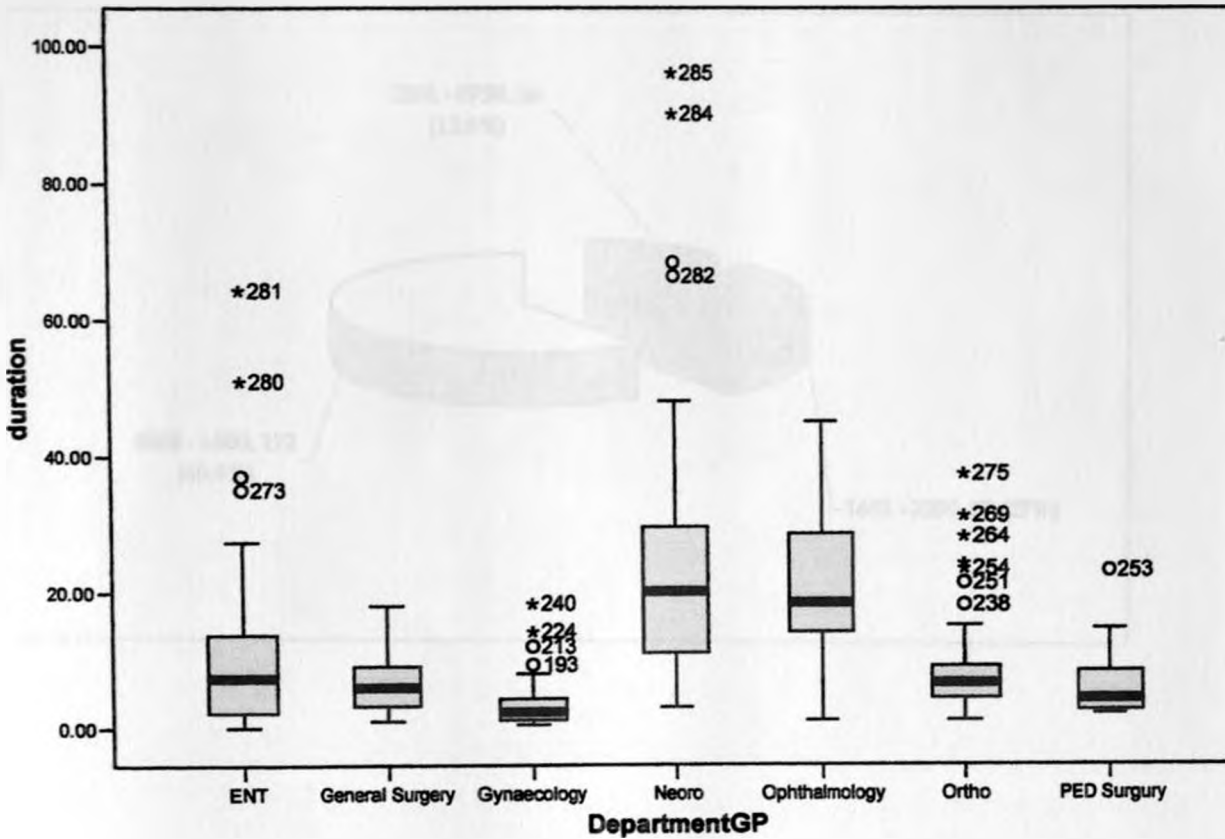
Figure 3: Distribution by waiting time in Hours (n = 285)



The overall mean waiting time for emergency surgery between theatre notification and actual surgery was 10.59 hrs with a range of 6 minutes to 96 hours. Median for all patients was 7 hrs.

About 60% of patients waited less than 8 hours before emergency surgery.

Figure 4: Distribution of Mean waiting time in Hours by Department (n = 285)

