

The role of a Medical High Care Unit in
service provision at an urban secondary level
hospital in South Africa.



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Declaration:

I declare that this dissertation is my own unaided work. It is being submitted for Part III of the degree of Master of Medicine in the University of Cape Town. It has not been submitted before for any degree or examination in any other university



A handwritten signature in black ink, appearing to be 'R. S. M.', written above a horizontal line.

Signed this fifteenth day of August 2005

University of Cape Town

*To my wife Heather and my family
for all their support and encouragement
thank you*

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Glossary of Terms

ACE	Angiotensin converting enzyme
APACHE	Acute physiology and chronic health evaluation score
CK	Creatine Kinase
COPD	Chronic obstructive pulmonary disease
CT	Computerised Tomography
DKA	Diabetic Ketoacidosis
ECG	Electrocardiogram
GFJH	GF Jooste Hospital
GSH	Groote Schuur Hospital
HCO ₃	Bicarbonate
HCU	High care unit
ICD 10	International classification of disease
ICU	Intensive care unit
MEWS	Modified Early Warning Score
NHLS	National Health Laboratory Services
Non STEMI	Non – ST elevation Myocardial infarct
SD	Standard Deviation
ST	ST segment of ECG wave form
STEMI	ST elevation myocardial infarct
UAP	Unstable angina pectoris
UK	United Kingdom

Appendices

Appendix A: Intensive care and high care units in the Cape Town Metropole

Appendix B: Modified Early Warning Score sheet

Appendix C: Data capture sheet

Appendix D: Explanation of data capture sheet

Appendix E: APACHE II score sheet

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Chapter 1 Introduction and literature review

Critical care

1.1 International critical care

- 1.1.1 Levels of critical care
- 1.1.2 Admission Criteria
- 1.1.3 Cost of critical care
- 1.1.4 Provision of critical care services
- 1.1.5 Quality of critical care service provision
- 1.1.6 Assessment of severity of illness

1.2 South African critical care

- 1.2.1 Levels of care
- 1.2.2 Cost of service
- 1.2.3 Provision of critical care services

1.3 The Western Cape Health Care service

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Critical care

Critically ill patients benefit from intensive care and organ support as was clearly shown in the 1950's where deaths from respiratory failure, during a polio epidemic, were reduced from 87% to 40% by the use of positive pressure ventilation.^(1;2) Numerous studies since then have demonstrated the poor outcome of critically ill patients refused admission to an intensive care unit(ICU).⁽³⁾ Two independent studies have further shown that during acute ICU bed shortages, patients managed outside of the ICU had significantly worse outcomes.^(4;5)

1.1 International critical care

1.1.1 Levels of critical care

The level of care that can be provided to ill patients varies throughout a hospital environment. Provision of care ranges from standard care on a general ward to advanced life support and monitoring in a specialized unit. Definitions of such levels of care remain under debate.^(2;6)

In the United Kingdom⁽⁷⁾ levels of patient care have been defined as:

Level 0 = General acute ward care.

Level 1 = General ward care with additional advice and support from the critical care team.

Level 2 = More detailed observation or intervention.

Level 3 = Advanced respiratory support alone, or basic respiratory support together with support of at least two organ systems.

The definition of an intensive care unit (ICU) or high care unit (HCU) is based on the level of service that can be provided. The exact criteria however, vary. The current British definition of an ICU encompasses aspects such as: a specific area designated to provide maximum surveillance; support of vital organ systems such as respiratory, circulatory and renal; 24-hour dedicated medical staff and nurse to patient ratio of 1:1.^(2;6)

1.1.2 Admission criteria

Admission criteria for intensive care units are based on individual patient needs for these services. Current American guidelines for intensive care admission include primary diagnosis criteria e.g. cardiogenic shock, stroke, altered mental status following drug overdose and status epilepticus and physiological parameters such as tachycardia greater than 150 beats/min and systolic blood pressure less than 80 mmHg.^(6;8) British guidelines are based on organ support criteria which include the need for mechanical ventilation, vaso-active drugs to support cardiac output and dialysis.^(6;9) In both guidelines the need for advanced respiratory support including intubation and mechanical ventilation are considered independent criteria for ICU admission.

Elderly patients have previously been thought to be poor candidates for intensive care admission and many international studies have been conducted to determine the outcomes of elderly patients following intensive care admission.⁽¹⁰⁻¹⁸⁾ The outcome of elderly patients in some studies has been shown to be worse than that of younger patients,^(10;14;19) although this was not shown in other studies.^(15;16)

1.1.3 Cost of critical care

The management of critically ill patients is both costly and an intensive undertaking requiring highly qualified staff and expensive equipment.^(12;20) The United Kingdom (UK) spends approximately 675 million British pounds annually on intensive care; daily costs range between 500 – 1000 pounds depending on the severity of illness.⁽²⁾ The cost of caring for critical ill patients has also been shown to be increasing.⁽²¹⁾ Many countries have reported the costs involved in intensive care over the past 15 years. (Table 1.1)

Table 1.1 Cost of ICU admissions

		Cost per admission	
		US Dollar	ZAR *
France ⁽²²⁾	1991	14000	95457
India ⁽²³⁾	1999	310	2077
Australia ⁽²⁴⁾	2002	7180	48610

* 2005 exchange rate

Comparison of cost is very difficult due to differing levels of service, equipment, staff and patient case-mix. It is however evident that a large amount of money is spent on caring for critically ill patients in many countries.

1.1.4 Provision of critical care services

It has been recognised that there is a global shortage of intensive care beds.^(3;4;25-27) The number of critical care beds varies between countries and continents. There are an estimated 11 ICU beds for every 631 ward beds (ratio 1:60) in Europe; in the United States of America 87 ICU beds are available for every 654 ward beds (ratio 1:8).⁽²⁸⁾ In the UK it has been calculated that for a population of 500 000 people, 55 intensive care and 30 high dependency beds would be needed to provide sufficient service 95% of the time.⁽²⁹⁾

Due to high costs and staffing requirements required to provide intensive care services, more high dependency units (HDU) have been established internationally to provide more cost effective care between the level of an ICU and a general ward. The HDU provides support for single organ failure (excluding mechanical ventilation) and close monitoring.^(2;29) Such HDUs have been shown to significantly reduce the burden on ICUs. The majority of patients admitted are post-operative and do not require the full services of an intensive care unit.⁽³⁰⁻³²⁾ The need for mechanical ventilation however remains a criterion for ICU admission.^(2;6)

The only so called "high-dependency unit" reporting the provision of ventilation facilities, is a specific Geriatric HDU at the Caritas Medical Centre in Hong Kong. This high care unit, equipped to provide full ventilatory support, invasive monitoring and multiple organ support including renal dialysis, clearly provides an ICU service although it has been called a HDU.⁽¹²⁾

1.1.5 Quality of critical care service provision

The survival outcome of patients admitted to an ICU may be considered a reflection of the quality of care received, although mortality rates are clearly influenced by the case-mix of patients admitted and the severity of illness on admission.⁽³³⁾ The level of physician staffing, including levels of training and numbers and nurse to patient ratios

has also been shown to influence outcome.^(20;34) The availability of a specialist intensivist, has further been shown to improve patient care and although this may not always be possible in developing countries, the importance thereof has been recognised.⁽³⁵⁾

Comparison between ICUs based purely on survival outcome is thus fraught with difficulty. Despite these limitations it is useful to look at the range of published mortality data in order to gain a rough estimate of the quality of service provided. Current mortality figures for ICU admissions range from 15 to 38%: United Kingdom 20.5%,⁽³⁶⁾ India and Asia 30.7% to 36%,^(24;37) South Africa 15% to 38%.⁽³⁸⁻⁴⁰⁾

Mortality data provides insight into appropriateness of ICU admissions. An ICU mortality of less than 10% has been suggested to indicate that admission criteria may be too liberal and that the ICU is functioning more as a HCU or post-operative recovery room. In contrast, a mortality in excess of 30% suggests that a proportion of patients with a very poor prognosis are being inappropriately accepted in the unit.⁽³³⁾

1.1.6 Assessment of severity of illness

Many scoring systems have been developed to assess the severity of illness of patients admitted to the ICU. These scoring systems allow for comparison of patient groups and predict mortality. The major scoring systems currently used include the Acute Physiology and Chronic Health Evaluation (APACHE) II, Simplified Acute Physiology Score (SAPS) II and Sequential Organ Failure Score (SOFA).⁽⁴¹⁻⁴³⁾ The most widely used scoring system, the APACHE II, has been validated and used in both developed and developing countries including Brazil, India and South Africa.^(37;40;44-46)

The Modified Early Warning Score (MEWS) was developed in the United Kingdom as a simplified assessment of severity of illness for use on a general ward to identify critically ill patients. It is based on 5 parameters: pulse rate, respiratory rate, temperature, systolic blood pressure and consciousness. As with more detailed scoring systems such as the APACHE II, SOFA and SAPS scores, points are allocated for each parameter.⁽⁴¹⁻⁴³⁾ The maximum score is 14; a score of greater than four has been shown to indicate the need for admission to critical care services and an expected

mortality of 25%^(47;48) (See Appendix B for score sheet of the MEWS) There has been no comparison between the MEWS and APACHE II.

1.2 South African critical care

Limitation and particularly the maldistribution of resources, places severe restrictions on the provision of intensive care in South Africa.^(32;49;50) The recently completed South African Critical Care Audit conducted by the Critical Care Society of South Africa (CCSA), has provided an overview of critical care services in South Africa.⁽⁵¹⁾

1.2.1 Levels of care

Although the current definition of an ICU and HCU are under review in South Africa, the descriptions and definitions closely match those of the United Kingdom.^(2;6) Intensive care units are generally considered to be able to provide: nurse to patient ratio of 1:1; intensive and invasive monitoring and support of multiple organ failure, including respiratory support (mechanical ventilation), renal support (dialysis) and circulatory support (inotrope and vasopressor agents).^(2;6) High care units are able to provide monitoring and care of patients with moderately severe physiological instability who do not require artificial life support.^(6;27;29)

An additional scoring system has been used to further grade intensive care units.⁽⁵²⁾ This system has graded ICUs into four categories based on the level of care that they provide.⁽⁵²⁾ (Table 1.2)

Table 1.2 Levels of intensive care units in South Africa

Level of Unit	Type of Unit
Level I	Tertiary hospital academic ICU
Level II	Specialized unit e.g. Coronary care or Neurosurgery
Level III	Community hospital ICU
Level IV	High care unit

1.2.2 Cost of service

Within the South African health care system, critical care service provision remains an expensive discipline.^(32;53) Although there are no recent published data of ICU costs, in 1991 the costs were estimated to exceed 2000 ZAR per day.⁽⁵⁴⁾ Current costs of hospital admissions are based on patient day equivalents (PDE) and there are no defined costs of an ICU bed. Tertiary level beds are reported to cost 1800 ZAR per day⁽⁵⁵⁾ whereas secondary level beds cost between 877 and 1000 ZAR per day.⁽⁵⁶⁾ It is clear that the additional costs of expensive medication, disposable equipment, laboratory testing and ICU staff greatly add to the cost estimated PDE in the context of an ICU admission.

1.2.3 Provision of critical care services

Intensive care unit beds accounted for 1-2% of all acute beds in 1993. The Chris Hani-Baragwanath Hospital had 18 ICU beds for a 3000-bed institution (ratio of 1:166).⁽²⁷⁾ The CCSA audit has calculated that there were 4168 HCU and ICU beds in South Africa in 2003. The number of ward beds was 130613 (ratio 1:31). This included all public sector (government) and private medical care beds. If the public sector beds are considered separately, the ratio is 1:60.⁽⁵¹⁾ This audit included all hospital beds, including paediatric services.

1.3 The Western Cape health care services

The Western Cape has an estimated population of 4.5 million people, 2.7 million living within the Cape Town Metropole.⁽⁵⁷⁾ Provision of health care is shared by private health care providers and government services. Patients who can afford private medical aid schemes are generally provided for in the private sector. All other patients use government health services.

There are a number of government hospitals within the Cape Town Metropole. (Table 1.2) The current number of public service adult ICU and HCU beds available in the Cape Town Metropole is 186. Approximately 87 of these beds have the facility to provide mechanical ventilation. The ratio of adult ICU/HCU beds to adult ward beds is

therefore 1:15. The ratio of ICU beds (ventilation facility) to ward beds is 1:32 (Table 1.3)

Table 1.3 Hospitals within the Cape Town Metropole

Hospital	Adult beds	Level of ICU/HCU	Beds (ventilated)
False Bay	65	No ICU/HCU	0
GF Jooste	224	HCU	8 (4)
Groote Schuur	819	Level I ICU and HCU	57(32)
Hottentots Holland	85	HCU	3 (1)
Karl Bremner	193	HCU	4 (0)
Somerset Hospital	215	Level III ICU	4 (4)
Tygerberg	1030	Level I ICU and HCU	108(42)
Victoria	130	HCU	2 (2)
Wesfleur	27	No ICU/HCU	0

(Bed numbers are based on figures reported by the superintends of the individual hospital and include specialized units such as Burns Unit, Haematology Isolation Unit, Coronary Care Unit and Renal Transplant Unit.)

