Dissertation in Part Fulfillment of Requirements

for the Award of the Degree of MMed (Anaesthesia) University of

Nairobi.

Title:

An Analysis of admission patterns into the Intensive Care Unit

at the Kenyatta National Hospital over a ten-year period

(1992- 2002).

Principal investigator: Gathuya Z. N. MBChB (Nrb)

Supervisor: Dr. Kahuho S. K

MBChB (Nrb),FFARCS (Irel),D. A. (Lond)

Senior Lecturer

Department of Surgery (Anaesthesia)

University of Nairobi

DECLARATION

I hereby certify that this is my original work and has not been submitted in any other institution.

Signed ---2- GATHUYA------------------------

Gathuya Z. N. MBChB (Nrb)

Date _3ʳᵈ APRIL 2003_

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

Signed ---

Dr. Kahuho MBChB (Nrb),FFARCS (Irel),D. A. (Lond)

Senior Lecturer

Department of Surgery (Anaesthesia)

University of Nairobi

DEDICATION

This work is dedicated to my daughter Chebet who was very close to me all the time I did this work and whose presence makes a very big difference in my life.

ACKNOWLEDGEMENTS

Special acknowledgment to my supervisor Dr. S.K. Kahuho for all his input and without whose apt guidance this work would not have been completed on time.

To Dr. Joel R. K. Lessan without whose support I would not have completed this work and the program in general.

To Jack Hungu whose technical and moral support Iam not able to ever repay.

To Prof Zipporah Ngumi with whom I share a name and who has been my mentor in this course.

To Prof Karega Mutahi who constantly urged me to keep up the pace even when the going was very tough.

To my entire family for standing by me during the difficult times in the programme and especially for understanding when I could not be with them during the programme.

To all those, who in a way or another, contributed to the completion of this work and the program in general I'm very grateful.

ABBREVIATIONS

ICU	Intensive care unit
ICNARC	Intensive care national audit & research centre
ICM	ICNARC coding method
ABGAs	Arterial Blood Gas Analysis
JCAHO	Joint Commission for the accreditation of Healthcare Organisations
TISS	Therapeutic Intervention Scoring System
APACHE	Acute Physiology and Chronic Health Evaluation
SAPS	Simplified Acute Physiology score
KNH	Kenyatta National Hospital
HDU	High Dependency Unit
CPAP	Continuous Positive Airway Pressure
BP	Blood Pressure
CVP	Central Venous Pressure
TPN	Total Parenteral Nutrition
IVF	Intravenous Fluids
SMR	Standardised Mortality Ratio

TOPIC

An Analysis of admission patterns into the Intensive Care Unit at the Kenyatta National Hospital over a ten-year period (1992- 2002).

Table of contents

INTRODUCTION

An analysis of all Intensive Care admissions is important for any unit as it guides and objectively determines the workings of the unit. A method for classifying the reason for admission into Intensive Care needs to be developed empirically from qualitative data. The method used here, of using a database of text description of reasons for admission ensures that all common conditions are included.

By collecting data on reasons for admission down to the condition level using a standard, detailed, hierarchical method, the number of uses of this data is enhanced. Any one of the thus identified conditions however common, or rare, can be studied.

The ICM combines a high level of detail about individual reasons for admission with a standardised and reproducible method to coalesce rare reasons of admissions into groups of sufficient sizes for statistical analysis.[1]

In this study the aim was to code using the ICM the admission into our intensive care unit. By supplementing the reason for admission with the socio-demographic and outcome data as was done in this study, important descriptive information was obtained. The additional data allowed further options for grouping, for example grouping by sex, ventilation and nutritional status at admission, source and outcome of the admission.

To achieve this goal a total of 790 patients were calculated as the minimum sample size that would be relevant. A total of 1064 randomly selected patients admitted into the Intensive Care Unit during the study period (Jun1992- Jun 2002) were studied.

SUMMARY

Kenyatta National Hospital is a 2000-bed capacity hospital that serves as the Kenyan National Referral Hospital and also receives referrals from within the East African region.

The study concentrates on the coding of reasons for all the admitted cases despite their admission physiological scores and goes ahead and evaluates them as the objectives. It does not delve into the criteria and scoring systems of admission to ICU. A systematic method of recording the reasons for admission to the ICU is central to the analysis, interpretation and comparison of mortality and morbidity data collected in different units. This thus serves as an audit of how the KNH ICU is doing in comparison to others.[1]

The method developed and tested by the ICNARC aimed at coding the reasons of admission into the ICU/HDU, the primary requirement being that it added explanatory power when attempting to estimate the probability of hospital death after discharge from the ICU/HDU.

The ICNARC method used in this study was able to code for all randomly selected patients up to 5 tiers.

LITERATURE REVIEW

Introduction

Critical care medicine evolved as a distinct speciality from a combination of events. The first one was that critically ill patients were sequestrated in a hospital area that facilitated closer observation. Secondly, striking medical and nursing advances made available life-saving, diagnostic and therapeutic interventions, which required uniquely skilful intra-operative and post-operative care.

Critical care medicine has always been an integral part of the practice of anaesthesiology.[2] Critical care medicine evolves daily. It involves rapid alterations in physiologic status that require rapid recognition and early intervention and this is the hallmark of critical care.

Intensive Care Units are the hospitals' facility within which the highest level of continuous patient care and treatment is provided.[3] Intensive Care Units have been in existence for a long time.[4,5] The predecessor of the modern ICU is the postoperative recovery rooms. In 1923, W. E Dandy helped create the first American ICU for postoperative recovery of neurosurgical patients.

Respiratory ICU originated from the successful use of positive-pressure ventilation to treat respiratory failure due to poliomyelitis in Copenhagen in 1952. Similar improvements occurred in the outcome of patients with severe closed chest injuries; mortality decreased from 76% to 16% in patients treated in Edinburgh between 1955 and 1965 as a result of both positive-pressure ventilation, and the opening of an assisted ventilation unit, an innovation mirrored across the world in the 1950s and 60s.

Interdisciplinary ICU's have both patient care and economic advantages over carefully selected departmental or specialty organ-oriented units[6] The number of Intensive Care Units beds required for an institution varies between 3% and 25% of the total hospital beds with an average of 12% for major adult and general hospitals.[7]

KNH ICU: Historical Background.

The physical building was put up between 1970 and 1972. In 1972, the first batch of patients was transferred from the Infectious Diseases' Hospital (IDH) from its polio unit. It was an 11 bed capacity unit. The unit mainly admitted patients with laryngotracheobronchitis who were mainly children and at that time there were ventilators. Later patients with tetanus were admitted into the unit and now ventilators were available for these patients. Volume-generating ventilators were then introduced in the unit.

The ratio of nurses to patients was 1 to 3.

In the 1980s the ratio of nurses to patients was improved to 1 to 2. There were more ventilators and the scope of patients admitted grew to include; flail chest, road traffic accident victims with head injury, Guillan Barre' Syndrome among others.

The Government of Japan, who had played a significant role in the establishment and running of the ICU, handed over the ICU to the Government of Kenya.

By the early 1990s the unit had grown and the nurse: patient ratio improved to 1:1. A high dependence Unit was established in 1999 with an 8bed capacity to help relieve pressure on the ICU. This unit has a ratio of nurses to patients of 1:2.

Standard of care

Standard or quality of care offered in any ICU is very important. Many factors are driving the development of standards of care. This leads to the quality assurance process recommended be JCAHO that has several steps.[8]

1.   Assign responsibility

2.   Delineate scope of care

3.   Identify important aspects of care

4. Identify indicators

5. Establish thresholds for evaluation

6. Collect and organise data

7. Evaluate care

8. Take actions to solve identified problems

9. Assess actions and document improvement

10. Communicate relevant information to the organisation-wide quality assurance program

Standards include criteria for admission and discharge from the unit,[9] recommendations for services and personnel specific to critical care delivery,[10] laboratory support[11] and nursing care.