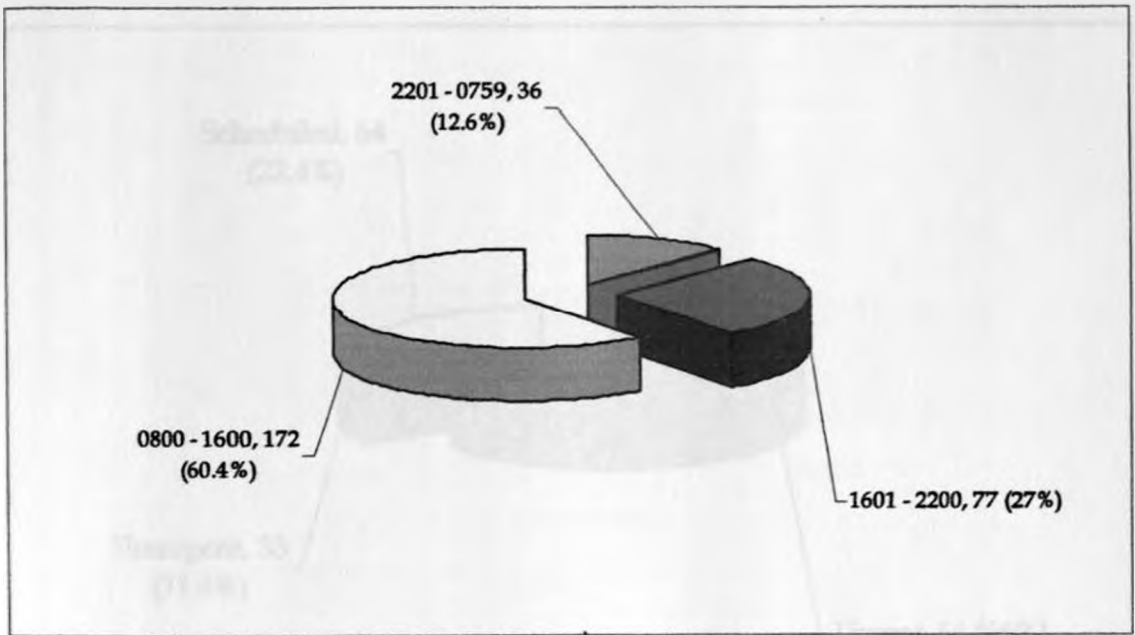


The box plot illustrates the mean waiting times that patients in each department are subjected to.

Gynecological emergencies have the shortest mean waiting time of 3.81hrs while neurosurgical emergencies experienced the longest mean waiting time of 25.46 hrs.

Other were pediatric surgery with mean waiting time of 6.64 hrs, general surgery, 6.99hrs; orthopedic surgery, 7.71hrs; ENT surgery 12.18hrs; ophthalmology, 20.62hrs.

Figure 5: Distribution of surgery over 24 hours (n=285)