GF Jooste Hospital situated in Manenberg (18.5km from the centre of Cape Town), drains the residential areas of Mitchells plain, Khayelitsha, Gugulethu, Nyanga, Heideveld and Manenberg. (See Appendix A) The estimated size of this population is 1.5 million people.⁽⁵⁷⁾ The Equity Gauge Project conducted in 2000 showed that the majority of people in this area are in a low socio-economic bracket.⁽⁵⁸⁾ (Table 1.4) Very few people have access to private health care and most are dependent on GF Jooste Hospital for in-patient health care service provision.

Table: 1.4 Population Characteristics in the GF Jooste Drainage area

	Below poverty Line	Unemployed	Limited education
Khayelitsha	55%	47%	26%
Mitchells Plain	30%	30%	20%

The Equity Gauge Project⁽⁵⁸⁾

An audit of medical health care service provision at GF Jooste Hospital was undertaken in 2003. This showed that the Emergency Department treats approximately 58 000 patients per year. Of these, 5451 require admission, reflecting a monthly average admission of 454 patients.⁽⁵⁹⁾ This audit assessed patient severity on admission using the Modified Early Warning Score (MEWS)⁽⁴⁷⁾ and demonstrated that approximately 25% of medical admissions were sufficiently ill to merit admission to a HCU/ICU.

Because of the large number of critically ill patients presenting to GF Jooste Hospital each month it is essential that adequate and equitable allocation of resources be done in order to address this need. Given this high demand for critical care service provision in a secondary level hospital, a prospective audit of service provision by the HCU at GF Jooste Hospital was undertaken.

Chapter 2 Study Design and Methods

2.1 Aims of the study

2.2 Study Design

2.3 Study Methods

2.3.1 Patient selection

2.3.2 Data capture

2.3.3 Definitions

2.3.3.1 Diabetic emergencies

2.3.3.2 Acute coronary syndromes

2.3.3.3 Poisoning, overdose or accidental ingestion of substances

2.3.3.4 Elderly patients

2.3.3.5 Indicators of severity

2.3.4 Outcome measures

2.3.5 Data entry

2.3.6 Data analysis

2.3.7 Ethical considerations

2.3.8 Funding

2.3.9 Conflict of interests

2.1 Aims of the study

The aims of this study were the following:

- I. Provide hospital management with a clear overview of services provided by the high care unit (HCU).
- II. Perform a cross-sectional analysis of patients admitted to the HCU in terms of diagnosis, clinical features, severity of illness and outcome in order to:
 - a. Identify clinical practice which could be improved to ensure optimal utilization of available resources.
 - b. Develop admission criteria and rational policies for management and transfer of patients to more appropriate levels of care.
 - c. Identify issues requiring further audit and research.

2.2 Study Design

An analysis was performed of prospectively gathered audit data obtained from all medical patients admitted to the HCU of GF Jooste Hospital from the 1st of January 2003 to the 31st of December 2003. This audit forms part of the hospital's policy of continuous audit of practice to promote the provision of quality care.

2.3 Study Methods

2.3.1 Patient selection

All medical patients admitted to the HCU during the study period were audited. The HCU admission book was used to ensure that all patient admissions were captured. No patients were excluded.

2.3.2 Data capture

Patient data were entered onto pre-printed data capture sheets. (Appendix C) Case definitions and explanations of all terms used in the data capture sheet are contained in Appendix D. The admitting doctor commenced data capture on admission to the HCU; this was completed prior to discharge, transfer or after death of the patient. Data pertaining to post-discharge events was obtained from the hospital records.

2.3.3 Definitions

Although patients may have had more than one diagnosis on admission, e.g. diabetic ketoacidosis and pneumonia, the major reason for admission to the HCU was considered the primary diagnosis and used for analysis.

2.3.3.1 Diabetic emergencies

Patients admitted to the HCU with uncontrolled blood sugar were classified as diabetic emergencies. These patients were then divided into 3 groups namely a) diabetic ketoacidosis (DKA) b) hyperglycaemic without ketones and c) hypoglycaemia.

a) Diabetic Ketoacidosis (DKA)

For the purpose of analysis we based our definition of DKA on the criteria published by the Endocrine Unit of the Pretoria Academic Hospital.⁽⁶⁰⁾ These include: glucose greater than 13mmol/l, arterial pH less than 7.3 and positive urine ketones.

At GF Jooste Hospital patients with a raised finger prick blood sugar test do not routinely have a peripheral venous blood glucose sample tested on admission. Raised finger prick glucose with positive serum ketones, rather than urine ketones, usually constitutes a diagnosis of DKA. In this setting, the diagnostic criteria for DKA that were thus used for analysis included:

- i) Raised glucose, either finger prick test or peripheral blood venous sample, greater than 13mmol/l
- ii) Arterial pH less than 7.35
- iii) Positive serum ketones

Severe DKA was defined using criteria previously used in a DKA audit by Levetan et al.⁽⁶¹⁾ They defined severe DKA as a serum bicarbonate of less than 12mmol/l and positive serum ketones.

b) Hyperglycaemia without ketones

Patients who were admitted to the HCU with a raised blood glucose of more than 13mmol/l, but without acidosis or positive serum ketones were assigned to this group.

c) Hypoglycaemia

Patients admitted with a blood glucose of less than 2.8 mmol/l were classified as hypoglycaemic.⁽⁶²⁾

2.3.3.2 Acute coronary syndromes

The definitions and management of patients with acute coronary syndromes such as ST-segment elevation myocardial infarction(STEMI), non-ST-segment elevation myocardial infarction(NSTEMI) and unstable angina pectoris(UAP), are continually evolving as more sensitive tests and early interventions are developed.⁽⁶³⁾ Based on the criteria defined by the World Health Organisation and the Joint European Society of Cardiology and American College of Cardiology Committee,⁽⁶⁴⁻⁶⁶⁾ patients were assessed as having one of the following acute coronary syndromes:

- i) STEMI: Ischemic chest pain symptoms with ECG changes of ST segment elevation and elevation of biochemical markers of myocardial injury (creatin kinase)
- ii) NSTEMI: Ischemic chest pain symptoms with ECG changes of ST segment depression and/or T wave inversion and elevation of CK three times above the upper limit of normal.
- iii) UAP: Ischemic chest pain symptoms with ECG changes of ST segment depression or T wave inversion without a rise in markers of myocardial injury (CK).

ECG assessment by the attending registrar and consultant was not formally reviewed by a cardiologist. Troponin and CK-MB analysis were not undertaken.

2.3.3.3 Poisoning, overdose or accidental ingestion of substances

It was not always possible to differentiate between accidental poisoning or intentional suicide attempt ingestion of substances from the admission records. For the purpose of analysis these patients were grouped together and collectively referred to as "overdose or poisoning".

2.3.3.4 Elderly patients

Elderly patients are most commonly considered to be 65 years or older; age limits of 70 to 75 years have also been used.^(12;67) For the purpose of this audit an elderly patient was defined as 65 years or older.

2.3.3.5 Indicators of severity of illness

a) APACHE II score

The APACHE II score⁽⁴¹⁾ is a well established and widely used local and international method of scoring the severity and likely outcome of ICU admissions. For this reason it was chosen as the primary scoring system for this audit. The APACHE II score was calculated on the worst recorded observations within the first 24 hours. For patients who died within the first 24 hours, APACHE II score was calculated on admission data. Data points not recorded were allocated a score of zero. The APACHE II scoring sheet is contained in Appendix E.

b) Mechanical ventilation

Mechanical ventilation was chosen as a second indicator of severity because it is widely considered to be an independent criterion for admission to an intensive care unit.^(2;8;68) In this study the need for mechanical ventilation was used as an indication that the patient admitted to the high care unit was receiving intensive care level service provision.

2.3.4 Outcome measures

Three primary outcome measures were defined in this audit:

I. Death – defined as

- (a) "High Care Unit death" when death occurred in the HCU or
- (b) "In-Hospital" when death occurred in the hospital ward following discharge from the HCU.

II. Transfer – defined as transfer of the patient to another facility for further management, e.g. psychiatric assessment or coronary care unit admission.

III. Survival – defined as alive at the time of discharge from GF Jooste Hospital or transfer to another facility.

2.3.5 Data entry

All data were entered into a Microsoft Access® database. Each record was entered sequentially and errors or omissions were corrected by reviewing the hospital records. All laboratory data were reconciled with the GF Jooste Hospital National Health Laboratory Services (NHLS) records.

2.3.6 Data analysis

Data were analysed using both Microsoft Excel® and Statistica® software. Mean, median, standard deviation and 95% confidence intervals were calculated using standard software analysis tools. Mean APACHE II scores were rounded to the nearest whole number as is accepted practice in the published literature. Categorical variables were compared using Chi-Square analysis and continuous variables were compared using Students'-T test. A p value of 0.05 or less was considered significant.

2.3.7 Ethical considerations

This audit forms part of the hospital's policy of continuous review of practice. As this study was a review of the audit data, the results had no influence on the management of the patients. For these reasons patient consent was not obtained.

Patient confidentiality was maintained by allocating of a unique numeric code to each data set with no reference to the name of the patient.

The ethical principles for this study have been based on the Helsinki declaration,⁽⁶⁹⁾ and formal approval was granted by the University of Cape Town Research Ethics Committee. (Appendix F)

2.3.8 Funding

The audit received no external funding.

2.3.9 Conflict of interest

None.

Chapter 3 Results

3.1 Overview of the hospital

- 3.1.1 The hospital
- 3.1.2 The high care unit (HCU)

3.2 Broad profile of HCU admissions

- 3.2.1 Patient demographics
- 3.2.2 Major diagnostic categories
- 3.2.3 Indicators of severity
- 3.2.4 Patient outcomes

3.3 Specific groups of interest

- 3.3.1 Patients admitted with diabetic emergencies
- 3.3.2 Patients admitted with acute coronary syndromes
- 3.3.3 Patients admitted following overdose or poisoning
- 3.3.4 Elderly patients
- 3.3.5 Patients requiring mechanical ventilation

3.1 Overview of the hospital

3.1.1 The hospital

3.1.1.1 The hospital and environs

GF Jooste Hospital is situated in Manenberg, 18.5 km from the centre of Cape Town. It was originally built as a convalescent home for "non-white" patients in 1975. In 1996 it was re-opened as an acute adult secondary level hospital.

3.1.1.2 Hospital bed capacity

The hospital has a total of 222 beds of which 40 are off-site. (Table 3.1) Although the beds are usually discipline-specific, "overflow" from one department is accommodated in another discipline's beds.

Table 3.1 GF Jooste Hospital bed allocation

Discipline	Number of beds
General Medicine	88
Stroke Unit	6
Surgery, including general, orthopaedics, gynaecology	80
High Care Unit	8
Low-care beds*	40

* These beds are located off-site at Lentegeur Hospital, and serve as a "step down" facility for the care of stable medical patients or patients requiring terminal care.

3.1.1.3 The Department of Medicine

In 2003 the department was staffed by 3 consultants, 4 registrars and 4 interns. Patients are admitted via the Emergency Unit. A medical "on-call team" consisting of a consultant, registrar and intern are responsible for all medical admissions during each 24-hour period. A medical admissions audit, conducted at GF Jooste Hospital in 2003, demonstrated a monthly admission average of 454 patients.⁽⁵⁹⁾

3.1.2 The high care unit (HCU)

3.1.2.1 Medical staff

The HCU is an 8-bed unit used by both the medical and surgical departments. Daily care of the patients, whilst in the HCU, is the shared responsibility of the discipline-specific registrar and the HCU intern. The HCU intern covers the Unit on-site during working hours. Weekend day cover is provided by the on-call discipline-specific registrar. Overnight admissions and after-hours emergency problems are dealt with by the Emergency Unit staff with telephonic advice from the discipline-specific registrar or consultant-on-call.

Consultant ward rounds take place on a daily basis and are conducted by staff from either Groote Schuur Hospital (GSH) or GF Jooste Hospital. The GSH consultants are affiliated with the Respiratory ICU. They provide both expert critical care input and facilitate referral to the GSH ICU should patients require a higher level of care.

3.1.2.2 Nursing staff

The HCU is staffed by a group of dedicated nurses supplemented by agency nurses as required. The number and level of training of the nursing staff varies with each shift. A shift usually comprises of two registered nurses and two enrolled nurses. A designated shift leader runs the HCU during each shift. This is the most senior person on duty and at most has "ICU experience". There are currently only two registered nurses who have formal ICU training. They work predominantly on day shifts.

3.1.2.3 Support staff

There are no medical technologists employed at GF Jooste Hospital. All ventilator maintenance, cleaning and sterilization is done by the nursing staff.