Criteria for admission

Because intensive care is very expensive and consumes so many resources, several attempts have been made at getting methods to determine who should be admitted and what the expected outcome will be. Patients admitted to the unit should be those whose lives are in imminent danger but whom it is believed that the immediate risk may be averted by active and often invasive therapeutic efforts. These patients require aggressive therapy for either appropriate management of a diagnosed condition or resuscitation while a definitive diagnosis is made.[3] Patients requiring support of two or more organ systems, and patients with chronic impairment of one or more organ systems who also require support for an acute reversible failure of another organ also require admission to ICU. Early referral is particularly important. If referral is delayed until the patient's life is clearly at risk, the chances of full recovery are reduced.

Rigid rules to cover admission to and discharge from ICU are destined to fail because every case must be assessed on its own merit.

Because admission and discharge criteria vary between units it is important to define characteristics of patients admitted (case mix) in order to assess the effects of the care provided and the outcome achieved.

Limited resources and curtailed reimbursement, coupled with growing questions about efficacy of ICU care have dictated the need for sound, objective measures of the outcome of patient care. The measures for outcome include mortality, length of stay in the ICU, readmission rates, length of survival, cost and quality of life attained at discharge.[13]

Factors such as bed availability and patient age influence ICU admission and clinical practice.

Several severity-scoring systems have been developed in an attempt to provide accurate estimates of patient outcome and reduce subjective implications to well delineated, objective, numeric measures.[14]

The systems so far developed include TISS[15], APACHE I- III[16,17,18], and SAPS.[19]

Respiratory support

Most patients admitted to the ICU require some form of respiratory support. This is usually because of hypoxemia or ventilatory failure or both. The support offered ranges from oxygen therapy by face-mask, through non-invasive techniques such as continuous positive airway pressure, to full ventilatory support with endotracheal intubation.

Ventilatory support

This refers to support with tracheal intubation. Clinical symptoms and signs are generally more useful than ABGAs in deciding the need for intubation. However it is indicated in patients with hypoxaemia on maximum oxygen therapy, hypercapnia with impairment of conscious level, and a falling vital capacity in patients with neuromuscular disorders. The initiation of ventilatory support ameliorates the patient's work of breathing to a considerable extent.[20] The support may be given by either positive or negative pressure ventilators.

Cardiovascular support

Circulatory support is required for hypotension, shock, and to prevent complications in patients at risk of organ failure.

Tissue perfusion may be jeopardised by shock, which is acute circulatory failure with inadequate or inappropriately distributed tissue perfusion resulting in generalised cellular hypoxia. Patients requiring meticulous cardiovascular support either from disease of the myocardium, rhythm or circulation are managed in the intensive care unit in the absence of a coronary care unit.

Circulatory insufficiency

The objective of management is to restore oxygen delivery to the tissues while correcting the underlying cause. Speed is essential. Respiratory support is mandatory. An adequate cardiac output should be maintained and the systemic blood pressure should be sufficient to maintain perfusion of vital organs. This is achieved by preload optimisation and volume replacement. Ionotropic support may also be indicated.

Open-heart surgery

Patients who undergo open-heart surgery and other types of heart surgery and invasive procedures are routinely admitted in the ICU for continued specialised care and observations.

Renal support

Acute renal failure is a clinical syndrome commonly seen in critically ill patients who require intensive care. In many cases the kidney is an innocent bystander affected secondarily by the primary disease process. As patients with acute renal failure usually have multiple organ dysfunctions, they are usually referred to the intensive care rather than to specialised renal units. They are managed in close liaison with renal physicians.

It is important as part of renal support to correct hypoxaemia, optimise cardiovascular function, correct metabolic acidosis, and avoid or use meticulously the nephrotoxic drugs. Renal replacement therapy should be initiated early for patients with an absolute indication.

Neurological support

Acute brain injury and encephalopathy

Patients with neurological conditions are admitted into intensive care units for various reasons ranging from control of airway to control of seizures and intra-cranial pressure. Patients with acute brain injury, regardless of cause, all raise similar intensive care problems. They therefore have similar care though some care may be specific for specific conditions.

The initial evaluation of the patient with head injury can be critical because outcome depends on the accuracy with which the initial assessment is made and recorded.[21,22,23,24]

The number and duration of secondary insults affect outcome. Hypotension, decreased cerebral perfusion, hypoxaemia, and hyperthermia are associated with worse outcome. ICU management aims to reduce secondary insults.

Sedation is required to depress coughing and spontaneous respiratory efforts in response to intubation and ventilation. It depresses the cerebral metabolic rate and may decrease the cerebral oxygen demand.

Patients with severe head injury generally require neuromuscular paralysis for the initial 12-24 hours in the ICU to prevent uncontrolled rises in intra-thoracic and hence intra-cranial pressures.

Spinal cord injury and peripheral neuropathies

When spinal cord is injured, the resulting spinal shock may last from weeks to months and is best managed in the ICU. The important factors in the ICU are the support of ventilation and continued immobilisation of the cord so that further damage is prevented.

The main conditions of peripheral neuropathies for which patients require ICU care are Guillan Barre Syndrome and myasthenia gravis. Most patients in this category are referred to the ICU in respiratory failure or impeding failure for ventilatory support.

Trauma patient support

The outcome of trauma patients in the ICU depends on the extent of injury and how fast they get attention. To avoid missed injuries and to enhance a positive outcome, care should be systematic and goal directed. Injury victims can largely be categorised as:

(1) Those with penetrating injuries,

(2) Those with blunt trauma,

(3) Those with thermal and toxic injuries (burns, inhalational injuries).

These groups are further sub classified into those with potential or known trunkal injuries and those with clearly isolated head injuries or those with clearly isolated extremities injury. An objective assessment of trauma can be based on one of the many scoring systems. The revised coma scale is commonly used as it correlates directly with survival[25]. In the care of the critically injured patients, the role of the ICU includes continuation of resuscitation and evaluation initiated in the emergency department and the operating room. For these patients the initial management is critical and often determines outcome.

As any system of the body may be involved in trauma, management should be optimised as such.

Gastrointestinal system support

In the intensive unit, most patients receive GIT support. This is mainly in terms of nutrition as most of the patients here are not able to feed by themselves. The nutritional support may be enteral, total parenteral or partial parenteral depending on the condition of the patient. They also have to get prophylaxis for gastric erosions and other stress ulcers.

Most of the patients admitted into the ICU for primarily GIT support are mainly due to trauma or surgery of the abdomen. Upper and lower GI bleeding especially when massive may also require ICU care.

Mortality in the ICU

Predicted mortality by diagnosis has been calculated from large databases generated from a range of ICUs. This allows a particular unit to evaluate its performance compared to the reference ICUs by calculating the standardised mortality ratio for each diagnostic group. For example, medical oncology patients' mortality in the ICU is higher than the background mortality in the unit. According to Hulme et al[26] the relative risk of mortality was 2.9 (95% CI 2.3, 3.6).

Case-mix adjusted mortality has been suggested as a method of comparing performance of different ICUs.

DESCRIPTION OF THE ICNARC METHOD

The final hierarchy has five tiers: type, system, site process, and condition.

- Type: is it surgical code or non-surgical

- System: which system of the body is involved

- Site: which anatomical site is involved

- Process: which physiological or pathological process is involved

- Condition: what is the name of the condition

There are 12 possible body systems and 55 pathological or physiological process and these are shown in Table 1

The ICM was developed to code for up to five reasons for admission. These are the primary reason for admission to ICU; the secondary reason for admission to ICU; up to two other conditions relevant to the admission; and a field allowing revision of the primary reason if further information became available after the first 24 hours. As a result, the ICM has to allow coding of conditions that would never be a primary reason for admission to intensive care but might be a secondary reason. A simple example would be a patient admitted after a suicide attempt with paracetamol overdose. The reason for admission is clearly self-poisoning but if the patient took the drugs from depression, this could be coded under psychiatric system.