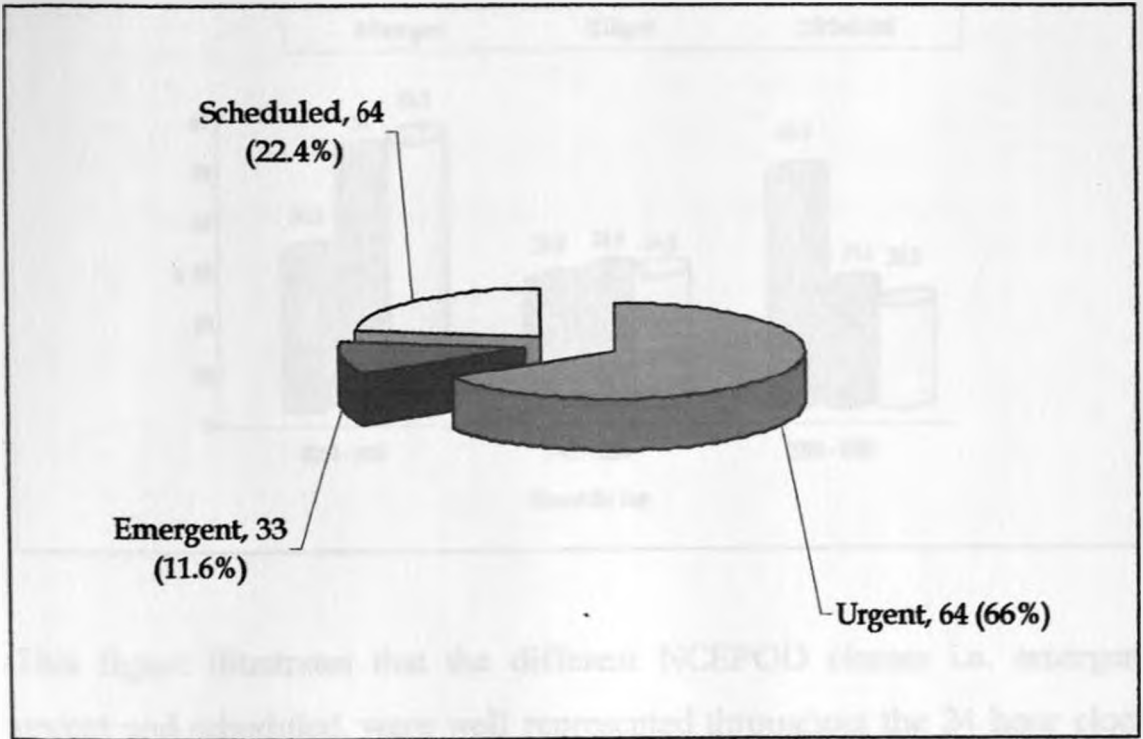


The pie chart illustrates that majority (60.4 %) of the patients were operated on between 0800 and 1600 hrs.

27% had surgery between 1601 and 2200 hours representing 77 out of 285 patients.

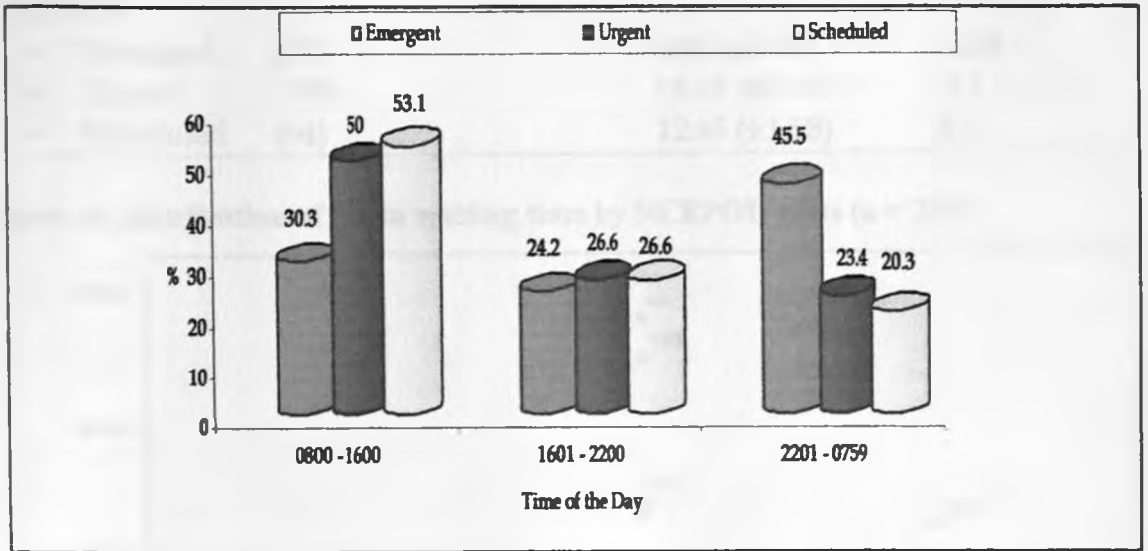
12.6% (36 patients) had surgery done between 2201 and 0759 hours.

Figure 6: Distribution of patients by NCEPOD classification (n = 285)



Urgent cases represented 66% of the emergency operations whereas 22.4% and 11.6% were accounted for by scheduled and emergent cases respectively.