3.1.2.4 Facilities available

a) Physiological parameter monitoring

Continuous ECG, pulse oximetry, non-invasive blood pressure monitoring and manual central venous pressure monitoring is available. There are no facilities for invasive monitoring e.g. intra-arterial blood pressure, pulmonary artery pressure or intra-cranial pressure monitoring.

b) Mechanical ventilation

The HCU is able to support a maximum of four simultaneously mechanically ventilated patients. The current ventilators include three Newport® ventilators and a Bear 1000® ventilator.

c) Support services

i) Pharmacy

All Essential Drug List (EDL) medications are available to support critically ill patients. Nasogastric feeding is provided but total parenteral nutrition (TPN) is not available. Renal haemodialysis or haemofiltration is not available. Patients requiring dialysis facilities are transferred to GSH.

ii) Laboratory

The NHLS provides on-site laboratory services at GF Jooste Hospital. All basic blood tests including blood gas analysis are performed in the laboratory. Specialized tests are sent to a reference laboratory.

iii) Radiography

A 24-hour radiology services provides a mobile X-ray service to the HCU. Ultrasound scanning is available on weekday mornings. Computerised tomography (CT) is not available. Patients requiring a CT scan or after-hours ultrasound, are transferred to Groote Schuur Hospital for further investigation.

3.1.2.5 Admission criteria

There are currently no defined age or admission criteria for the HCU. Critically ill patients are admitted directly to the HCU from the Emergency Unit or from the general wards at the discretion of the attending doctor.

3.1.2.6 Referral of patients for specialised services

Patients requiring invasive monitoring, dialysis or drugs not available at GF Jooste Hospital are referred to the nearest available tertiary service bed. If patients are considered too unstable or if ICU beds are not available they are managed in the HCU until transfer is possible.

3.2 Broad profile of HCU admissions

3.2.1 Patient demographics

A total of 860 medical patients were admitted to the HCU during the study period. One patient was considered dead-on-arrival in the HCU and was excluded from the analysis. The total number of patients audited was therefore 859. This constitutes 80.3% of the total 1070 patients admitted to the HCU.

3.2.1.1 Ethnic profile

Of the 859 patients, the majority were of Mixed-ancestry (54%); 43% were Black, 2% Indian and 7 patients (1%) were White. See Appendix G for detailed break down of ethnic and gender statistics.

3.2.1.2 Age and gender

More than half of patients admitted to the HCU were female (54.7%). There was a wide spread in the age profile of the patients; median age was 47 years (range 13 – 86 years). There was no significant difference between the mean ages of the male and female patients; males 45.9 (SD 15.4) years and females 45.5 (SD 18.2) years.

3.2.1.3 HIV status

Since routine HIV testing of patients admitted to the HCU was not undertaken the HIV status of most patients was not known. Of the 859 patients admitted an HIV antibody test result was available in 63 patients (7.3%); 40 patients were positive and 23 were negative.

3.2.1.4 Length of stay in HCU

The turnover of patients in the HCU was high with a median length of stay of 2.4 days (range, 0.5 – 14 days). Almost two thirds (61.6%) of patients were discharged within 2 days or less. Only 2.7% stayed for 7 days or more. (Figure 3.1)

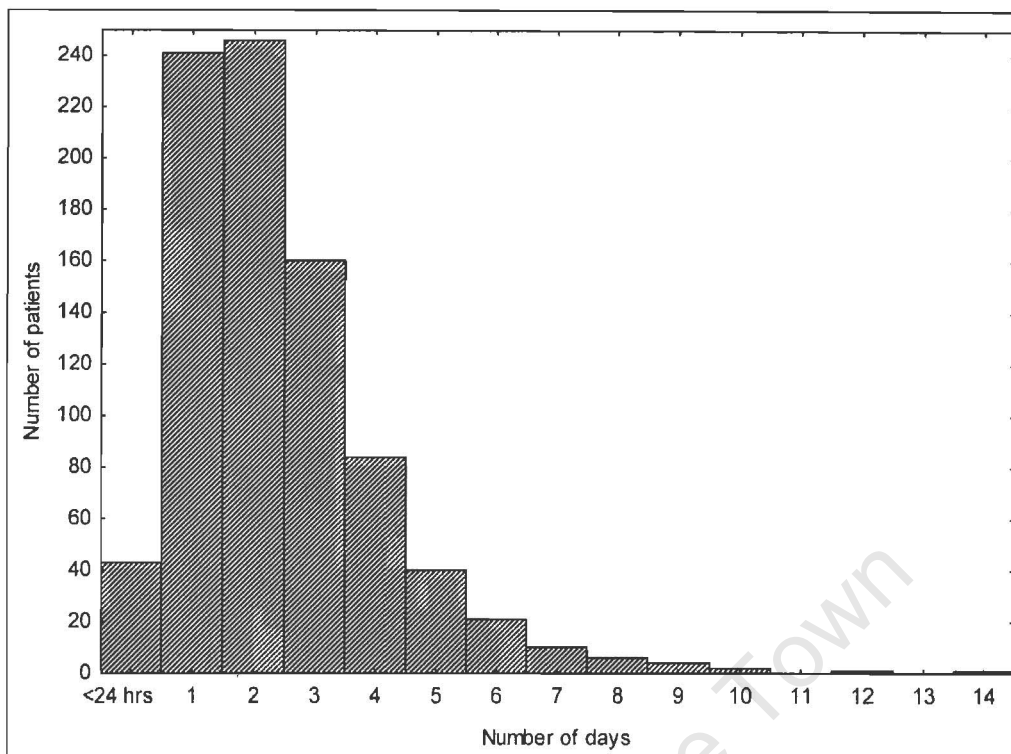


Figure 3.1 Length of stay in the HCU

3.2.2 Major diagnostic categories

Figure 3.2 shows the spectrum of disease seen in patients admitted to the HCU. Acute coronary syndromes, diabetic emergencies, sepsis and overdoses/poisonings constituted the major work load of the HCU. Table 3.2 outlines the major diagnostic categories. A complete list of admission diagnoses is contained in Appendix H. Results for these major diagnostic categories will be discussed separately.

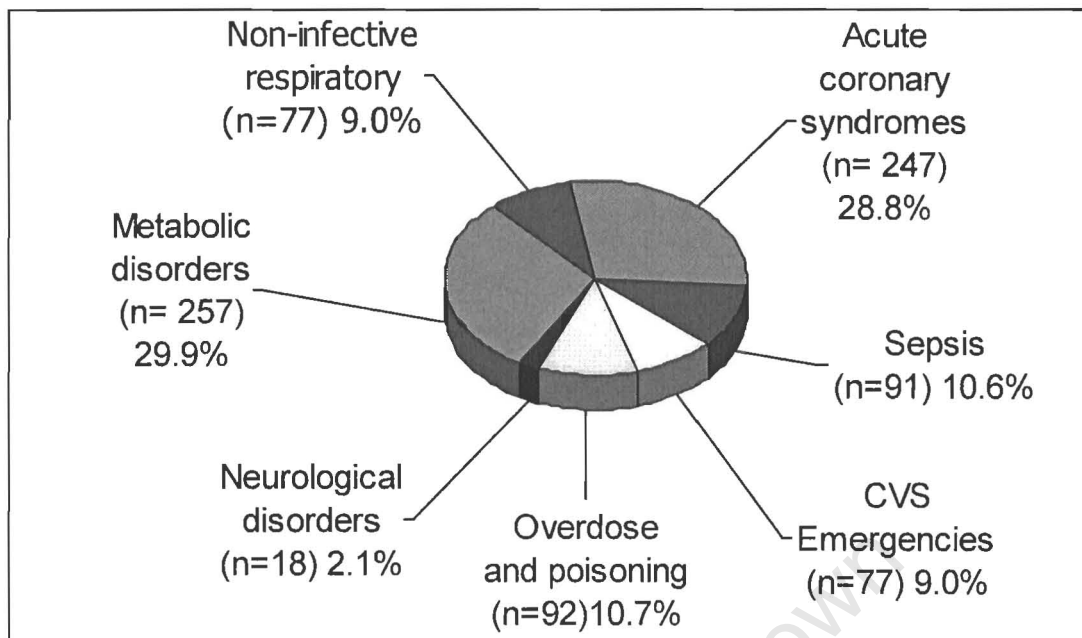


Figure 3.2 Major diagnostic categories

Table 3.2 Diagnostic categories and diagnoses

Diagnostic category	Diagnoses included in this category
Acute coronary syndrome	Myocardial infarction (STEMI and NSTEMI) and unstable angina pectoris
Acute Metabolic disorders	Diabetic emergencies (DKA, hypoglycaemia and hyperglycaemia), renal failure, electrolyte abnormalities
Overdose or poisoning	Overdoses or poisoning
Acute Neurological disorders	Status epilepsy, Myasthenia gravis and Guillain-Barré syndrome
Acute Cardiovascular disorders	Stroke, pulmonary oedema, cardiac arrhythmias, malignant hypertension
Non-infective respiratory disorder	Asthma, COPD, other non-infective chronic lung disease
Sepsis syndrome	Pneumonia, septic shock, meningitis

3.2.3 Indicators of severity

3.2.3.1 APACHE II scores

APACHE II scores were recorded in 703 of 859 patients. The median APACHE II score was 9 (range, 0 – 38). (Figure 3.3) There was a statistically significant difference between the mean (SD, 95%CI) APACHE II scores of HCU survivors 9 (6, 9 - 10) and non-survivors 18 (8, 16 – 20) ($p < 0.001$).

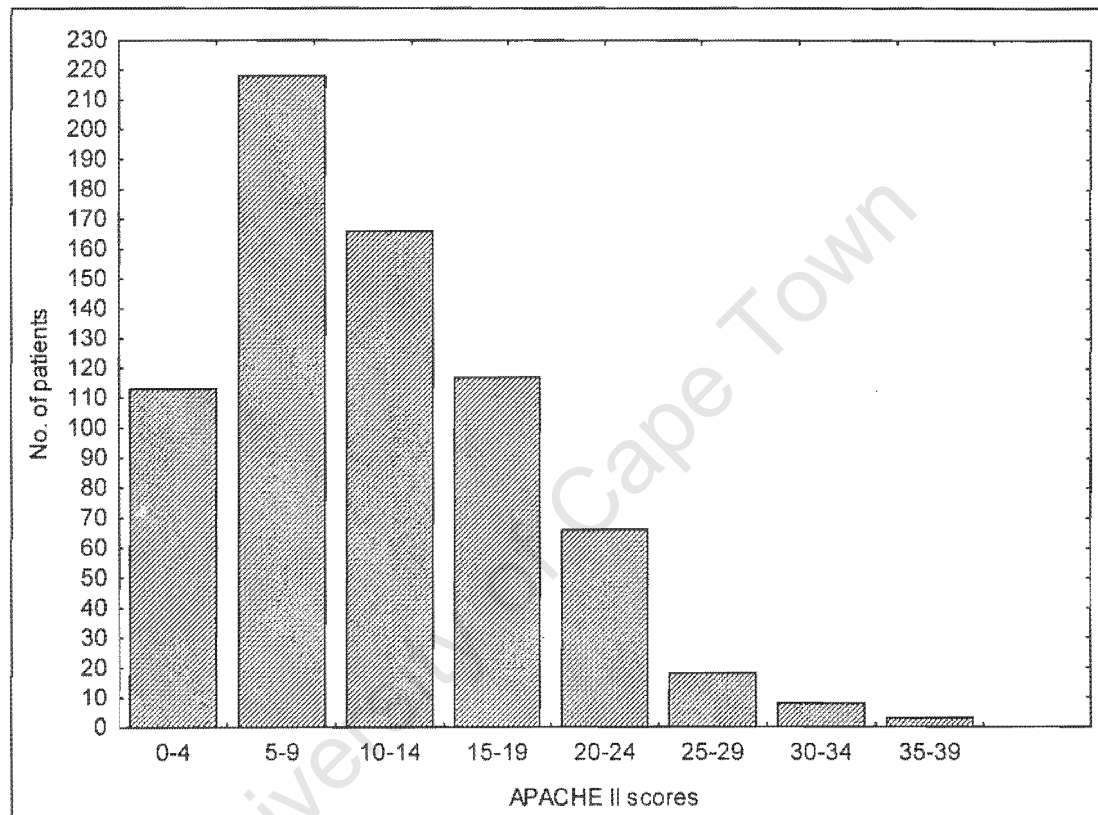


Figure 3.3 Range of APACHE II scores

3.2.3.2 Ventilated patients

A total of 213 patients required mechanical ventilation during the audit period. This represents 24.8% of all patients admitted to the HCU. Of mechanically ventilated patients, 17.4% were transferred to GSH for further treatment; the remaining patients were managed in the HCU.

3.2.4 Patient outcomes

3.2.4.1 HCU and in-patient mortality

More than three quarters (77%) of all HCU admissions were discharged alive. The high care unit mortality was 10.7% (n=92). Total in-hospital mortality of patients admitted to the HCU was 14.8% (n=127). (Figure 3.4) A detailed table of outcomes for all diagnostic groups can be found in Appendix H.