The ICM also contains a number of minor surgical conditions. These are included to allow coding of the surgical condition when patients are admitted for a complication of surgery or anesthesia.

The ICM was developed to be user friendly. As a result, conditions that affect more than one system are coded under all the relevant systems. This occurs commonly with neurological conditions affecting the respiratory system; for example, a patient with Guillan-Barre syndrome can be coded by two routes:

- Type: non-surgical

- System: Neurological

- Site: Peripheral nervous system

- Process: inflammation

- Condition: Guillan-Barre syndrome

Or

- Type: non-surgical

- System: Respiratory

- Site: Peripheral nervous system causing respiratory failure

- Process: inflammation

- Condition: Guillan-Barre syndrome

This duplication of codes means that there are more final codes than are unique conditions.

If the user has no clear idea of the condition that precipitated admission to ICU, or if the condition that the patient is suffering does not appear in the coding method, the coding can be limited to 'type: system: site' or 'type: system: site: process'. The ICM was designed to be used with a physiological data set, so non-specific syndromes, which are defined by a range of physiological abnormalities are not included as they should be determined objectively from physiological data.[1]

Table 1: Systems & processes involved in ICU patients

System	Code	Process	Code
Respiratory	01	Accidental intoxication / poisoning	01
Cardiovascular	02	Acidaemia	02
Gastrointestinal	03	Affective disorder	03
Neurological	04	Alcohol and drug dependence	04
Trauma	05	Alcohol-related disorders	05
Poisoning	06	Alkalemia	06
Genitourinary	07	Burns/hyperthermia	07
Endocrine/metabolic/thermoregulatory	08	Chromosomal deletion syndromes	08
Haematological	09	Collapse	09
Musculoskeletal	10	Coma/encephalopathy	10
Dermatological	11	Congenital/ acquired deformity	11
Psychiatric	12	Contiguous gene syndromes	12
		Degeneration	13
		Diabetes Mellitus	14
		Dissection or aneurysm	15
		Envenomation	16
		Epidural/ Spinal drug administration	17
		Failure	18
		Fluid Overload	19
		Haemolysis/Thrombocytopaenia	20
		Haemorrhage	21
		Hypercalcemia	22
		Hyperglycemia	23
		Hyperkalemia	24
		Hypernatremia	25
		Hypertension	26
		Hyperthermia	27
		Hypocalcemia	28
		Hypoglycemia	29
		Hypokalemia	30
		Hyponatremia	31
		Hypoplasia/dysplasia	32
		Hypothermia	33
		Inborn errors of metabolism	34
		Infection	35
		Inflammation	36
		Mental Handicap	37
		Neurosis/ personality disorder	38
		Obesity	39
		Obstruction	40
		Obstruction or embolus	41
		Oedema/ inflammation/fibrosis	42
		Overactivity	43
		Schizophrenia	44
		Seizures	45
		Self intoxication/poisoning	46
		Sex chromosome disorder	47
		Shock and hypotension	48
		Starvation	49
		Transplant or related	50
		Trauma	51
		Trisomy	52
		Tumour/ malignancy	53
		Uderactivity	54
		Vascular	55

JUSTIFICATION OF STUDY

In the background of escalating medical costs and devastating poverty in our environment, the medical fraternity is expected to continually provide adequate medical services without compromise on standards and ICUs are not left out in this.

According to a paper by Scase, A et al[27] and presented at the proceedings of the Intensive Care Society and Riverside Group in London, there is no significant difference between matched patients admitted to ICU 5 years apart. This study matched for diagnosis, age and sex for patients admitted 5 years apart.

This means that the data obtained from this study can be used to make predictions about patterns of admission to the ICU and possible outcomes for the future. This will better the unit's preparedness to offer better care to the patients.

Patients requiring intensive care cut across the whole social spectra and whereas others have financial capacity to finance their stay there, others cannot and yet all must be treated alike. It is important therefore, to analyse admissions and see where most of our resources spent and whether the outcomes for these justify the use of such resources in our unit.

Few studies have been done about patterns of ICU admissions in our setup.[28, 29] These have been on criteria for admission. And have not been very comparative to other intensive care units for which a lot of work has been done.

This study will set out to establish the patterns and see whether there are any developing patterns. These would help in better resource allocation and management.

OBJECTIVES

Research Question

How does the Kenyatta National Hospital ICU compare to other ICUs in the developed world in terms of care offered to its patients?

Broad Objective

To analyse the admission patterns into the Kenyatta National Hospital ICU.

Specific Objectives

1. To classify all the patients admitted into the ICU according to the ICNARC coding method.

2. To formulate recommendations based on the findings that will help improve the management and care of patients admitted into the Intensive care Unit at the Kenyatta National Hospital.

MATERIALS AND METHODS

Study design
This was a descriptive study of the cross-sectional design. The data was collected at

one point in time though it covered a 10-year period (Jun 1992- Jun 2002).

Study population
This comprised of critically ill patients admitted into the Intensive Care Unit, the age,

social, economic and demographic details of whom were greatly varied.

Sampling and Sample size
Random sampling was used for all patients admitted into the Unit in the study period

and met the inclusion criteria.

The **sample size** was be determined by the formula $n = \dfrac{Z^2_{1-\alpha/2} * P\,(1-P)}{d^2}$

where   P= Proportion of patients admitted to ICU

Z=Standard Error of the mean corresponding to 95% confidence interval

α= Level of significance at 5%

d= absolute precision taken as 0.05

Thus, $n = \dfrac{1.96^2 * 0.95(1-0.95)}{(0.05)^2}$ =790

A sample size of 790 was the minimum number required for the study though a total

of 1064 patients were entered for the study.

Study Methodology
The study was conducted by the principal investigator under the guidance of a

supervisor from the Department of Anaesthesia in the University of Nairobi.

The data was collected mainly from patients' medical records review. The daily

admissions return records from the unit were also consulted to ensure that legible

entries were not omitted. In addition, the admission record books in the unit were also consulted for completeness of the data.

The principal investigator used a preformed questionnaire (Appendix 1) to study the records, to determine demographic details, date of admission/discharge or death, type of admission, system and anatomical site involved, the initial physiological/pathological process at the time of admission and the final diagnosis.

The collected data was serialised and no names of patients appeared on the data form for confidentiality. The data was kept in custody of the principal investigator until the time of analysis.

To ensure that no data was lost it was entered into the computer as soon as possible. The hard copies were also kept safely until the completion of the study. Where data had to be verified both the data form and the patient's file were revisited to ensure correctness of the data.

The study was concluded with the presentation with the presentation of the obtained information for analysis.

All the files used were handed over to the person assigned those duties in the department.

ETHICAL CONSIDERATIONS

Before the study was commenced, the written approval of the hospital's Ethical & Research Committee was sought and obtained. (Appendix 2)

The written approval from the Committee was presented to the Medical Records Department for the sourcing of the patients' medical records.

The records thus obtained were treated with ultimate confidentiality.

The data forms used did not bear any patient's name but inpatient number and were serialised especially for the study.

ELIGIBILITY

Inclusions

All patients admitted into ICU for more than 12 hours during the entire study period.

Exclusions

If files are missing or case notes incomplete.

STUDY LIMITATIONS

Being a retrospective study, the investigator relied on entries in the patients' records that may not have been standard.

Randomly selecting patients for inclusion into the study may present some bias.

The pathological/ physiological processes of the patients are bound to change in the course of the admission and this study had no allowance to reflect these continuous changes.

Multiple pathological/ physiological processes may be on-going at the same time and some may actually be interrelated. The principal investigator relied on her intuition to get only the most relevant to that particular admission.

Patients readmitted, for the same condition, were treated as separate entities as identifying the readmissions in our setup may be very complex.

DATA MANAGEMENT AND ANALYSIS

All the data collection forms were collected and data fed into the computer using the excel program.