Figure 7: Comparison of NCEPOD class vs. time of operation on 24 hr clock



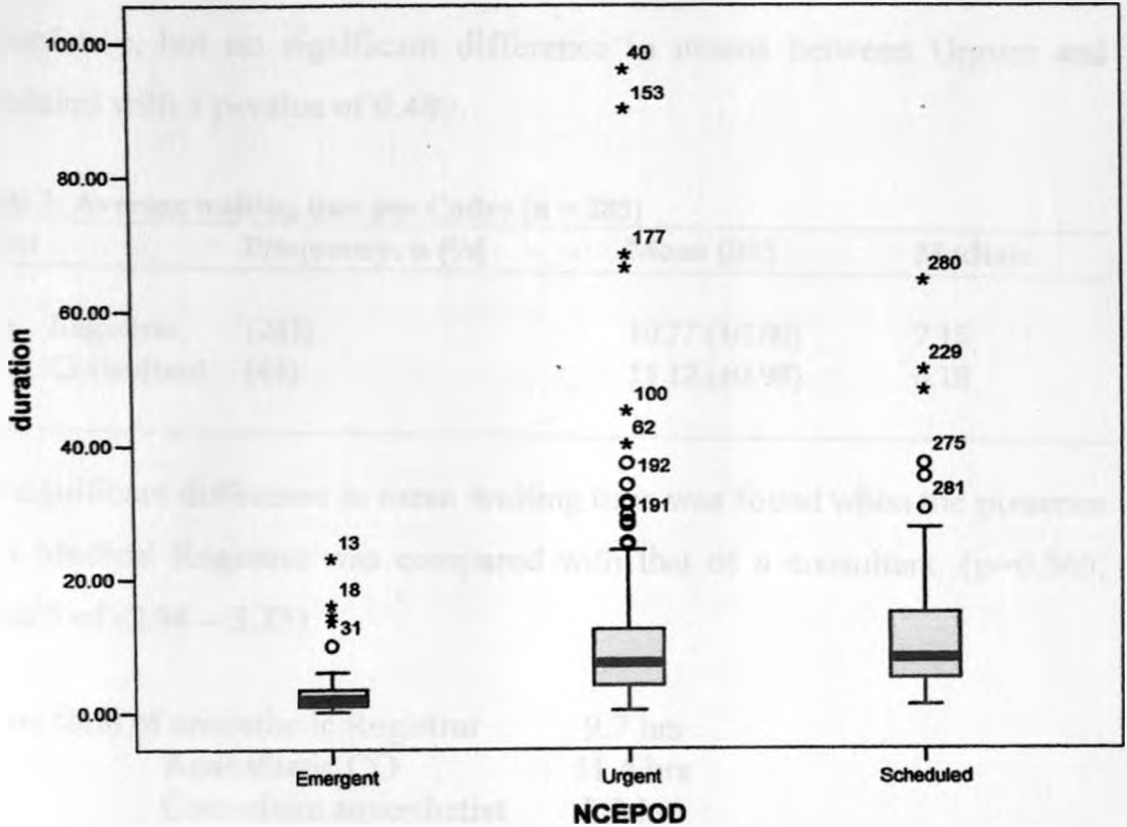
This figure illustrates that the different NCEPOD classes i.e. emergent, urgent and scheduled, were well represented throughout the 24 hour clock. However, emergent cases predominated between 2201 and 0759 whereas scheduled cases were more between 0800 and 1600 when compared with other classes.

No statistically significant difference exists between NCEPOD class and time zones of operation (P-value = 0.064). However, this finding is important because it is contrary to the standards of best practice guidelines as outlined by NCEPOD¹ (See discussion).

Table 1: Average waiting time for each NCEPOD class (n = 285)

Factor	Frequency, n	Mean (SE)	Median
NCEPOD			
• Emergent	(33)	3.98 (±0.93)	2.00
• Urgent	(188)	11.12 (±0.98)	7.3
• Scheduled	(64)	12.45 (±1.58)	8.0

Figure 8: Distribution of Mean waiting time by NCEPOD class (n = 285)



P-value = 0.005, there is a significant difference in mean waiting time between the NCEPOD classes with a p-value of less than 0.05.

Table 2: Association between the NCEPOD class vs. waiting time in Hours (n = 285)

Factor	Mean difference	95%CI	P-value
Emergent vs. Urgent	7.14	2.44 - 11.84	0.003
Emergent vs. Scheduled	8.47	3.90 - 13.04	<0.001
Urgent vs. Scheduled	1.33	-5.12- 2.45	0.489

There was a significant difference in mean waiting time between Urgent and Emergent, Emergent and Scheduled with p-values of 0.003 and 0.001 respectively, but no significant difference in means between Urgent and scheduled with a p-value of 0.489.

Table 3: Average waiting time per Cadre (n = 285)

Factor	Frequency, n (%)	Mean (SE)	Median
• Registrar	(241)	10.77 (\pm 0.80)	7.15
• Consultant	(44)	11.12 (\pm 0.98)	5.18

No significant difference in mean waiting time was found when the presence of a Medical Registrar was compared with that of a consultant. (p=0.569, 95%CI of -2.94 – 5.35).