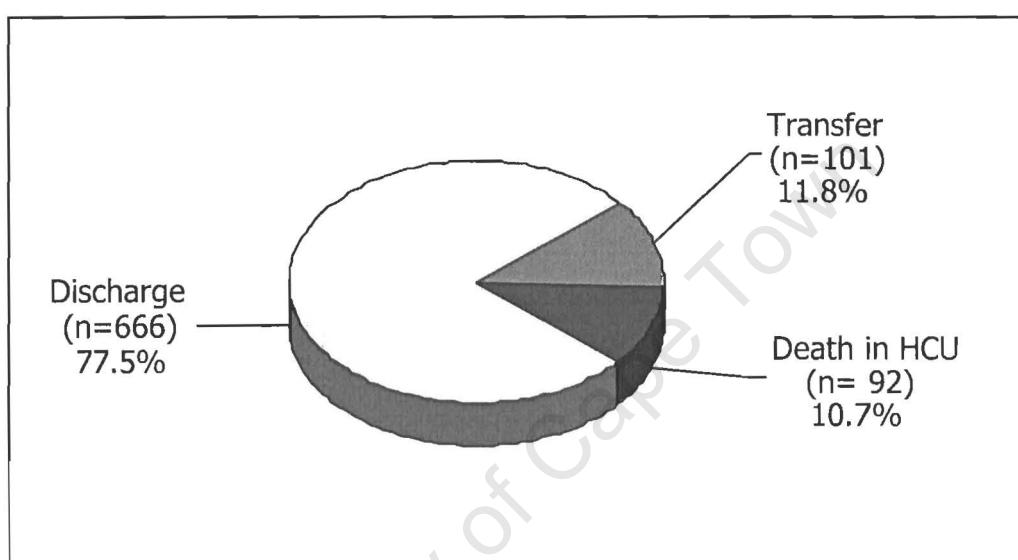


Figure 3.4 Outcomes of HCU admissions

The mortality rate for patients within the first 24 hours in the HCU was significantly higher than for patients surviving the first day 19.3% vs. 8.7% ($p=0.0003$). This was true of ventilated and non-ventilated patients. (Table 3.3)

Table 3.3 Outcome of patients within 24hrs of admission to HCU

	Death within 24 hrs (%)	Death beyond 24 hrs (%)	p value
Required mechanical Ventilation	31 (47.0%)	33 (22.4%)	$p<0.003$
Non- ventilated	15 (6.8%)	13 (3.0%)	$p=0.023$

3.2.4.2 Transferred patients

A total of 101 patients (12%) were transferred to other institutions. The outcome for these patients was known in 54.5% of cases (n=55). The largest group, 33 patients, was transferred to the Respiratory ICU at GSH for further intensive care support. Nearly a quarter of these patients (24.2%) died in the tertiary ICU. Twenty three patients were transferred to the GSH coronary care unit (CCU). Of these patients two died (9%). Seven patients were transferred directly to Lentegeur Hospital for psychiatric management. The outcome of the remaining transferred patients is not known.

3.3 Specific groups of interest

Seven major diagnostic groupings, previously referred to in Table 3.2, were identified in the audit data. The largest of these diagnostic categories, namely the metabolic disorders, consists mainly of patients with diabetic emergencies. Acute coronary syndromes and overdoses or poisoning, are the other major groupings that have been analysed in greater detail.

Two further subgroups of patients namely elderly patients and patients requiring mechanical ventilation have been considered separately.

3.3.1 Patients admitted with diabetic emergencies

A total of 229 patients were admitted with uncontrolled diabetes, representing 27% of all admissions. Diabetic ketoacidosis (DKA) was diagnosed in 202 patients, 18 were admitted with hyperosmolar non-ketotic coma (HONK) and nine with hypoglycaemia. The patients with DKA are discussed in detail.

A total of 43 patients were excluded from further analysis because they did not fulfil the diagnostic criteria defined for DKA. The final number analysed was a total of 159 admissions in 142 patients. Twelve patients had two admissions, one patient required three admissions and a single patient was admitted six times during the 12-month audit period.

3.3.1.2 Patient demographics

The median age of the patients was 35 years (range, 13 - 77 years). The mean age of this group was significantly lower than the mean age of other patients admitted to the HCU (Table 3.4) More than one third (42%) were under the age of 30 years, an almost two thirds (60%) of the DKA patients were under the age of 40 years. (Figure 3.5)

Table 3.4 Summary of DKA patients vs. non-DKA patients

	DKA (n= 159)	Non-DKA (n=700)	p value
Mean age (SD,95% CI) years	36.9 (15.6, 34.5 -39.3)	47.2 (16.7, 45.9-48.4)	p<0.0001
Mean APACHE II score (SD, 95%CI)	12 (7, 11 – 13)	10 (7, 9 – 10)	p=0.002
Required mechanical ventilation	11.3%	27.9%	p<0.0001
In-hospital mortality	11.9%	15.4%	p=0.264

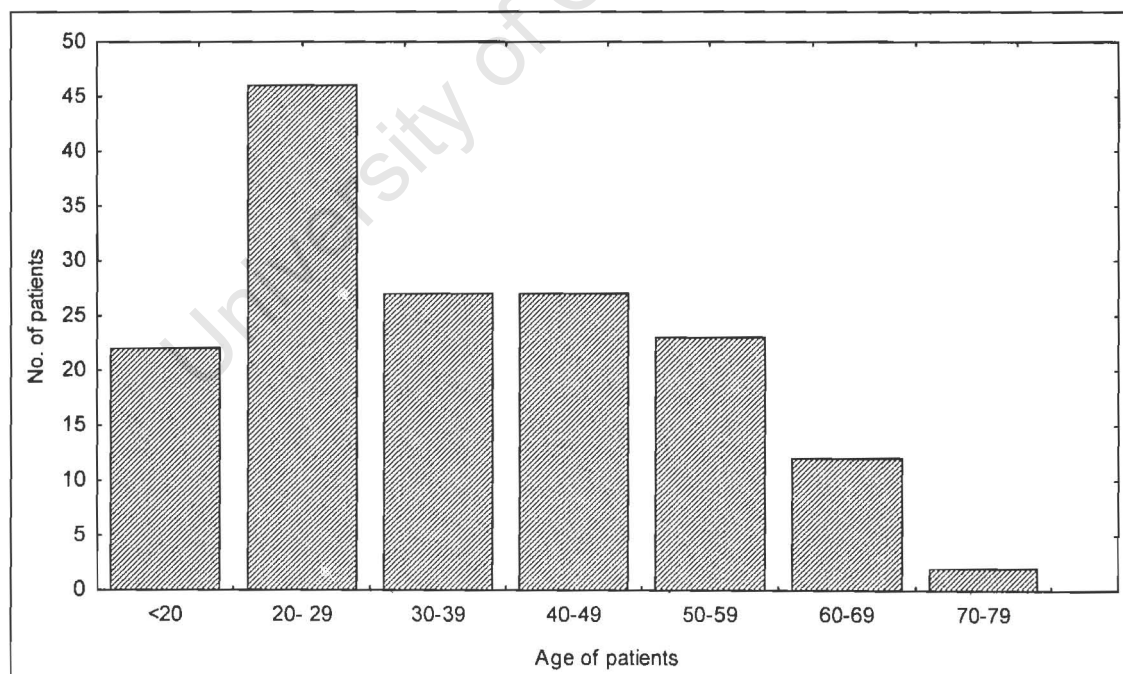


Figure 3.5 Age of DKA patients

3.3.1.3 Severity of illness

The severity of illness varied widely in this patient group. Severe DKA was found in 92 of the 159 patients (58%). Biochemical abnormalities are shown in Table 3.5. The mean APACHE II score for DKA patients was higher than other HCU patients (Table 3.4)

Table 3.5 Laboratory variables for DKA patients

	Mean	SD	95% CI	Median	Range
pH	7.09	0.16	7.07 – 7.12	7.15	6.6 - 7.3
Base deficit (mmol/l)	18.4	7.86	17 - 19	19	3.3 - 37.3
Actual Bicarbonate (mmol/l)	9.23	5.9	8.2-10.2	7.6	1.3 – 22.3
Glucose	34	18.4	31 - 36	29.4	5 - 105

Eighteen patients required mechanical ventilation. The data in Table 3.6 indicate that these patients were older, sicker and had a worse outcome compared to the non-ventilated DKA patients.

Table 3.6 Comparison of ventilated and non ventilated DKA patients

	Ventilated DKA (n = 18)	DKA not requiring ventilation (n = 141)	p value
Mean age (SD,95%CI) years	46.4 (15.6, 38.7 – 54.1)	35.7 (16.2, 33.1 – 38.2)	p=0.006
Mean APACHE II score (SD)	23 (8)	11 (5)	p<0.001
Mean pH (SD,95%CI)	6.97 (0.22, 6.86 – 7.08)	7.11 (0.15, 7.09 – 7.14)	p<0.001
In-hospital mortality	72.2%	4.3%	p<0.01

Of the 18 patients who were ventilated, 13 died in the hospital (72.2%). There was no statistically significant difference between ventilated survivors and non-survivors in terms of biochemical parameters measured on admission to the HCU, age or APACHE II score. The cause of death in eight of these patients was considered to be septic shock.

3.3.1.4 Patient outcomes

Overall DKA patients had a HCU mortality of 9.4% (15/159) and an in-hospital mortality of 11.9%. This figure is however skewed by the in-hospital mortality of DKA patients requiring mechanical ventilation (72.2%) The in-hospital mortality of non-ventilated DKA patients (4.3%) was significantly lower. (Table 3.6)

3.3.2 Patients admitted with acute coronary syndromes

Acute coronary syndromes accounted for 28.7% of all admissions to the HCU in 2003, a total of 247 patients. Complete data were available for 210 patients who were analysed further.

3.3.2.1 Patient demographics

Over half the patients were male (50.4%). As a group they were significantly older than other HCU admissions. (Table 3.7) More than one third of patients had modifiable risk factors for ischemic heart disease. (Table 3.8)

Table 3.7 Summary data of acute coronary syndrome patients as compared to other HCU admissions

	Acute coronary syndrome patients (n= 247)	Other HCU patients (n= 612)	p value
Mean age (SD,95% CI) years	56.4 (11.6, 54.8- 57.9)	41.7 (16.9, 40.5 -43.1)	p<0.0001
Mean APACHE II score (SD,95%CI)	6 (5, 6 - 7)	12 (7, 11 - 12)	p<0.0001
Required mechanical ventilation	6.2%	27.4%	p<0.0001
Mortality	5.7%	22.2%	p<0.0001

Table 3.8 Modifiable risk factors for ischemic heart disease in acute coronary syndrome HCU admissions

Risk factor	Number of patients (%)
Hypertension	131 (62.4%)
Current smoker	103 (49%)
Diabetes mellitus	78 (37%)
Hyperlipidaemia*	29 (13.8%)

* Only 44 patients (17.8%) had serum cholesterol levels checked. Of these patients 66% had a level greater than 5.5mmol/l.

3.3.2.2 Management of ACS

Figure 3.6 shows the distribution of ACS admitted to the HCU. Of STEMI patients 42% (n=40) received intravenous thrombolysis with streptokinase. The median time following the onset of pain to receiving thrombolysis was 5.0 hours (range, 0.5 - 18 hours). 90% of the NSTEMI and UAP patients received low molecular weight heparin.

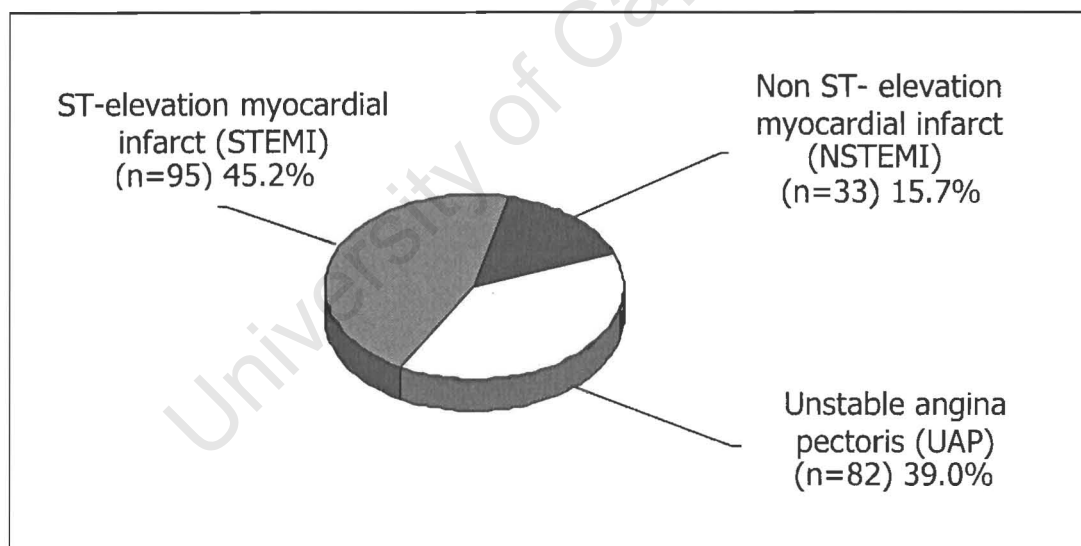


Figure 3.6 Acute coronary syndrome events

More than half of patients (58.7%) received both aspirin and beta-blocker therapy. Aspirin, beta-blocker and ACE inhibitor therapy was given to 40%. At least one of the drugs was prescribed in more than half of patients: aspirin 85.2%, beta-blocker 62.5% and ACE inhibitor 66.7%.

3.3.2.3 Severity of illness

Nearly two thirds (61.9%) of patients admitted with an acute coronary syndrome, had suffered a myocardial infarct (STEMI or NSTEMI). Overall the patients with acute coronary syndromes had lower APACHE II scores, and required ventilation less frequently than other HCU patients. (Table 3.7) Ventilation was required for 9 STEMI, 6 NSTEMI and 3 UAP patients. These differences were not statistically significant.