The data was edited and cleaned to ensure that all data forms were included and to ensure that all the forms were filled completely. In the event of some information missing, the principal investigator went back to the Medical Records Department to verify.

At analysis the items in the questionnaire were separated analysed using tally method.

The age groups of 10year interval were set up and all the 1064 patients in the study appropriately classified. Gender separation was also done and presented as results of the study. All patients under one year of age were grouped together.

Different data presentation methods were used for all the study parameters and presented in the results.

RESULTS

A total of 1064 patients admitted into the Kenyatta National Hospital's Intensive Care Unit during the study period were entered.

Using the ICM a total of 222 unique conditions were established. Where a condition could have two codes only one was used so the final codes and unique conditions tallied.

Figure 1
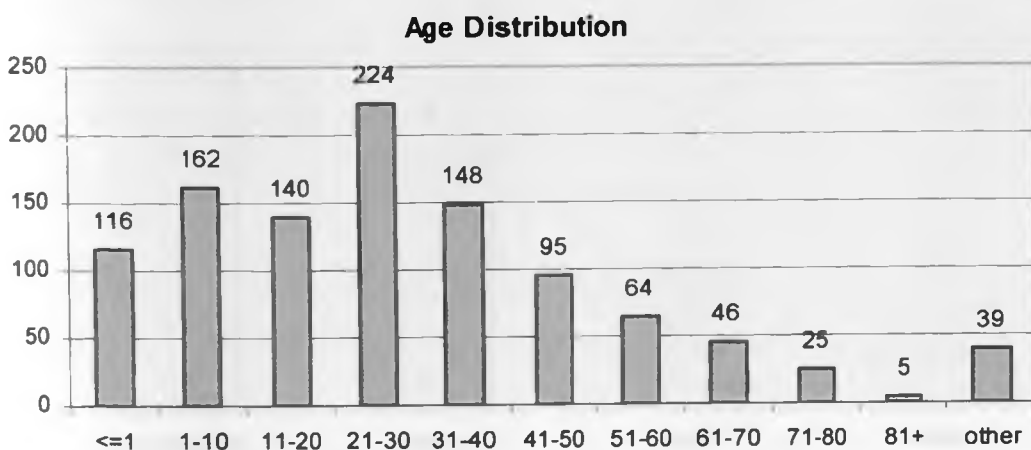
The mean age was 25.8 years with majority being in the 21-30 year range. Elderly patients were the least with only 30 being over 70years.

A category called 'others' accounted for patients who mainly were brought to the ICU as unknown and there was no way of establishing their age.

Mean age for patients from different sources is as follows;

Table 1

Wards	Theatre	Casualty	Other hospitals	Total
20.1	25.8	23.6	32.9	25.8

The average duration of stay for the patients admitted into the ICU was 5.91 days.
The duration of stay average varied greatly depending on the source of patients with
patients from other hospitals averaging 10 days while those from theatre averaged 2.8
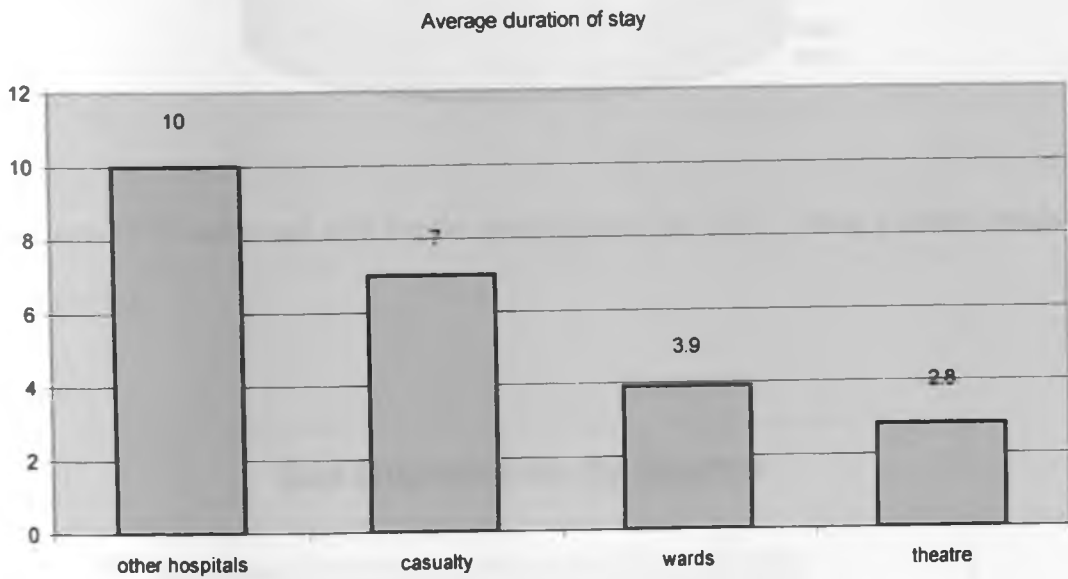days.

Figure 2
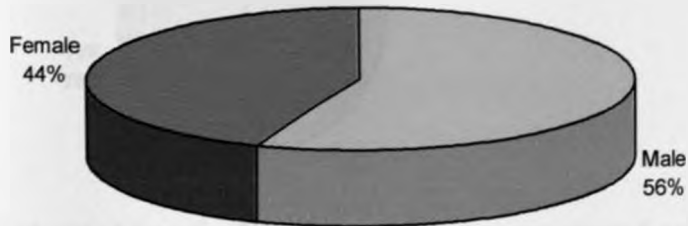
Average duration of stay

Figure 3

Distribution by Sex

There were 596 males and 468 female admitted into the ICU. Giving a male: female ratio of 1: 0.8.

Figure 4
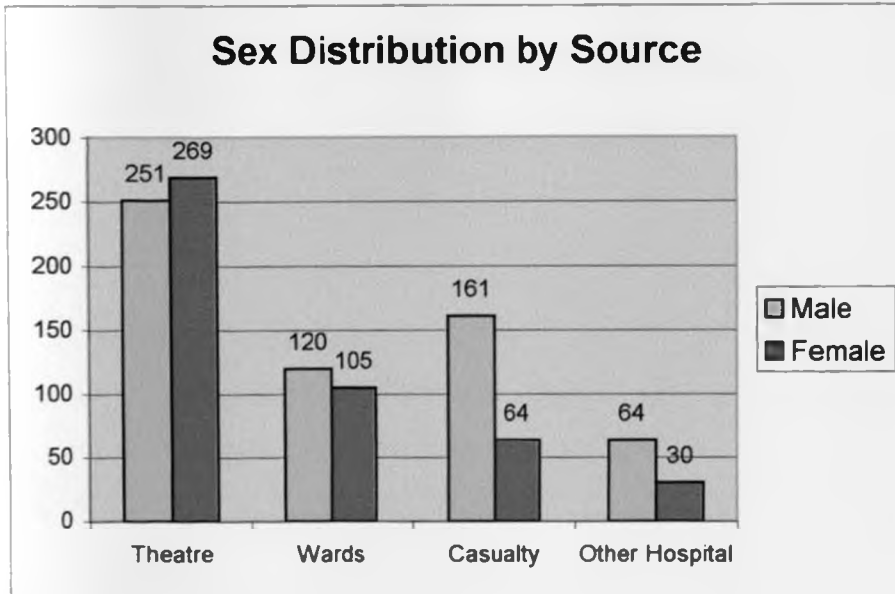
There was marked difference in the sex distribution for patients who came from casualty and also those who came from other hospitals.