Mean time of anaesthetic Registrar	9.7 hrs
Anaesthetic CO	11.4 hrs
Consultant anaesthetist	7.3 hrs

There was no significant difference in mean waiting time across anaesthetic cadres. (P-value = 0.268). It was therefore interpreted that anaesthetists in KNH may not have as significant an influence on the timing of emergency surgery as previously thought.

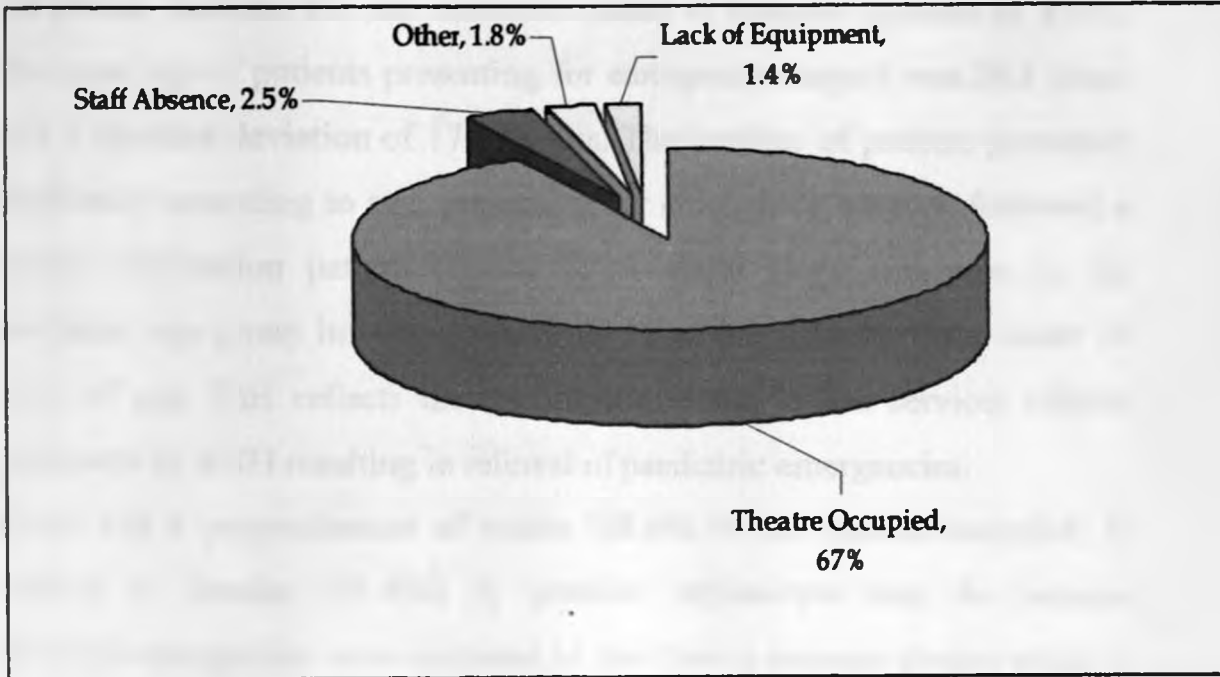
Table 4: Association between the Time of the Day operation begins vs. waiting time in Hours (n = 285)

Factor	Mean difference	95%CI	P-value
0800-1600 vs. 1601-2200	3.8	0.5 - 7.2	0.024
0800-1600 vs. 2200-0759	5.5	2.1 - 8.8	0.002
2200-0759 vs. 1601-2200	1.6	-6.5 - 3.2	0.512

Time zone	Mean time
0800 – 1600hrs	8.2 hrs
1601 – 2200hrs	12.0 hrs
2201 – 0759hrs	13.7 hrs

There were significant differences in mean waiting time between daytime operations and after-hours operations. Patients operated on during the day waited less than those operated on at night. (P-value = 0.007).

Figure 9: Reasons for Delay (n = 285)



About 71.7 % of participants were subjected to waiting times over 4 hours. The pie chart indicates that the most important cause of delay was due to occupation of theatre by another emergency (67% of participants). Staff absence and Lack of equipment were responsible for delay in 2.5% and 1.4% of participants respectively. Other causes (1.8%) included fatigue, patient waiting for anaesthetic review due to electrolyte imbalance among other miscellaneous causes.