3.3.2.4 Patient outcomes

The in-hospital mortality was 5.2% (n=11). All these patients suffered either a STEMI (n=9) or a NSTEMI (n=2). Twenty five patients (12%) required transfer to the coronary care unit (CCU) at Groote Schuur Hospital. Of these patients, two died in the CCU.

3.3.3 Patients admitted following overdose or poisoning

3.3.3.1 Patient demographics

A total of 92 patients were admitted following a drug or substance overdose or poisoning. This represented 10.7% of the total number of patients admitted to the HCU. There was a predominance of female patients (56.7%) and the mean age of the group was lower than other HCU admissions. (Table 3.9)

Table 3.9 Summary of overdose or poisoning patients as compared to other HCU admissions

	Overdose or poisoning (n= 92)	Other HCU patients (n= 767)	p value
Mean age (SD,95%CI) years	27.9 (12.1, 25.5-30.6)	47.4(16.3,46.2-48.5)	p<0.001
Mean APACHE II score (SD,95%CI)	9 (6, 8 – 10)	10 (7, 10 – 11)	p=0.08
Required mechanical ventilation	42%	29%	p<0.001
In- hospital mortality	3.3%	19.3%	p=0.001

The substances ingested varied widely, but prescription medication made up the majority (Figure 3.7). Tricyclic antidepressant therapy (TCA) (n=32), was the commonest prescription medication ingested. A detailed table of all the ingested substances can be found in Appendix I.

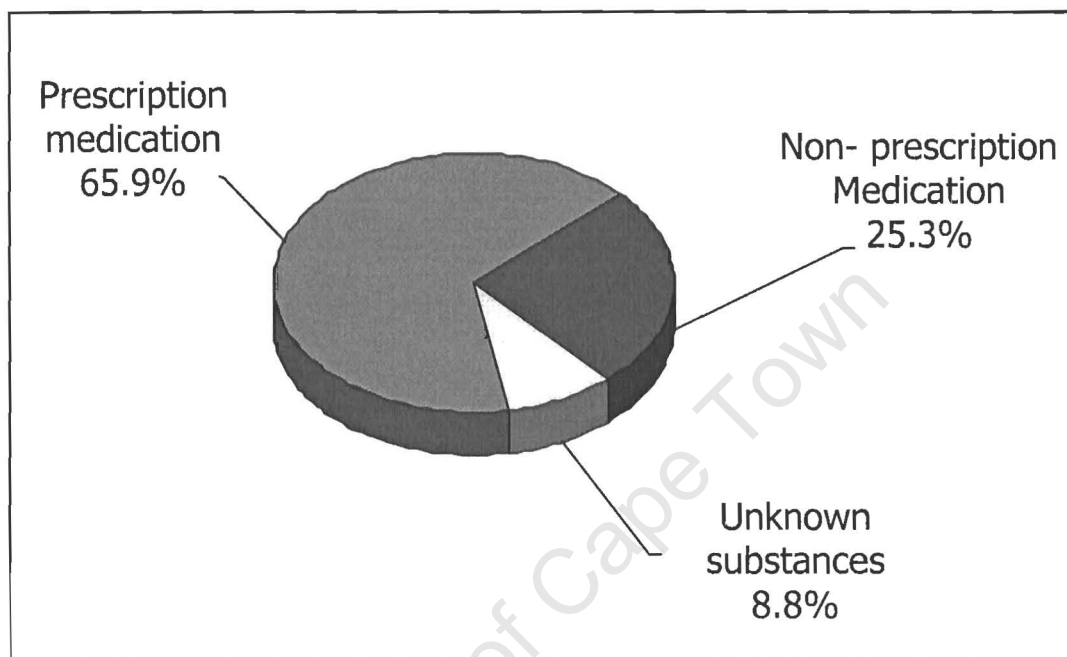


Figure 3.7 Substances ingested (accidental/intentional) by HCU admissions

3.3.3.2 Severity of illness

The mean APACHE II score for overdose or poisoning patients was not statistically different when compared to other HCU admissions (Table 3.9). The mean (SD, 95%CI) APACHE II score of the 39 patients (42%) who required ventilation was however significantly higher than for the non-ventilated overdose or poisoning patients 14 (4, 12 - 15) vs. 5 (5, 4 - 6) ($p < 0.001$).

Of these patients, 39 (18.3%) required ventilation. This represents the largest single diagnosis requiring ventilation during the study period. Over half (53.8%) of all overdose or poisoning patients who required mechanical ventilation had ingested TCA, this represented 65% of the patients admitted following ingestion of TCA therapy.

3.3.3.3 Patient outcomes

Three patients died in hospital following an overdose or poisoning. Five patients required transfer to another facility and a further nine patients were transferred for inpatient psychiatric care. The patients who died in hospital included one patient with a carbamazepine overdose, one following organophosphate ingestion and one presenting with warfarin toxicity. The in-hospital mortality was significantly lower in this group when compared to other HCU admissions (Table 3.9) Patients who required mechanical ventilation following TCA overdose (n=21) had a 100% survival.

3.3.4 Elderly patients

3.3.4.1 Patient demographics

Patients over the age of 65 years constituted 116 admissions (13.5%) The median age in this group was 70 years (range, 65 – 86years). (Table 3.10) Nearly two thirds (64.7%) were female.

Table 3.10 Summary of elderly patients compared to other HCU patients

	Admissions ≥ 65years (n=116)	Admissions < 65years (n=743)	p value
Mean age (SD,95%CI) years	71.1 (5.1, 70.2-72.0)	41.2 (14.4, 40.0-42.3)	p<0.001
Mean APACHE II score (SD,95%CI)	12 (7, 11-14)	10 (7, 9-10)	p<0.001
Required mechanical ventilation	19.8% (n=23)	25.6% (n=190)	p=0.18
In-hospital mortality	21.0% (n=25)	13.9% (n=102)	p=0.027

3.3.4.2 Diagnostic categories

The majority of patients (67.2%) were admitted following cardiovascular events, including stroke (n=78). Metabolic disorders, predominantly diabetic emergencies, accounted for a further 16 patients (13.8%). (Figure 3.8) Appendix J contains a detailed table of admission diagnoses for all elderly patients.

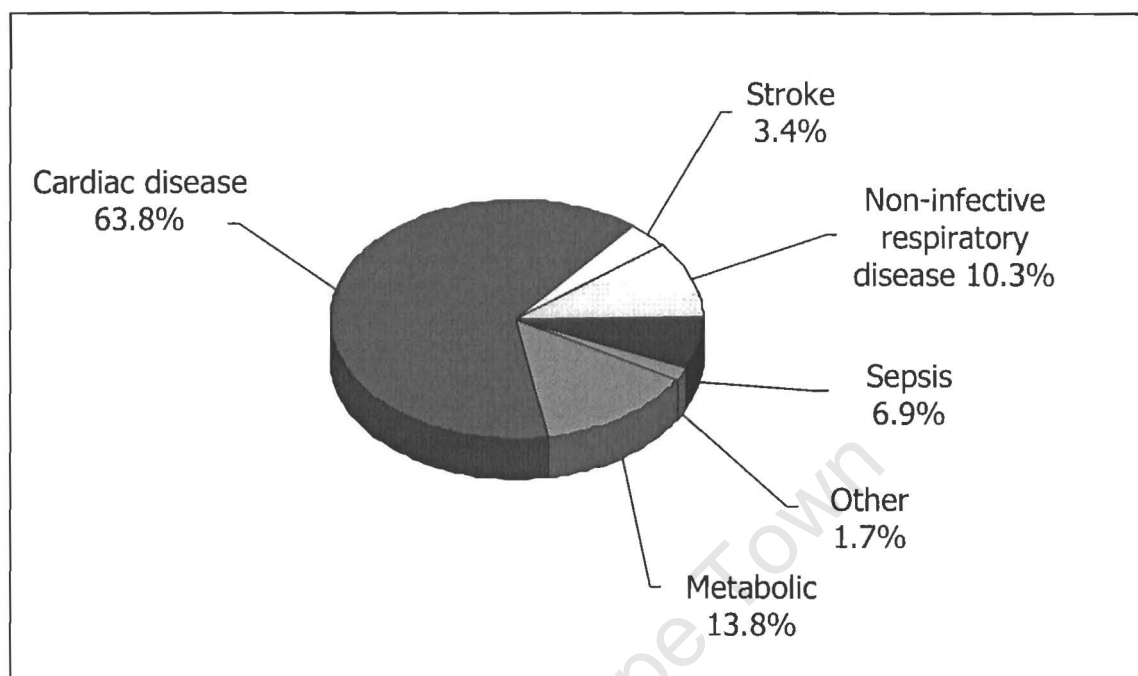


Figure 3.8 Diagnostic categories of elderly patients

3.3.4.2 Severity of illness

The mean APACHE II score for elderly patients was significantly higher than for younger patients. (Table 3.10) Mechanical ventilation was required by 23 of the 116 patients (19.8%). These patients had a significantly higher mean (SD, 95%CI) APACHE II score 19 (7, 16-23) as compared to non-ventilated elderly patients 11(7, 9 -12) ($p < 0.0001$).

3.3.4.3 Patient outcomes

The HCU mortality was 11.3% with a total in-hospital mortality of 21.5%. The in-hospital mortality in this group of patients was significantly higher than those aged under 65 years of age. (Table 3.10) Elderly patients requiring ventilation did not have a significantly higher mortality than younger patients; 52.7% vs. 36.8% ($p = 0.159$).

3.3.5 Mechanically ventilated patients

A total of 213 patients required mechanical ventilation during 2003. This represents 24.8% of the total medical patients admitted to the HCU.

3.3.5.1 Patient demographics

Mechanically ventilated patients were younger than patients not requiring ventilation and their length of stay was also slightly longer, 2.8 days vs. 2.3 days, although the difference did not exceed a full day in the HCU. (Table 3.11)

Table 3.11 Summary of mechanically ventilated patients

	Ventilated patients (n= 213)	Non-ventilated (n= 646)	p value
Mean age (SD,95%CI) years	41.6 (18.4, 38.7-44.6)	47.2 (17.5, 42.8-51.5)	p=0.004
Mean length of stay (SD,95%CI) days	2.8 (1.9, 2.6-3.1)	2.3 (1.5, 2.2-2.4)	p<0.0001
Mean APACHE II score (SD,95%CI)	16 (7, 15 - 17)	8 (6, 6 - 9)	p<0.0001
In-hospital mortality	38.5%	7.0%	p<0.0001

The largest diagnostic category of patients requiring mechanical ventilation were patients presenting with sepsis. More than half of these admissions were for pneumonia including tuberculosis and pneumocystis pneumonia. The remainder had meningitis or septic shock.

Overdoses or poisoning, acute non-infective respiratory disorders (acute severe asthma and COPD), acute metabolic disorders (diabetic emergencies) and acute cardiovascular disorders (stroke, pulmonary oedema and cardiogenic shock) were the other major groups requiring ventilation. (Figure 3.9) Appendix K contains a detailed table of all diagnostic groups requiring mechanical ventilation.

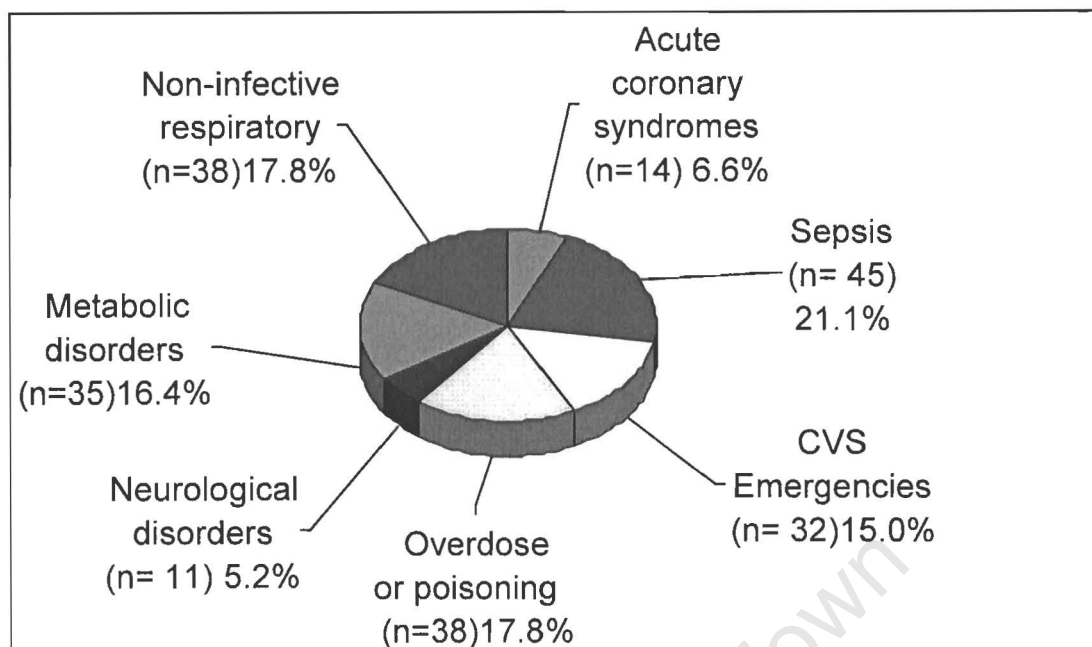


Figure 3.9 Patients requiring mechanical ventilation

3.3.5.2 Severity of illness

The mean APACHE II score for the mechanically ventilated patients was significantly higher than for the non-ventilated patients. (Table 3.11)

3.3.5.3 Patient outcomes

The majority of mechanically ventilated patients were managed in the HCU; only 37 patients (17.4%) required transfer to GSH for further treatment. This did however represent a greater number as compared to non-ventilated patients (9.9%). ($p < 0.003$)

The HCU mortality was 30.1%. The in-hospital mortality for mechanically ventilated patients was significantly higher than for non-ventilated patients. (Table 3.11) The mortality for the major diagnostic groups of patients requiring ventilation ranged widely. (Table 3.12) Appendix K contains a detailed table of hospital mortality data for all ventilated patients.