Figure 5

Distribution by Nutrition
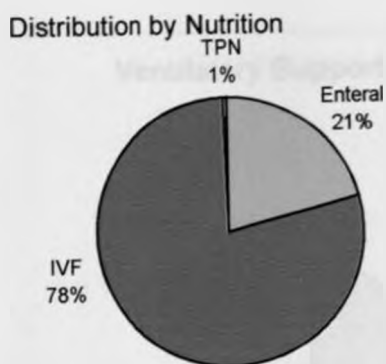
Of the patients admitted into the ICU, 78% of them were started only on intravenous fluids for nutrition. 1% of the admitted patients were put on total parenteral nutrition at admission while the remaining 21% were started on enteral feeds at admission.

Figure 6

Ventilatory Support atadmission

25%

75%

- ☐ yes
- ■ no
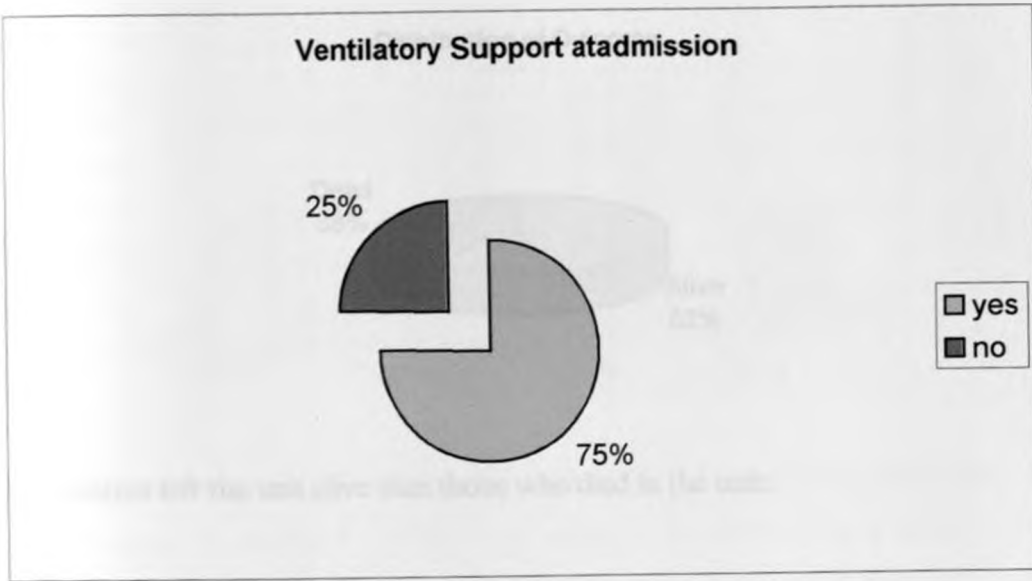
Majority of the patients were on ventilatory support on admission to ICU.

Figure 7

Ventilation at Admission by Source

	Theatre	Casualty	Wards	Other hospitals
no	203	16	5	10
yes	317	209	220	84
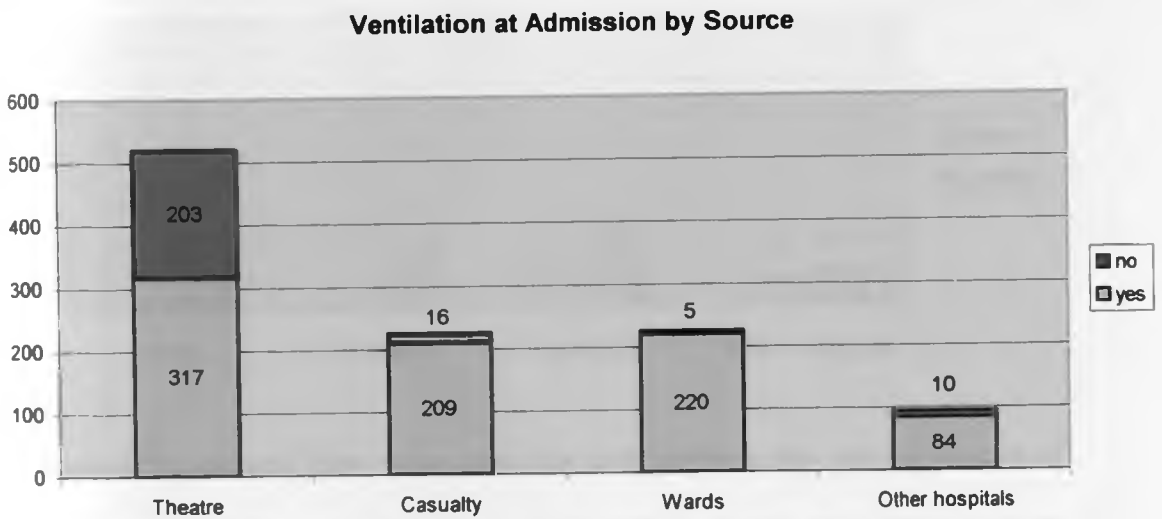
Ventilatory support varied widely depending on where the patients came from. The range was from 98% for patients from the wards to 60% for patients from theatre.

27

Figure 8

Distribution of Outcome

Dead
38%
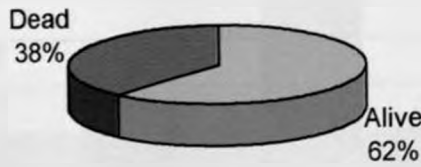
Alive
62%

More patients left the unit alive than those who died in the unit.

Figure 9

Outcome by source
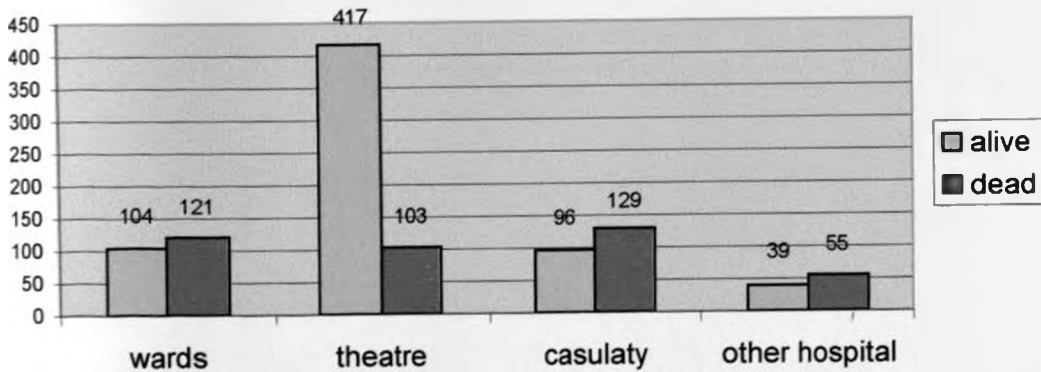
For most of the sources, there were almost as many patients who died in the unit as those who survived. In contrast, patients admitted from theatre were thrice as more likely to leave the unit alive.

Figure 10
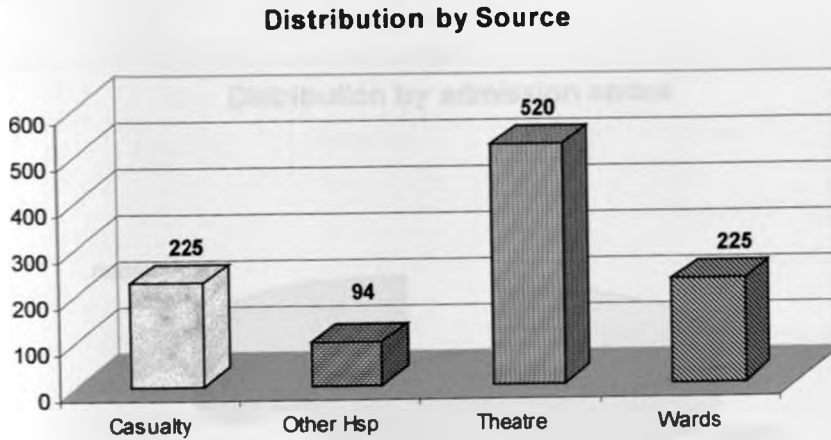
Distribution by Source

Majority of the patients 520 (48.9%) admitted into the ICU were from theatre for various reasons. While only 94 (8.9%) were admitted as transfer in from other hospitals. There were an equal number of patients admitted from the hospital's casualty department and the wards 225 (21.1%).