7.0 DISCUSSION

The results indicate the non selective nature of hospital patients in KNH. The mean age of patients presenting for emergency surgery was 36.1 years with a standard deviation of 17.08 years. The number of patients presented graphically according to age, presenting for emergency surgery, followed a normal distribution pattern (figure 1). A slight skew was seen in the paediatric age group however, where 20 % of the patients were under 10 years of age. This reflects the exclusive and specialised services offered regionally by KNH resulting in referral of paediatric emergencies.

There was a preponderance of males (65.6% of the patients sampled) in relation to females (34.4%). A possible explanation may be because obstetric emergencies were excluded as they have a separate theatre which is not part of the main theatre suite.

The mean waiting time for emergency surgery in KNH is 10.5 hours.

Neurosurgery department experienced the most delay with a mean time of 25.46 hrs followed by ophthalmology with 20.62 hrs. Theatre Mortality statistics for the period January 2007 to June 2007 indicate that emergency neurosurgical procedures were the most common cause of mortality²³. This was attributed to the delays associated with CT scanning of the head, waiting for neurosurgical review and theatre delay after the theatre list had been prepared. This study reinforces these findings. The best department was gynaecology and paediatric surgery with mean waiting times of 3.8 and 6.64 hrs respectively. Emergency gynaecological surgery was predominantly due to ectopic pregnancy. The median waiting time for ENT surgery was 2.3 hrs however, indicating the presence of outliers which have skewed the

mean (12.18 hrs). This is attributed to scheduled procedures which include nasogastric tube insertion for malignancies etc.

Figure 3 also illustrates that about half of the patients waited less than 8 hours for emergency surgery with the largest group waiting for between 5 to 8 hours.

Table 1 indicates that emergent cases (33 in total) had an average waiting time of 3.98 hrs, with 11.2 and 12.45 hrs for urgent and scheduled cases respectively. This shows that emergent cases are recognised and concerted efforts should be made to bring down this waiting time further.

The difference in mean waiting times between urgent and scheduled surgery was not statistically significant (table 2). This illustrates failure to recognise the difference between these two NCEPOD classes in KNH which would potentially adversely impact morbidity and mortality. It is therefore evident that theatre allocation and prioritisation is not a simple matter and a senior anaesthetist should be involved in the process as well as further training of staff and adoption of protocols as outlined by NCEPOD¹.

Figure 5 illustrates that 60 % of surgery is done between 0800 and 1600 hrs, 27 % between 1601 and 2200 hrs and 12.6 % between 2201 and 0759 hrs.

According to NCEPOD 60 % or more of emergency cases should be done between 0800 to 1800 hrs. This criterion has been fulfilled in KNH according to this study.

However, 12.6 % of emergencies were done between 2201 and 0759 while NCEPOD recommends that 5 % or fewer emergency cases should be done between 2400 to 0800 hrs. Furthermore 100 % of cases done after 2400 hrs should be classified as emergent according to NCEPOD. Figure 7 illustrates that 45.5% of cases done after 2200 hrs were emergent and that there was no

statistical significance between the time of day surgery was done and the NCEPOD class.

Since KNH has 2 dedicated emergency theatres, these findings compare well with those of Calder, F. et al (1998)¹² who studied the effect of introducing a dedicated 24-hour emergency theatre facility on operating patterns in a 500-bed district general hospital. The total amount of emergency general surgery performed after 2200 hours was reduced to 13.1%, (12.6% in KNH) with a concomitant increase in emergency day-time operating to 51.2 %.(60% in KNH)

About 70 % of emergencies were delayed (waited more than 4 hours before surgery). Most of these were due lack of theatre space (67%). Staff absence and lack of equipment accounted for 2.5 and 1.4 % of cases respectively.

(See Figure 8) This compares favourably to the study by Jawaid, M. et al. (2005)⁸ which involved 45 patients and found that 73.3% were subjected to a delay of more than 3 hours.