Table 3.12 In-hospital mortality of mechanically ventilated patients

	Number requiring mechanical ventilation	In-hospital mortality % (n)
Sepsis	45	62.2% (28)
Overdose or poisoning	38	5.3% (2)
Non-infective respiratory disorders	38	18.4% (22)
Metabolic disorders	35	62.9 % (22)
Acute cardiovascular disorders	32	43.8% (14)
Acute coronary syndromes	14	28.6% (4)
Acute neurological disorders	11	36.3% (4)

Patients who died on or following ventilatory support were older, significantly sicker with higher APACHE II scores and stayed longer in the HCU (Table 3.13). The group of patients with the lowest mortality were patients ventilated following TCA ingestion. All patients in this group survived. Patients who had a very poor outcome following mechanical ventilation are listed in Table 3.14.

Most of the patients in the acute cardiovascular disorder group who died had suffered a stroke (11 of 14). Diabetic emergencies accounted for 18 of 22 deaths in the metabolic disorder group. In the sepsis group, pneumonia(10), septic shock(9), meningitis(5) and pneumocystis pneumonia(3) had a bad outcome.

Table 3.13 Comparison of survivors and non-survivors following ventilation

	Ventilation survivors	Ventilation non- survivors	p value
Mean age (SD,95%CI) years	41.2(17.7, 38.4 – 44.1)	46.3 (16.3, 42.3 – 50.4)	p = 0.05
Mean APACHE II score (SD,95%CI)	15 (6, 14 – 16)	19 (8, 17 – 21)	p<0.0001
Mean length of stay (SD,95%CI) days	2.4 (2.0, 1.9 – 2.9)	3.0 (2.0, 2.7 – 3.3)	p = 0.05

Table 3.14 Patient groups, requiring mechanical, with a very poor outcome

Admission diagnosis	Patients ventilated	Patients transferred	In-hospital mortality (%)
Pneumonia	21	3	10 (47.6%)
Diabetic ketoacidosis	18	2	13 (72.2%)
Stroke	11	0	9 (81.8%)
Septic shock	10	1	9 (90%)
Meningitis	7	1	5 (71.5%)
Acute liver failure	6	3	3 (50%)
Pneumocystis pneumonia	4	0	3 (75%)

Chapter 4 Discussion

4.1 The HCU at GF Jooste Hospital

- 4.1.1 Workload
- 4.1.2 Level of service provision
- 4.1.3 Resources

4.2 HCU admissions

- 4.2.1 Patient demographics
- 4.2.2 Severity of illness and patient outcomes

4.3 Specific patient groups

- 4.3.1 Diabetic emergencies
- 4.3.2 Acute coronary syndromes
- 4.3.3 Overdoses and poisoning
- 4.3.4 Elderly patients
- 4.3.5 Patients requiring mechanical ventilation

4.1 The HCU at GF Jooste Hospital

4.1.1 Work load

The HCU at GF Jooste Hospital is a very busy unit, admitting nearly 90 patients a month with over 70 of these being medical admissions. The turnover of patients is high with the majority of patients admitted for less than 3 days. The total of 859 patients admitted during the 12-month audit period represents approximately 16% of the total medical admissions to the hospital. There is no record of the number of patients who were not admitted to the HCU due to a lack of beds. There is also no record of how many patients with a high MEWS were not admitted to the HCU due to a predicted poor outcome. From the available data it is however clear that the HCU facility provides an essential and probably inadequate service for the needs of the community.

4.1.2 Level of service provision

Categorising the GF Jooste Hospital HCU as either an intensive care unit or a high care unit is difficult. Based on the need for mechanical ventilation, widely regarded as an ICU admission criterion, the HCU provides intensive care support to over 200 medical patients per annum. This represents almost one quarter of all admissions. The APACHE II scores of these patients support the argument that they were critically ill. Critically ill non-ventilated diabetic patients, with a mean APACHE II score of 12, represent another group of patients being cared for at an ICU level. Together these patients represent 34.2% of admissions. Based on these data it is clear that this unit provides ICU level services for at least one third of admissions per annum.

4.1.3 Resources

This audit shows that the high care unit is not adequately staffed to function as a full intensive care unit, a service it provides for more than one third of admissions. There is a lack of ICU trained nursing staff, dedicated 24-hour medical personnel, technician support and invasive monitoring systems. The nurse to patient ratio of 1:2 is below that expected of an ICU, especially when considering that up to four of the eight patients may be ventilated at any one time. This is clearly not adequate for the level of service provided by the unit.

A major factor influencing the level of medical care provided is the availability of intensive care input by the consulting staff from Groote Schuur Hospital. This level of experience in intensive care management allows for early and accurate diagnoses, a critical care management plan and early referral to a tertiary level intensive care unit should this be deemed necessary.

4.2 HCU admissions

4.2.1 Patient demographics

The age of patients admitted to the HCU varied widely. The youngest patient aged 13 following a drug overdose and the oldest at age 86 with pulmonary oedema (both survived). The racial distribution reflects the community drained by GF Jooste Hospital with a few White patients being transferred to the HCU due to the lack of ICU or HCU beds at other institutions.

4.2.2 Severity of illness and patient outcomes

The HCU provides care for a heterogeneous population of patients. This audit focussed only on medical patients who made up the majority (80.3%) of admissions. The severity of illness varied considerably between patients with mild angina to multi-organ failure and septic shock. The HCU mortality was low at 10.7% (in-hospital 14.8%). Mechanically ventilated patients however had an in-patient mortality of 38.5%. As indicated in the literature review, published mortality figures for ICU admissions range between 15 and 38%.^(36;38;39;45)

It is however very difficult to compare the mortality data of the GFJH high care unit with reported local or international data. Case-mix variability between units and the varying severity of illness between patient groups are the principal factors that limit the validity of such comparisons.

One way of dealing with the difficulty encountered when trying to compare mortality data of the HCU with published data, is to categorise the study data into three groups: Patients with a low mortality (less than 10%), patients with a high mortality (more than

30%) and patients with a mortality ranging between 10 and 30%. Within these groups, specific disease outcomes in different units can then be compared, in order to define the quality of service provided in the HCU at GF Jooste Hospital.

Low mortality

Patients with an in-patient mortality of less than 10% could be considered to be appropriate HCU admissions. They represented 39.5% of all admissions and constituted mainly acute coronary syndromes and overdoses or poisonings. Their mortality rate (4.7%) was lower than the in-patient mortality for all GF Jooste Hospital medical admissions (15%).⁽⁵⁹⁾ These patients did not require the services of a fully equipped intensive care unit.

A sub-group of these patients, namely those admitted following drug overdoses or poisoning had a very low overall mortality despite their need for mechanical ventilation. These patients would have had a significantly higher mortality if mechanical ventilation was not available at GF Jooste Hospital. These patients could not be managed in a general ward. The ability to manage these patients appropriately at the secondary level reduced the pressure on tertiary ICU beds and limited the numbers of patient transfers between hospitals.

High mortality

The second group of patients are those with a very poor outcome; an in-patient mortality of greater than 30%. Patients with sepsis made up most of this group and comprised 10.6% of all admissions. Specific subgroups of patients requiring mechanical ventilation also had a greater than 30% mortality. These included stroke, DKA, hypoglycaemia and status epilepsy. The combined mortality of this group was 41.7%. The poor outcome in this group may be related to many factors.

Firstly, certain disease groups are known to have a high ICU mortality, e.g. the expected mortality for severe pneumonia requiring ventilation is reported to be between 22 and 54%,⁽⁷⁰⁻⁷²⁾ acute severe asthma or COPD requiring ventilation has an ICU mortality ranging from 8 to 22%.⁽⁷³⁻⁷⁵⁾ The GF Jooste in-hospital mortality for these groups was 47.6% and 15% respectively. The unit is thus providing a level of care for

these critically ill patients with an outcome in keeping with internationally published ICU outcomes for such groups.

Secondly, the admission of critically ill patients who have a poor outcome despite good care e.g. patients with septic shock have an expected mortality of 30 to 50% despite the full services of an ICU.^(71;76;77) In the GFJH HCU these patients had a mortality rate in excess of 70%. This reflects the limited ability of the unit to provide adequate care for such severely ill patients. Nearly 50% of these critically ill ventilated patients died within 24 hours of admission, an indication of their critical condition on arrival. The significant difference in APACHE II scores between ventilation survivors and non-survivors further supports this concept. Many ICUs may refuse admission to such severely ill patients if the expected outcome is thought to be poor and admission is regarded as futile.^(3;5;78;79)

Strict selection criteria are needed for such groups to prevent consumption of limited resources by patients with poor expected outcomes. The unavailability of tertiary ICU beds or the inability to transfer these critically ill patients to a tertiary level ICU may have resulted in their admission to the HCU at GFJH despite their need for ICU care. Guidelines for such admissions need to be developed.

Thirdly, the admission of gravely ill patients by junior clinicians after-hours. The current GF Jooste Hospital policy permits junior doctors, less than 5 years post registration, to admit critically ill patients directly to the HCU after hours. This policy obviates the need for junior doctors to make critical management decisions beyond their level of experience and training. The final decision to withdraw active management is deferred until senior staff conduct ward rounds the following morning. This decision is most often made in consultation with a Groote Schuur Hospital ICU consultant who may suggest withdrawal of therapy if further intensive care is deemed futile. From an audit perspective this "permissive" admission policy tends to overestimate the HCU mortality due to inappropriate admissions. However, given the available staff resources, the policy is appropriate.

Intermediate mortality

The third group of patients, 49.9% of cases, with a mortality rate between 10 and 30% reflects the unit's ability to provide a varying level of care, based on demand. The major diagnoses included in this group were: acute cardiovascular disorders (pulmonary oedema, cardiomyopathy and malignant hypertension), acute neurological disorders (uncontrolled epilepsy and Guillain-Barré syndrome), acute metabolic disorders (non-ventilated diabetic patients and electrolyte abnormalities) and acute non-infective respiratory disorders (asthma and COPD). The combined mortality of this group was 14.2%.

The flexibility to ventilate patients if required and to provide a degree of intensive care with organ support and close monitoring is vital for this group of patients. These patients received excellent care in a HCU environment; often they received care beyond that expected of a high care unit e.g. mechanical ventilation. Their admission to a HCU at a secondary level hospital significantly reduced the pressure on critical care beds at the tertiary level.

4.3 Specific patient groups

4.3.1 Diabetic emergencies

The management of diabetic emergencies forms a major component of the service provided by the HCU; more than one quarter of admissions over the 12-month audit period. Previous surveys conducted at the Chris Hani Baragwanath Hospital in Gauteng and Groote Schuur Hospital in Cape Town showed a similarly high prevalence of diabetic emergencies among medical admissions: 60 patients in a 2-month study,⁽⁸⁰⁾ 48 patients in 2 months⁽⁸¹⁾ and 131 patients in 5 months.⁽⁶¹⁾

These figures can be compared to reports from other international institutions e.g. the MedStar Research Institute in Washington DC, admitted 260 patients with DKA to an urban teaching hospital over a 3.5 year period⁽⁸²⁾ and the Austin and Repatriation Medical Centre in Victoria Australia, recorded 312 admissions over 13years.⁽⁸³⁾ Reasons for the large numbers of diabetic emergencies presenting to GFJH were not explored in this audit. This group of patients however represents a high risk group who require

specific study and targeted intervention to reduce the number of admissions and potential long term morbidity.

The HCU clearly provides an excellent service to patients with DKA, including the 58% with severe DKA. The mortality in the DKA patients was 9.4%. If one excludes the 11 patients who were ventilated with severe septic shock and died, the overall mortality figure is 2.5%. This compares very favourably with local and international published mortality rates for all DKA patients that range from 2.5% to 11%.^(61;80;81;83-85)

Patients with a diagnosis of DKA who required ventilation had an in-hospital mortality of over 70%. Why this particular group of patients had such a high mortality is unclear from the audit data, but may be attributed to severe sepsis in the setting of severe DKA. This mortality is however higher than that usually expected for severe sepsis (up to 50%).⁽⁷¹⁾ This may reflect the HCU's limited ability to provide adequate multi-organ monitoring and support for such critically ill patients who would best be treated in an ICU with multi-organ monitoring and support. The availability of an ICU bed at the time of admission, or the feasibility of transferring these critically ill patients during admission, could not be determined from the audit data.