Figure 11

Distribution by admission codes

nonsugical
33%
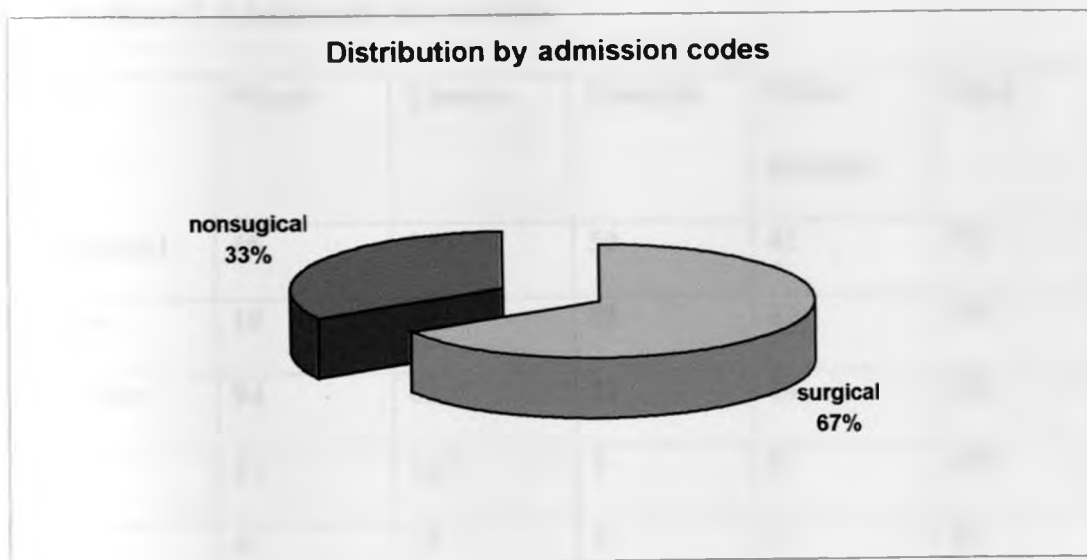
surgical
67%

There were twice as many surgical admissions as were the non-surgical ones

Figure 11

Sex Distribution by Admission code
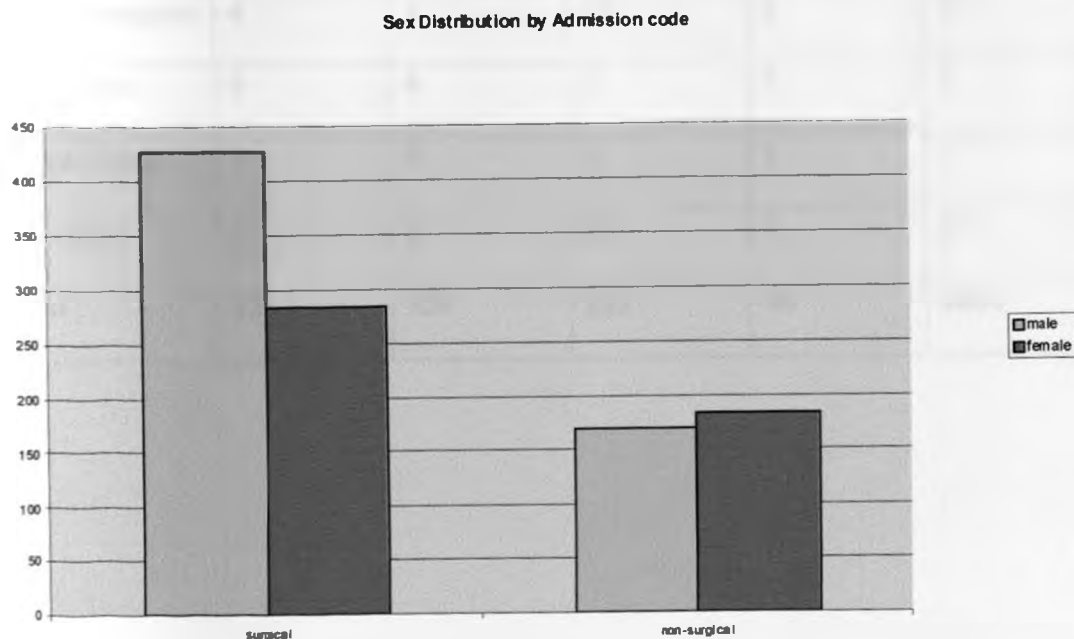
There was almost no difference in sex distribution for patients admitted for non-surgical conditions. On the other hand there were significantly more males admitted under the surgical code than were females.

Table 2

Distribution of Admissions by systems

System	Wards	Theatre	Casualty	Other hospital	Total
Neurological	45	145	50	41	281
Trauma	10	24	85	21	140
Respiratory	94	62	31	14	201
CVS	21	167	9	8	205
GIT	8	75	4	2	89
GUT	23	37	2	4	66
MSS	1	2	0	0	3
Endocrine	9	7	1	0	17
Dermatological	4	1	22	0	27
Psychiatric	0	0	1	0	1
Haematology	5	0	1	1	7
Poisoning	5	0	20	2	27
Total	225	520	225	94	1064

Table 3

The top ten Conditions admitted into the ICU by their ICNARC code and diagnosis.

ICNARC Code	Diagnosis	Number	Percentage
1.5.4.2.1 Count	Traumatic Head injury	150	32.54%
1.4.2.39.1 Count	Brain Tumors	78	16.92%
1.2.4.8.2 Count	Mitral Valve Replacement	56	12.15%
2.1.4.27.1 Count	Pneumonia	41	8.89%
1.11.1.5.1 Count	Burns	25	5.42%
1.3.2.39.1 Count	Cancer of oesophagus	24	5.21%
1.1.1.39.4 Count	Laryngeal papillomas	23	4.99%
2.4.2.7.5 Count	Poor reversal	23	4.99%
2.6.8.34.8 Count	Organophosphate Poisoning	21	4.56%
2.2.5.40.1 Count	Complete heart Blocks	20	4.34%
Total		461	100

The top ten conditions accounted for slightly less than half 43.3% of the total admissions into the ICU.

Advanced Analysis of the Top five Conditions

			Sex Outcome						
			F		F Total	M		M Total	Grand Total
Source	Nutrition	Data	Alive	Dead		Alive	Dead		
Casualty	Enteral	Count of IPNum	1		1	1	2	3	4
		Average of Duration	21.00		21.00	13.00	5.00	7.67	11.00
	IVF	Count of IPNum	13	22	35	34	63	97	132
		Average of Duration	9.54	6.00	7.31	9.79	5.90	7.27	7.28
Casualty Count of IPNum			14	22	36	35	65	100	136
Casualty Average of Duration			10.36	6.00	7.69	9.89	5.88	7.28	7.39
Otherhosp	Enteral	Count of IPNum	3	1	4	6	8	14	18
		Average of Duration	6.67	28.00	12.00	10.17	11.63	11.00	11.22
	IVF	Count of IPNum				2	6	8	8
		Average of Duration				2.50	4.83	4.25	4.25
	TPN	Count of IPNum		1	1		1	1	2
		Average of Duration		12.00	12.00		3.00	3.00	7.50
Otherhosp Count of IPNum			3	2	5	8	15	23	28
Otherhosp Average of Duration			6.67	20.00	12.00	8.25	8.33	8.30	8.96
Theatre	Enteral	Count of IPNum	7	1	8	5		5	13
		Average of Duration	2.14	7.00	2.75	1.60		1.60	2.31
	IVF	Count of IPNum	61	10	71	43	10	53	124
		Average of Duration	3.33	8.30	4.03	3.81	10.40	5.06	4.47
Theatre Count of IPNum			68	11	79	48	10	58	137
Theatre Average of Duration			3.21	8.18	3.90	3.58	10.40	4.76	4.26
Wards	Enteral	Count of IPNum	3	2	5	3	6	9	14
		Average of Duration	12.33	3.00	8.60	9.00	7.50	8.00	8.21
	IVF	Count of IPNum	4	11	15	6	14	20	35
		Average of Duration	9.75	4.82	6.13	7.83	3.57	4.85	5.40
Wards Count of IPNum			7	13	20	9	20	29	49
Wards Average of Duration			10.86	4.54	6.75	8.22	4.75	5.83	6.20
Total Count of IPNum			92	48	140	100	110	210	350
Total Average of Duration			4.99	6.69	5.57	6.58	6.42	6.50	6.13

DISCUSSION

Over the ten-year period Jun 1992- Jun 2002 a total of 1064 patients admitted into the ICU were randomly selected for the study. The Kenyatta National Hospital's ICU is a general critical care area for medical and surgical patients regardless of their age.