Reasons for delay varied widely in different studies. 'Occupation of theatre by another case', the main cause of delay in KNH, accounted for only 15.1 % of delays in the study conducted in a tertiary care hospital in Pakistan by Jawaid, M. et al.⁸ The commonest cause of delay in this study was due to "late night admissions" (21.2%) followed by non availability of cross matched blood (18 %). In a similar study by Jonnalagadda (2005)²⁰ only 3% of cases experienced delay due to occupation of theatre by another emergency. The major cause of delay in this study was late arrival of the patient from the ward (17% of patients). A possible reason why KNH experienced greater delay due to theatre occupation by another emergency compared to other institutions may be due to the large volume of emergency

patients either referred or presenting in casualty as emergencies thereby exceeding the capacity. In addition all the different departments in KNH share the same theatre facilities as opposed to other tertiary centres where some hospitals catered for a particular speciality. In some multidisciplinary hospitals, specialised theatres run by specific departments were available.

The orthopaedic department performed well in terms of mean waiting time because of a dedicated emergency theatre during daytime hours and also had the larger share emergency patients (34.7 %) followed by general surgery with 16.1%. This is a pointer to the huge backlog of orthopaedic cases pending in the ward necessitating the establishment of a dedicated daytime emergency theatre. However many orthopaedic scheduled cases that had waited in the ward for several days took precedence over other urgent cases with a higher NCEPOD priority. Neurosurgical and ophthalmologic cases that were hard pressed to get theatre space are a case in point. These cases were largely done outside the normal working hours and experienced undue delay as a consequence. Failure to acknowledge or expedite neurosurgical and ophthalmologic emergencies was a major finding in this study. Other causes of delay occurred outside theatre for example some patients waited for grouped blood and investigations (e.g. CT scan) but most of these occurred outside theatre and rarely contributed to delay once the theatre list was in theatre.

A comparative follow up study done by Jawaid, M.etal.⁹ after implementation of improvement guidelines showed a reduction in the number of patients who experienced more than 3 hours delay in emergency surgery. 73% of patients experienced delay in the initial study which was reduced to 43.5% in the subsequent study.

8.0 CONCLUSIONS

- 1. The mean waiting time in KNH for all emergencies was 10.5 hrs with about 71% of patients experiencing delay of more than 4 hours before onset of surgery. An improvement in the process leading to emergency surgery is desirable and possible.**
- 2. The main reason for delay was due to occupation of theatre in contradistinction to similar studies done elsewhere. This is an indication of the large workload and hence shortage of theatre space.**
- 3. There is a deficiency in prioritization and allocation of the different NCEPOD classes of emergency cases in KNH. This is evidenced by the inability to differentiate between scheduled and urgent surgeries in terms of mean waiting time. Lack of a theatre protocol to classify patients is a contributor to this error.**
- 4. All emergency classes were operated on at all times of the day contrary to best practice standards as outlined by NCEPOD which states that 100% of cases after midnight should be emergent or urgent. However, KNH fulfilled the requirement that 60% of emergencies be done during daylight hrs.**

9.0 RECOMMENDATIONS

1. Objective prioritization of emergency cases following set guidelines is required in KNH to replace the current system.
2. The NCEPOD classification which helps to consider the consequences of a delay between the decision that an operation is required and surgery taking place should be applied to patients before theatre allocation in KNH.
3. The consultant anaesthetist in charge of theatre should be actively involved in assigning theatre space because from this study urgent and scheduled cases were not differentiated. He should always be available to improve theatre allocation of emergencies.
4. It is clear that more emergency theatres are needed in KNH because the most common cause of delay was due to occupation of theatre by another case. In addition, concerted attempts to improve theatre efficiency should be made
5. Orthopaedic surgery should run its own independent trauma theatre which will decongest the 2 main theatres for handling of other emergencies. This is occasioned by the large volume of patients from this department.
The other elective theatres will also experience fewer disruptions due to dire emergencies since an extra theatre will be available.
6. Acute surgical emergencies should be relocated for similar reasons. Patients with minor ailments e.g. abscesses would be operated on at the point of admission in a theatre run by the general surgeons.

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7. 100% of patients operated after 2400 hrs should be classified as emergent according to NCEPOD and a senior anaesthetist should be informed, consulted, or be present.

8. Follow up studies need to be done on the process of emergency surgery in KNH after implementation of the above measures in order to monitor progress, search for new areas of improvement, and increase staff morale.