4.3.2 Acute coronary syndromes

The audit data did not provide an accurate case definition of patients with acute coronary syndromes. This limits the comparison of results to other units. ECGs were not reviewed by a cardiologist, accurate recording of levels of ST elevation or depression was not done and sensitive laboratory markers of myocardial damage such as troponin-t were not available. This audit does however reflect the management of patients with acute coronary syndromes in the hospital based on the data available to the doctor.

It is evident from the audit results that the emergency care of patients presenting with myocardial ischemia could be improved. It is well known from the international literature, including published guidelines that early intervention with thrombolytic agents in patients with ST-elevation myocardial infarction (STEMI) is vital to improve patient outcome.⁽⁸⁶⁾ Of the 90 patients documented to have an STEMI only 40 received thrombolysis with a median duration of chest pain, prior to lysis, of 5 hours. The reasons for the delay in instituting or withholding thrombolytic therapy were not

addressed in this audit. This early management takes place in the Emergency Unit prior to admission to the HCU and has to be addressed at that level.

There are many trials evaluating the benefit of medical treatment following acute myocardial infarction. These trials have included the use of drugs such as aspirin, beta-blockers, ACE inhibitors, nitrates, HMG Co-A reductase inhibitors (statins) and platelet inhibitors.^(65;87-91) Based on current recommendations patients should ideally be treated with aspirin, a beta-blocker and an ACE inhibitor following a myocardial infarct.^(87;90;91) The majority of patients admitted to the HCU following an ischemic event received these drugs. The regular prescription of post-ischemic event medication reflects the high level of care provided within the HCU. Patients did not receive lipid-lowering drugs as they were not available in the hospital at the time of the audit. More recently lipid-lowering drugs have become available for routine use in patients with acute coronary syndromes.

There was a high prevalence of modifiable risk factors in patients admitted with acute coronary syndromes. Lifestyle changes including smoking cessation and appropriate treatment of hypertension and diabetes need to be instituted as secondary prevention measures.

4.3.3 Overdoses or poisoning

The vast majority of patients admitted in the poisoning or overdose category had ingested prescription drugs. The most frequently ingested medication was TCA therapy. Although almost half of all overdose or poisoning patients required mechanical ventilation, the outcome was favourable in 96.7%. This low mortality is comparable to internationally reported mortality outcomes ranging from 4.4 to 18.2%.⁽⁹²⁻⁹⁴⁾

Without the ability of the HCU to successfully support these patients (18% of ventilated patients) they would all have required transfer to GSH ICU for ventilation. These patients had a short length of stay in the HCU with an excellent outcome. This supports the need for short-term ventilation facilities at secondary level hospitals in South Africa.

4.3.4 Elderly patients

Elderly patients may be denied admission to intensive care units as younger patients take precedence for admission.^(12;17;95) The audit data shows that over 13% of all HCU admissions were elderly. Not unexpectedly the overall outcome of these elderly patients was worse than for the younger patients; mortality of 21.5% vs.13.9%. The in-hospital mortality of elderly HCU admissions however compares favourably to reported outcomes in elderly patients in ICUs which range from 20 to 50%.^(10;12;14;17;18) The ability to accurately compare these data is however limited by the lack of definition of case-mix of patients, selection criteria and level of service provided, for e.g. dialysis, in different centres. It has been shown that the post-discharge long-term outcome of elderly patients, particularly of the very elderly (>85 years) is worse than the younger patients.⁽⁶⁷⁾ This audit did not study long term outcome in these patients.

4.3.5 Patients requiring mechanical ventilation

Nearly 25% of all patients admitted to the HCU required mechanical ventilation. The overall outcome for ventilated patients is comparable to published outcomes, as previously discussed. The largest group of patients requiring mechanical ventilation, those admitted following poisoning (accidental or intentional), had the lowest mortality. The patients requiring mechanical ventilation for pneumocystis pneumonia, stroke, septic shock, DKA or meningitis all had an in-hospital mortality rate of over 70%. Possible reasons for the excessively high mortality in these patients have already been discussed. The admission of these patients may need to be reviewed in order to prevent inappropriate resources being spent.

Chapter 5 Conclusions and recommendations

5.1 Overall services

- 5.1.1 Service provision at secondary level
- 5.1.2 Patient outcomes
- 5.1.3 Resources
- 5.1.4 Consultant staff

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- 5.3.6 Critically ill and ventilated patients
- 5.3.7 Impact of Human Immunodeficiency Virus (HIV)

University of Cape Town

5.1 Overall services

5.1.1 Service provision at secondary level

The GF Jooste Hospital HCU provides care for a large number of patients presenting with a variety of medical disorders and a wide range of illness severity. The unit operates as a high care unit but also cares for many critically ill patients. By providing both high care and limited intensive care services, the unit plays a critical role in service provision to the sickest patients presenting to the hospital. This is reflected by the fact that 16% of all medical admissions were admitted to the HCU and 25% of all HCU admissions required mechanical ventilation. The ability to mechanically ventilate over 200 patients a year significantly impacts on the broader health care service provision needs by reducing the load on tertiary services that would otherwise have been required to admit these patients.

5.1.2 Patient outcomes

The HCU has a low overall mortality of 10.7%. Individual groups of patients have widely differing mortality rates depending on the admitting diagnosis. The very low mortality (less than 5%) for non-ventilated patients, in contrast to the greater than 30% mortality for the sickest patients, may reflect the limited ability of the unit to significantly alter outcome in the very ill. These severely ill patients may have had a better outcome if transfer to a fully staffed and equipped intensive care unit was possible.

5.1.3 Resources

The unit's current staff and equipment resources limit the level of service that the unit is able to provide. Improved nurse to patient ratios, full-time medical cover and ICU training of nursing staff are justified given the type of service demands made on the unit. This should also improve the quality of service provided to critically ill patients.

5.1.4 Consultant staff

The regular input of specialist physicians, in particular GSH intensivists, plays a vital role in the overall function of the unit. Firstly, by providing expert advice on critically ill patients and optimizing their management in the unit. Secondly, by the early identification of patients who require or would benefit from transfer to a tertiary level

ICU. Thirdly, the opinion of experienced specialist physicians enables the staff to make critical decisions regarding withdrawal of therapy for patients whose outcome is expected to be poor. This level of input, limits prolonged and costly attempts at patient care in a resource constrained environment.

5.2 Limitations of the study

This prospective audit focussed on patients admitted to the HCU and the service provided. Accurate documentation of demand was not undertaken, nor an assessment of the impact on patient transfer to the tertiary level. To fully establish the HCU's role in the broader health care service further studies looking at these aspects are required.

Despite the use of data capture sheets and collection protocols, data collection was not always complete or accurate. This may reflect the high turnover of medical staff or the lack of a dedicated data collector. The hospital records department was also undergoing refurbishment during this time which prevented the retrieval of all hospital records post discharge to complete missing data.

The audit broadly evaluated the overall function of the unit with specific focus on certain areas. It is evident from the results that certain data points were not defined accurately enough making interpretation and comparison of some data difficult. This was particularly evident in the acute coronary syndrome group. Similarly the lack of information regarding the exact nature of overdoses and poisonings may reflect clinician inability to obtain this information from confused ill patients on admission. Future studies should include accurate diagnostic criteria and use of International Classification of Disease (ICD) codes.

The APACHE II severity scoring system used to score severity of illness is a well established and validated measure. Unfortunately in this audit all data points were not always recorded, leading to an under-estimation of patient illness severity. The Modified Early Warning Score of patients admitted to the HCU was not documented as part of the audit. The MEWS and APACHE II scores could thus not be compared, making comparison of the severity of illness of ward patients with the non-ventilated

HCU patients impossible. Such a study would permit comparison of the outcome of patients, with identical MEWS, managed in the HCU as compared to the general ward. It would also identify patients admitted to the ward who may have benefited from admission to the HCU.

5.3 Specific recommendations and future research

5.3.1 Demand on beds

A better assessment of the demand for HCU beds and refusal of admissions due to bed unavailability needs to be undertaken. This will help to clearly define the extent of the demand for critical care services at the secondary level. It will also aid in the development of admission policies as outcomes for similar patients could be compared following admission to the HCU or general ward. Further assessment of admissions due to a lack of tertiary ICU beds, would further highlight the role played in reducing pressure on tertiary intensive care units.

5.3.2 Long term outcome

The impact on short term survival has been clearly demonstrated with a low overall mortality in the majority of patients. The long term outcome of HCU survivors is not known. This is particularly important in two subgroups, namely, elderly patients and critically ill or ventilated patients. If the long term outcome (three to six months) of these patients is found to be poor then the appropriateness of admitting such patients to the unit may need to be reviewed.

5.3.3 Diabetic emergencies

The large number of patients admitted with DKA is of concern. The precipitating causes for admission to the HCU was not audited, but the large number of readmissions may reflect inadequate care in the community. Precipitating factors, be they poor compliance, lack of education or understanding about the disease, poor provision of insulin, glucose monitoring or delayed referral need to be identified. Those patients requiring recurrent admission need to be targeted for strategic intervention. In addition a study of DKA patients requiring ventilation should be undertaken to identify reasons for the high mortality in this group.

5.3.4 Acute coronary syndromes

It is clear from the audit data that accurate definitions and the management of these patients needs to be improved. The reasons for delay or withholding of therapy, particularly thrombolysis, needs to be investigated. This area of patient care falls within the scope of the Emergency Unit. A joint study of pre-hospital and Emergency Unit service provision should be undertaken. Patients admitted with unstable angina had a universally good outcome. The use of high care beds for these stable patients with chest pain syndromes may not be an optimal use of resources given the service demands of the unit. This should be reviewed.

5.3.5 Drug overdoses and poisoning

This group of patients formed a major work load for the HCU with many patients requiring ventilation following ingestion of neurotropic drugs such as tricyclic antidepressants. An awareness campaign at the primary care level needs to be undertaken to educate medical staff and patients about the potential fatal outcome following ingestion of these agents. Whether provision of smaller quantities of these drugs, or alternative medication is feasible, needs to be investigated.

5.3.6 Critically ill and ventilated patients

A significant number of severely ill patients were admitted to the HCU during the audit period. Based on the current audit, early identification of patients who are critically ill and require transfer to a more appropriate level of care may improve outcome. Routine APACHE II scores and close liaison with the GSH intensive care unit staff should facilitate identification of patients who should be managed at a tertiary level. Ventilation of patients with low APACHE II scores and those patients requiring ventilation following drug overdose has been shown to have a good outcome; this service should be maintained at GF Jooste Hospital.

5.3.7 Impact of HIV

Routine testing for HIV infection is not done for HCU admissions. As the GF Jooste Hospital HIV Clinic increases the awareness and enrolment of patients on anti-retroviral therapy, the number of patients known to be HIV positive can be expected to increase. It is probable that the number of HIV-positive patients admitted to the HCU will increase as the availability of HAART increases. Patients previously refused admission to

the HCU with advanced HIV and no prospect of anti-retroviral therapy may now be admitted to the HCU with acute inter-current illness prior to commencement of HAART. These patients, and increasing numbers of patients developing complications of antiretroviral therapy, such as lactic acidosis, may also require admission in future. A prospective study of these patient requirements needs to be done. The impact on service provision is likely to be significant.