ICNARC Coding

This is a method for coding the reason for admission to Intensive Care Units that has been developed empirically from good qualitative data.[1] Other Intensive Care-specific methods have been based on expert opinion. The use of a large database of text descriptions of reasons for admission to develop and test the method ensured that all common conditions were included; this was confirmed by the very high rate of fully coded admissions.

This method is hierarchical with 5 tiers. Many of the Intensive Care-specific coding methods include some element of hierarchical coding. The computerised hierarchical structure developed for the ICM is far more detailed and consistent than previous methods. The ICM presents only relevant choices at each level, so a rapid selection of a single condition from over 700 possible options is possible. Results of independent inter-rater reliability testing[1] suggest that the inter-physician agreement is good. Given the multiple routes to final condition, it means that the level of inter-observer agreement is far better than these figures suggest.

In our study, there were 222 unique conditions admitted into the Intensive Care Unit. It must also be noted that due to observer preference as set out in the original study, conditions that could be coded into two systems only one was used.

This duplication of final codes means that there would have been more final codes but the unique conditions would still be 222.

It was thus possible to get the incidences of each of the unique conditions. This is shown in the results as table 3 with the ICNARC code, the unique condition and incidence.

In the ICM data can be pooled at any level of the hierarchy for example gastrointestinal conditions (body system), gastrointestinal tumours (body system /process) and oesophageal tumours (body system /site / process). By supplementing the reason for admission with the socio-demographic and outcome data as was done in this study, important descriptive information was obtained. The additional data allow further options for grouping, for example grouping by sex as done here or severity of illness for the same condition (not done in this study).

Since ICM was designed for use in conjunction with a physiological data set, non-specific syndromes that are defined by range of physiological abnormalities are not included as they should be determined objectively from physiological data.[1]

Once the coding was completed various analysis could be undertaken. This included analysis for top conditions (Table 3), distribution of admissions by the affected system (Table 2) and even advanced analysis of any category of classification.

Age and Sex Distribution

The mean age was 25.8 years (range 1day to 83years) with majority 224 (21.1%) being in the 21-30 year range. Elderly patients were the least with only 30 (2.8%) being over 70years. There were 116 (10.9%) children under 1year age. It is a significant number of the total patients admitted into the ICU. (Figure 1) Higgins and colleagues[30] found that mortality of children admitted into the adult Intensive Care Unit was less than the predicted mortality. This suggested that an acceptable level of care for children with a low expected mortality is possible in an adult Intensive Care Unit. This seems to justify our continued care of children in an adult Intensive care Unit. However, this contraindicates the recommendation from National Co-ordinating Group on Paediatric Intensive Care Services. They recommend that adult Intensive care Units restrict their paediatric activity to initiation of intensive care before transfer to a paediatric Intensive Care Unit [30]. The number of patients admitted into the ICU decreased steadily after 40 years. (Figure 1)

The mean age also varied depending on the source of the patients. The mean age for patients from the wards was 20.1 years, theatre 25.8 years, casualty 23.6 years and from other hospital was 32.9 years. (Table 1) Odea and colleagues found that the average age for transferred patients was 54.3 slightly less than for the non-transferred patients whose average age was 56.4years.[31]This differs from our study in that the average age of the transferred patients was more than the non-transferred. This may be because our unit presented both adults and paediatrics and theirs only adult. This may also explain why the mean age in our unit is far much less than in their set-up.

A category called 'others' accounted for patients who were mainly brought to the ICU as unknown and there was no way of establishing their age. There were mainly unknown adults with only one person in the group being an unknown child.

There were slightly more males (56%) than were females (44%) admitted into the unit. (Figure 3) with a male: female ratio of 1:2. This differed with another study by Wagner that found a male to female ratio of 2:1.[32] There was a difference in the sex distribution depending on the source of patients. (Figure 4) For patients admitted from the casualty department, there were 161(71.6%) males as opposed to 64(28.4%) females. This may be because there were more men who had traumatic head injuries 121(80.7%) as opposed to the women in the same diagnoses who were 29(19.3%). For the top 5 conditions, on the other conditions the distribution may have been more equal. There were 350 patients (32.8%) of the total 210(60%) were males while 140(40%) were females (Table 3)

Source and Nutrition

Majority of the patients 520 (48.9%) admitted into the ICU were from theatre for various reasons. While only 94 (8.9%) were admitted as transfer in from other hospitals. This corresponds to a study by Hilditch et al, which described demographics and outcome of patients transferred into ICU from other hospitals. They found that 8.7% of all admissions were from other hospitals.[33] There were an equal number of patients admitted from the hospital's casualty department and the wards 225 (21.1%).

Tunnel and colleagues[34] found that of the patients admitted into the intensive care unit, 36.8% of patients were admitted from the operating theatres this is much less than the proportion of patients admitted into our intensive care from the operating theatre (48.9%). They also found, in comparison to our set-up, that the number of patients from accident and emergency department and wards was almost equal (30.3% and 32.9% respectively) though their figures are slightly higher than in our set-up.

It is evident from the data collected that most of the patients admitted into the ICU were only on intravenous fluids at the time of admission. There is need to evaluate this in the unit especially for patients' whose duration of stay is likely to be prolonged so as to start effective nutrition early. Feeding critically ill patients during the gross catabolic phase of their illness should be beneficial.

Nutritional support has become an integral part of the complete care of the hospitalised patient. It is defined as the provision of specialised diets either via the enteral or parenteral routes.

The primary goal of nutritional support in the critically ill patients is to provide usable substrates (proteins, lipids, carbohydrates) vitamins, trace elements, electrolytes to meet energy needs conserve lean body mass and maintain or restore physiologic

haemostasis. Bartlet and colleagues[35] found that cumulative deficit of 10,000kcal equivalent to less than 6 days of starvation for normal adult correlated with increased mortality and frequency of multiorgan failure. Enteral feeding has been described as the method of choice from various studies done.[35]However some patients are known not to be able to tolerate enteral feeds or not take enough by the enteral root and may require parenteral supplementation. Most critically ill patients require both enteral and parenteral nutrition.