10.0 STUDY LIMITATIONS

1. Determining adequacy and quality of staff in theatre as the cause of delay was complicated by the nature of the proposed operation and type of theatre staffing records kept.
2. Fatigue as a cause of delay was difficult to determine objectively since it is confounded by other factors such as staff motivation.
3. Few studies have addressed perioperative organizational problems leading to delayed surgery.
4. Some aspects of theatre efficiency, including patient turnaround time and duration of anaesthetic and surgical procedures, which would impact on delays were beyond the scope of this study.
5. Many important causes of delay originate outside theatres which was not the primary focus of this study and whose analysis would require a more resourced study.

This study therefore concentrated on the time profiles and multidisciplinary interaction between theatre notification of an emergency and the beginning of the designated emergency surgery or procedure.

APPENDIX 1: DATA COLLECTION TOOL

1. Patient initials	
2. Study number	
3. Age	
4. Sex	
5. Diagnosis	
6. Operation	
7. Arrival in casualty (time)	
8. Arrival in ward (time)	
9. Time list received	
10. Time operation began (fill time in corresponding time zone)	<p>a. 0800 to 1600 hrs</p> <p>b. 1601 to 2200 hrs</p> <p>c. 2201 to 0759 hrs</p>
11. Patient arrival to start of surgery (duration in hours) (7 to10)	
12. Time list received to start of surgery(duration in hours) (9 to 10)	
13. NCEPOD class (tick one)	<p>a. emergent</p> <p>b. urgent</p> <p>c. scheduled</p> <p>d. elective</p>
14. ASA classification (tick one)	<p>a. 1</p> <p>b. 2</p> <p>c. 3</p> <p>d. 4</p>
15. Anaesthetist's cadre (tick)	

	a. Anaesthetic registrar b. anaesthetist CO c. Consultant anaesthetist
16. Surgeon's cadre(tick)	a. Surgical registrar b. Consultant Surgeon

REASON FOR DELAY (Tick as appropriate)

A. STAFF ABSENCE/ SHORTAGE	B.ORGANISATIONAL DELAYS
Anaesthetist	Theatre occupied
Surgeon	Lack of equipment
Other (specify)	Other(specify)

APPENDIX 11: EXPLANATION AND CONSENT FOR ANAESTHETIST IN CHARGE.

My name is Dr Kevin Arunga, a postgraduate student in Anaesthesiology at the University of Nairobi. I am carrying out the following observational study on the operative processes in emergency surgery at the Kenyatta National Hospital.

Study and purpose

The study aims to identify the duration of time patients wait for emergency surgery in KNH, at what time of the day the operations are done and by whom.

The data obtained will be correlated with other studies done elsewhere.

The purpose of the study is to assess the quality of care provided in this institution and to assist in improving standards of care for the benefit of Kenyans at large.

The study will in no way interfere with laid down operating procedures in the hospital and will be purely observational in nature.

Confidentiality

The data obtained was treated with confidentiality and the identity of all participants was protected. No reference was be made to individuals during presentation of the data or in the data collection tool.

The cadres of the anaesthetist in charge and the surgeon was recorded for statistical comparison only and not as a staff appraisal exercise.

Participation was on a voluntary basis

Consent for study

I (Participant), do hereby consent to participate in this study of timing of emergency surgery in KNH, the nature of which has been fully explained to me.

Signature

Date.....

I confirm that I have explained to the anaesthetist the nature of this study

Signature

Date

APPENDIX 111: TIME FRAME OF STUDY

ITEM	YEAR 2007/2008											
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Problem identification	x	x										
Proposal writing			X	X	x							
Submission to ethics committee							x	x				
Data collection									X	x	X	
Data analysis												x
Submission of thesis												x



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24th January 2008

Ref: KNH-ERC/ 01/ 74

Dr. Kevin Otieno Arunga
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Otieno

RESEARCH PROPOSAL: "TIMING OF EMERGENCY SURGERY IN KENYATTA N. HOSPITAL"
(P299/10/2007)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** your above cited research proposal for the period 24th January 2008 – 23rd January 2009.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimen must also be obtained from KNH-ERC for each batch.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely

PROF A N GUANTAI
SECRETARY, KNH-ERC

c.c. Prof. K.M.Bhatt, Chairperson, KNH-ERC
The Deputy Director CS, KNH
The Dean, School of Medicine, UON
The Chairman, Dept. of Surgery, UON
Supervisors: Dr. P. Otieno Ragot Olang, Dept. of Surgery, UON
Dr. Gathukia Kinyua, KNH