Nutritional assessment, including determination of nutrient requirements should be performed before prescribing enteral or parenteral nutrition. In our set up very few patients were started on total parenteral at the time of admission. These were mainly patients transferred from other hospitals. This is also according to evidence in literature that parenteral nutrition is not justified in unselected major surgery.[35]In prescribing feeds for the patients it is also important to take into account their therapies as some of them contain nutrients e.g. Propofol and intravenous fluids and hyper nutrition ensued from non-quantified fluid therapy/drugs. Sodium loads may aggravate lung and gut function. The provision of occult calories and minerals may be quite substantial and should be taken into consideration.[36]

Duration of Stay and Outcome

The average duration of stay for the patients admitted into the ICU was 5.91 days. The duration of stay average varied greatly depending on the source of patients with patients from other hospitals averaging 10 days while those from theatre averaged 2.8days. In a study done in 4 centres in the United Kingdom the average duration of stay in the intensive care ranged from 2.3days in Norwich to 6.4days in Cambridge.[37] Odea and colleagues[31] found that the duration of stay was greatly influenced by source of patients. Patients who were transferred to the intensive care had an average duration of stay of 2.7days as opposed to a similar population of non-transferred patients whose average duration of stay was 1.8days.[31]

The results of critical care are usually discussed in terms of patient survival. Yet survival in itself is a poor indicator of the impact of therapy in some selected disease processes. In our study, the survival rate was 62% with a mortality of 38%. This accounts for deaths that occurred in the unit. It does not reflect patients who may have died soon after discharge from the intensive care unit. The mortality also varied depending on the source of the patients with those from other hospitals leading with mortality of 58.5%. Those from theatre had the least with 19.8%. From casualty was 57.4% while from the wards was 53.8%. The mortality averaged for the intensive care units in Sweden was 20% with a predicted mortality of 27.8%.[38] According to Wagner and colleagues, mortality in critical illness is undoubtedly related to age.[32]They found a mortality of 19% in the elderly and also that both predictive and actual intensive care units mortality in the elderly was much higher than the young. Our unit also had higher mortality than that in Odea's study that showed a mortality of 27% for non-transferred patients.[31]

Admission codes and ventilation at admission

According to this study, there were twice as many surgical admissions as were non-surgical admissions giving a ratio of 2:1. (Figure 10) This is different from a study by Tunnell and colleagues who found that the ratio for surgical: non-surgical admissions was 1: 1.37.[34]

Of the female patients admitted 60% were surgical with the remaining 40% being non-surgical. (Figure 11) The distribution for males was 71.5% surgical and 28.5% non-surgical. Of the surgical patients 47.7% were female while of the non-surgical patients 54% were females. This is different to a study by Lam and Ridley [39] which found 45% of non-surgical patients to be female and 38% of the surgical patients to be female.

The number of patients ventilated at admission in our study was 75%. This is different from Odea's study that found that only 59.4% of the new admissions were ventilated at admission. However in the same study they found that 75.3% of those transferred in from other hospitals were ventilated at admission.[31] in our set-up, those transferred from other hospitals, 90% were ventilated at admission.

CONCLUSION

A lot of data has been achieved by using this coding method, though retrospectively and only randomly applied. There is great potential for the use of this coding method even in our intensive care unit.

The more conditions are coded the better the observers will become. There is need to try in future to code our admissions for easy of use by all those who come after us. The ICM is definitely an easy to use system that can be used.

Our intensive care unit compares considerably to other intensive care units. However some parameters are certainly different probably due to differences in set up. For example, the leading condition for us is Traumatic head injuries while in other places it is usually respiratory or coronary problems.

RECOMMENDATIONS

1. A method for coding for admissions into intensive care unit should be established. The ICM would be a good model.

2. A protocol for commencing feeding of patients in the intensive care should be established with an aim of starting feeding as early as possible.

3. Studies should be undertaken to establish why our mortality is higher than in other units with an aim of bringing it down.

4. Follow-up studies on the various unique conditions especially the top five conditions should be undertaken to try and improve our quality of care for specific conditions.

Appendix

QUESTIONNAIRE

1. Questionnaire number ☐☐☐☐   2. Date __ __/ __ __/ __ __

Demographic Data

3. IP Number ☐☐☐☐☐☐☐   4. Age years☐ months☐ days☐

5. Sex☐

6. Date of Admission   __ __/ __ __/ __ __

7. **Date of Discharge/ Death** __ __/ __ __/ __ __

8. Number of days in ICU   ☐☐☐

9. Outcome   1. ☐ Alive   2. ☐ Dead

10. Nutrition   1.☐ TPN   2. ☐ Enteral   3. ☐ IVF

11. Source   1. ☐ Casualty   2. ☐ Wards   3. ☐ Theatre

                4. ☐ Other Hospitals

Diagnosis

12. Site involved

13. Condition   Primary

                Secondary

                Other relevant conditions

                        1. _____

                        2. _____

                        3. _____

14. Ventilated at admission

1. ☐ Yes   2. ☐ No

15. Code

    1. ☐ Surgical   2. ☐ Non-surgical

16. System

1. ☐ Respiratory	7. ☐ Genitourinary
2. ☐ Cardiovascular	8. ☐ Endocrine/Metabolic
3. ☐ Gastrointestinal	9. ☐ Haematological
4. ☐ Neurological	10. ☐ Musculoskeletal
5. ☐ *Trauma*	11. ☐ Dermatological
6. ☐ *Poisoning*	12. ☐ Psychiatric

17. Process

☐ **Accidental poisoning**

1. ☐ Acidaemia	13. ☐ Diabetes Mellitus
2. ☐ Affective disorder	14. ☐ Dissection or Aneurysm
3. ☐ Alcohol and drug dependence	15. ☐ Envenomation
4. ☐ Alcohol related disorders	16. ☐ Epidural/spinal drug administration
5. ☐ Alkalemia	17. ☐ Failure
6. ☐ Burns	18. ☐ Fluid Overload
7. ☐ Chromosomal deletion syndromes	19. ☐ Haemolysis/ Thrombocytopenia
8. ☐ Collapse	20. ☐ Haemorrhage
9. ☐ Coma/encephalopathy	21. ☐ Hypercalcemia
10. ☐ Congenital anomaly	22. ☐ Hyperglycaemia
11. ☐ Contiguous gene syndromes	23. ☐ Hyperkalemia
12. ☐ Degeneration	24. ☐ Hypernatremia
	25. ☐ Hypertension

26. ☐ Hyperthermia

27. ☐ Hypocalcemia

28. ☐ Hypoglycaemia

29. ☐ Hypokalemia

30. ☐ Hyponatremia

31. ☐ Hypoplasia/Dysplasia

32. ☐ Hypothermia

33. ☐ Inborn errors of metabolism

34. ☐ Infection

35. ☐ Inflammation

36. ☐ Mental handicap

37. ☐ Neurosis or personality disorder

38. ☐ Obesity

39. ☐ Obstruction

40. ☐ Obstruction or embolus

41. ☐ Oedema/inflammation/fibrosis

42. ☐ Over activity

43. ☐ Schizophrenia

44. ☐ Seizures

45. ☐ Self Poisoning

46. ☐ Sex chromosome disorders

47. ☐ Shock/ Hypotension

48. ☐ Starvation

49. ☐ Transplant related

50. ☐ Trauma

51. ☐ Trisomy

52. ☐ Tumor/Malignancy

53. ☐ Under activity

54. ☐ Vascular

Ref KNH-ERC/01/1504   Date 27 September 2002

Dr. Gathuya Z.N.
Dept. of Surgery (Anaesthesia)
Faculty of Medicine
University of Nairobi

Dear Dr. Gathuya,

RESEARCH PROPOSAL   "AN ANALYSIS OF ADMISSION PATTERNS INTO THE ICU AT
KENYATTA NATIONAL HOSPITAL OVER A TEN YEAR PERIOD (1991-2000)"
(P32/4/2002)

This is to inform you that the Kenyatta National Hospital Ethical
and Research Committee has reviewed and **approved** the revised version
of your above cited research proposal.

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 data base that will be consulted
in future when processing related research study so as to minimize
chances of study duplication.

Thank you.

Yours faithfully,

PROF. A.N. GUANTAI
SECRETARY, KNH-ERC

c.c.   Prof. K.M. Bhatt,
        Chairman, KNH-ERC,
        Dept. of Medicine, UON.

        Deputy Director (CS),
        Kenyatta N. Hospital.
        Supervisor: Dr. Kahuho, Dept. of Surgery (Anaesthesia), UON

        The Chairman, Dept. of Surgery, UON

        The Dean, Faculty of Medicine, UON

        CMRO