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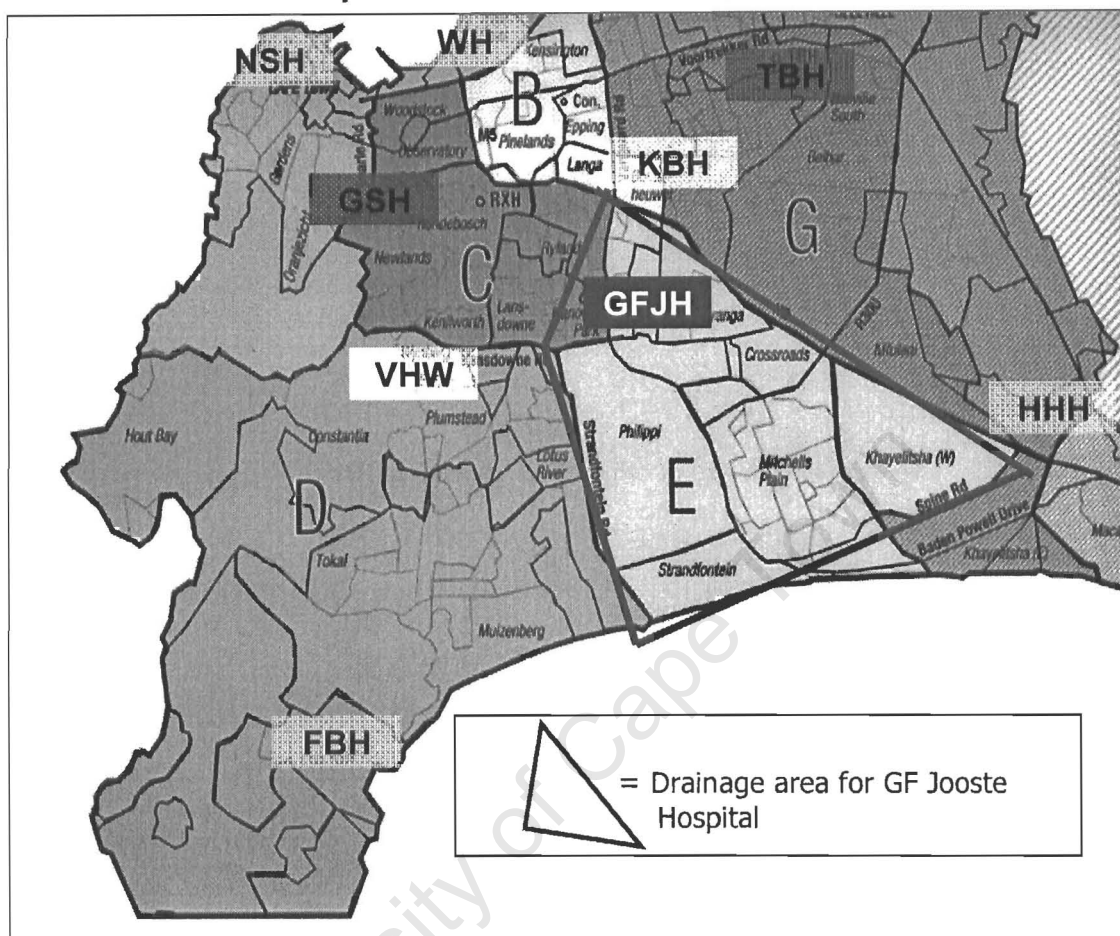
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Intensive Care and High Care units in the Cape Town Metropole



Hospital	Adult beds	Level of ICU/HCU	Beds (ventilated)
FBH = False Bay	65	No ICU/HCU	0
GFJH = GF Jooste	224	HCU	8 (4)
GSH = Grootte Schuur	819	Level I ICU plus HCU	57 (32)
HHH = Hottentots Holland	85	HCU	3 (1)
KBH = Karl Bremner	193	HCU	4 (0)
NSH = Somerset Hospital	215	Level III ICU	4 (4)
TBH = Tygerberg	1030	Level I ICU plus HCU	108 (42)
VHW = Victoria	130	HCU	2 (2)
WH = Wesfleur	27	No ICU/HCU	0

Bed numbers are based on figures reported by the superintends of the individual hospitals and include specialized units such as Burns Unit, Haematology Isolation Unit, Coronary Care Unit and Renal Transplant Unit.

Modified Early Warning Score

	3	2	1	0	1	2	3
Systolic BP	< 70	71-80	81-100	101-199		≥ 200	
Heart rate		< 40	41-50	51-100	101-110	111-129	≥ 130
Resp rate		< 9		9-14	15-20	21-29	≥ 30
Temp		< 35		35-38.4		≥ 38.5	
AVPU				Alert	Voice	Pain	Unresp.

GF JOOSTE HOSPITAL HIGH CARE UNIT WORK SHEET
(Managed by or referred to Department of Medicine)

1. Number:
2. Initials
3. First Name:
4. Surname:
5. Age:
6. Sex: M F
7. Race: C B I W
8. Folder Number:
9. Date Admitted
10. Date discharged: Home Ward
11. Number of Days:
12. Diagnoses:
 - a. Diagnosis 1:
 - b. Diagnosis 2:
 - c. Diagnosis 3:
 - d. Diagnosis 4
 - e. Diagnosis 5
 - f. HIV: Pos Neg Unk
13. Survived High Care: Y N
14. Survived hospital: Y N
15. Transferred to another Hospital:
 - a. N Y
 - b. Destination:
 - c. Reason:
 - d. Outcome: S D
16. Died:
 - a. N Y
 - b. Preventable: N Y
 - c. Treatment withdrawn: N Y Reason:
 - d. Cause:

17. Ventilation:

- a. Y N
- b. Indication:
- c. Tube Y N Trache Y N
- d. Days:
- e. Complications Y N
 - i. Complication 1:
 - ii. Complication 2:
 - iii. Complication 3:
 - iv. Complication 4:
- f. CPAP Y N

18. DKA etc:

- a. New Y N
- b. Number previous admissions: Time period:
- c. PH:
- d. BE:
- e. Blood Glucose:
- f. Serum Sodium:
- g. Ketones pos: Y N
- h. WCC:
- i. Precipitating event:
- j. Diabetic Complications:
- k. Current Smoker: Y N
- l. Ex Smoker: Y N
- m. Pack Years:
- n. Alcohol: binge drinker Y N excessive daily alcohol Y N
- o. Dwelling:
- p. Employment:
- q. Previous treatment:
- r. Previous attendance as GSH Diabetic Clinic or other facility: Y N
- s. Referral: GSH Diabetic Clinic: Y N Day Hospital Y N Other Y N
- t. Discharge diabetic medication:

19. Acute Coronary syndrome:
- a. ST elevation: Y N
 - b. ST depression: Y N
 - c. CK:
 - d. Total Cholesterol LDL HDL TG
 - e. Risk Factors
 - i. Family History: Y N
 - ii. Cigarette Smoking: Current Y N Ex: Y N Pack years
 - iii. Diabetes: Y N
 - iv. Hypertension: Y N
 - v. Hyperlipidaemia: Y N
 - f. SK: Y N Dose: Hours from onset of chest pain:
 - g. Heparin Y N Aspirin Y N Beta-blocker Y N ACE Y N Warfarin Y N
Other Y N
 - h. Complications:
 - i. Complication 1:
 - ii. Complication 2:
 - iii. Complication 3:
 - iv. Complication 4:
 - i. Referral
20. Overdose/Poisoning:
- a. Type OD Y N Poisoning: Y N
 - b. Compound:
 - c. Complications:
 - i. Complication 1:
 - ii. Complication 2:
 - iii. Complication 3:
 - d. Referral
21. APACHE 2 Score:
- a. Temperature:
 - b. Mean arterial pressure (2XDBP+SBP divided by 3)
 - c. Heart Rate:
 - d. Respiratory rate:
 - e. FiO₂ >50% record A-a gradient
FiO₂ <50% record PaO₂
 - f. PH or serum HCO₃ if no blood gases:
 - g. Serum Sodium
 - h. Serum potassium
 - i. Serum creatinine:
 - j. Haematocrit % or HB
 - k. White cell Count
 - l. Neuro Point Score
 - m. Age score
 - n. Chronic Health Point Score:
 - o. Total:

Explanations of Data capture Sheet

The data capture sheet was created prior to the audit, and contains both information on basic patient demographics and specific medical conditions:

Item

1- (Number) Unique Database identification number

2 - 6 Patient details

7- (Race)

Race classification is based on the four defined race classes, and was based on hospital records and attending doctor's assessment.

8- (Folder number) GF Jooste Hospital folder number

9 - 10 Dates based on day of admission and discharge/transfer

11- (No. of days)

The length of stay was calculated to the nearest day, and where admissions were shorter than 24 hours, it was calculated as a fraction of a day.

12 a-e (Diagnoses)

The primary diagnosis was based on the admitting doctor's diagnosis and consultant opinion on the following day's post intake ward round. Accuracy of these diagnoses was checked, where possible with supporting laboratory data e.g. Diabetic ketoacidosis.

The primary diagnosis was converted into an alphabetical code prior to entering onto the database. (Due to the size of the ICD 10 Classification system, a unique table of codes was established for the purpose of this audit. These codes were based on the original diagnosis.

f- (HIV)

Routine HIV testing is not undertaken prior to admission to the HCU. The HIV status was recorded based on the best knowledge of the patient or attending doctor and if needed, informed consent was undertaken prior to testing. The completed records were filed and specific data regarding HIV status was deleted from the original once the data had been entered. The data pertaining to HIV status is stored on a second password protected database.

13- (Survived High care unit) Survival defined as transfer to ward or another hospital.

14- (Survived hospital)

Hospital survival defined as discharge home or transfer to another hospital. Survival of patients transferred to the ward was determined by the recorded outcome in the relevant ward's admission book.

15- (Transferred to another Hospital)

Information on transfer outcome was sought from the relevant hospital's admission records.

16 a-d (Died)

Cause for death and whether death was preventable was based on attending doctor's opinion or post mortem if requested. (Only deaths that occurred in the HCU.)

17- (Ventilation) Defined as requiring intubation and mechanical ventilation.

18 a-t (DKA)

Laboratory data was gathered from laboratory records. Other information recorded was based on records available and information reported by the patient.

19 a-g (Acute coronary syndrome)

ECG criteria were documented by the attending doctor. Treatment given was recorded as per nursing/doctors notes.

20 a-d (Overdose/poisoning)

Definitions of poisoning versus overdose, was based on the attending doctor's opinion and that subsequently reported by the patient.

21 a-o (APACHE II score)

The standard APACHE II scoring chart was used. Any data not available was recorded as zero.

Apache II score

		4	3	2	1	0	1	2	3	4	Score	
Temperature	° C	>40	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	<30		
MAP	mmHg	>159	130-159	110-129		70-109		50-69		<50		
Heart rate	bpm	>179	140-179	110-139		70-109		55-69	40-54	<40		
Respiratory rate	bpm	>49	35-49		25-34	12-24	10-11	6-9		<6		
Oxygenation												
FiO ₂ >0.5 AaDO ₂	mmHg	>499	350-499	200-349		<200						
FiO ₂ <0.5 PaO ₂	kPa				PaO₂	>9.3	8.1-9.3		7.3-8	<7.3		
Arterial pH		>7.69	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15		
Se HCO ₃ if no ABG	mmol/L	>51.9	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15		
Serum sodium	mmol/L	>179	160-179	155-159	150-154	130-149		120-129	111-119	<111		
Serum potassium	mmol/L	>6.9	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5		
Serum creatinine *	mg/100ml	> 3.5	2 - 3.4	1.5 - 1.9		0.6 - 1.4		< 0.6				
Dble points for ARF	umol/l	>305	170-304	130-169		54-129		<54				
Haematocrit	%	>59.9		50-59.9	46-49.9	30-45.9		20-29.9		<20		
HB		>19.9		16.7-19.9	15.4-16.6	10-15.3		6.7-9.9		<6.7		
Total WCC	x 10 ⁹ /L	>39.9		20-39.9	15-19.9	3-14.9		1-2.9		<1		
GCS points	Neurologic points=15-GCS											
Total of APS all of the above 12 variables												
Age points	<44	0	45-54	2	55-64	3	65-74	5	Total APS =			
Chronic health points	Non-operative or emergency 5					Elective post-op 2			>74 6			
Total APACHE II	APS + Age points + Chronic Health points					Neither 0						

UNIVERSITY OF CAPE TOWN



Research Ethics Committee
E53 Room 44.1, Old Main Building Groote
Schaar Hospital, Observatory, 7925
Queries : Xolile Fula
Tel : (021) 406-6492 Fax: 406-6411
E-mail : Xfula@cure.uct.ac.za

20 July 2004

REC REF: 150/2004

Dr R van Zyl-Smit
20 Cleveland Road
Claremont
7708

Dear Dr van Zyl-Smit

AUDIT OF ALL MEDICAL ADMISSIONS TO GF JOOSTE HOSPITAL HIGH CARE UNIT IN 2003

Thank you for your letter to the Research Ethics Committee dated 15 July 2004.

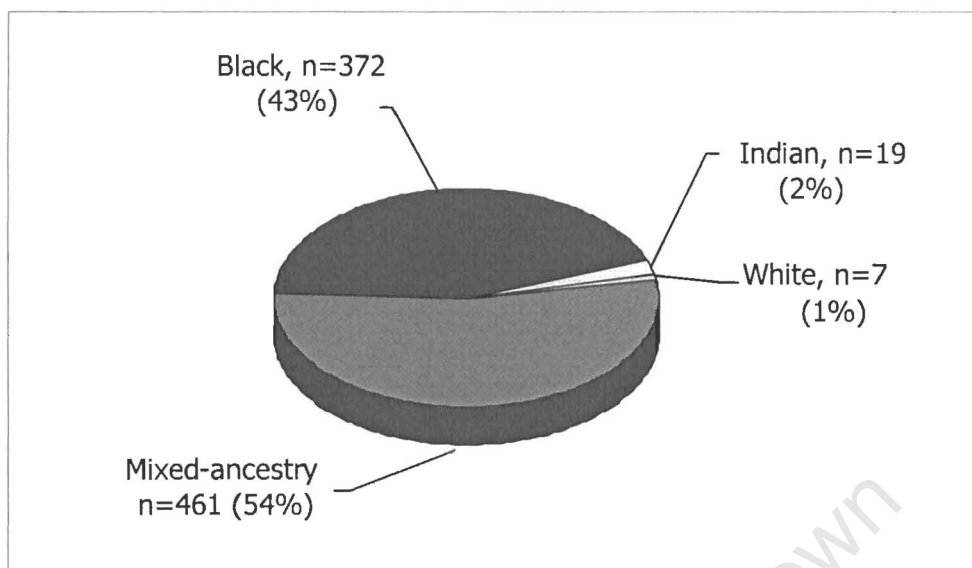
It is a pleasure to inform you that the research Ethics Committee has formally approved the above mentioned study.

Please quote the REC. REF in all your correspondence

Yours sincerely

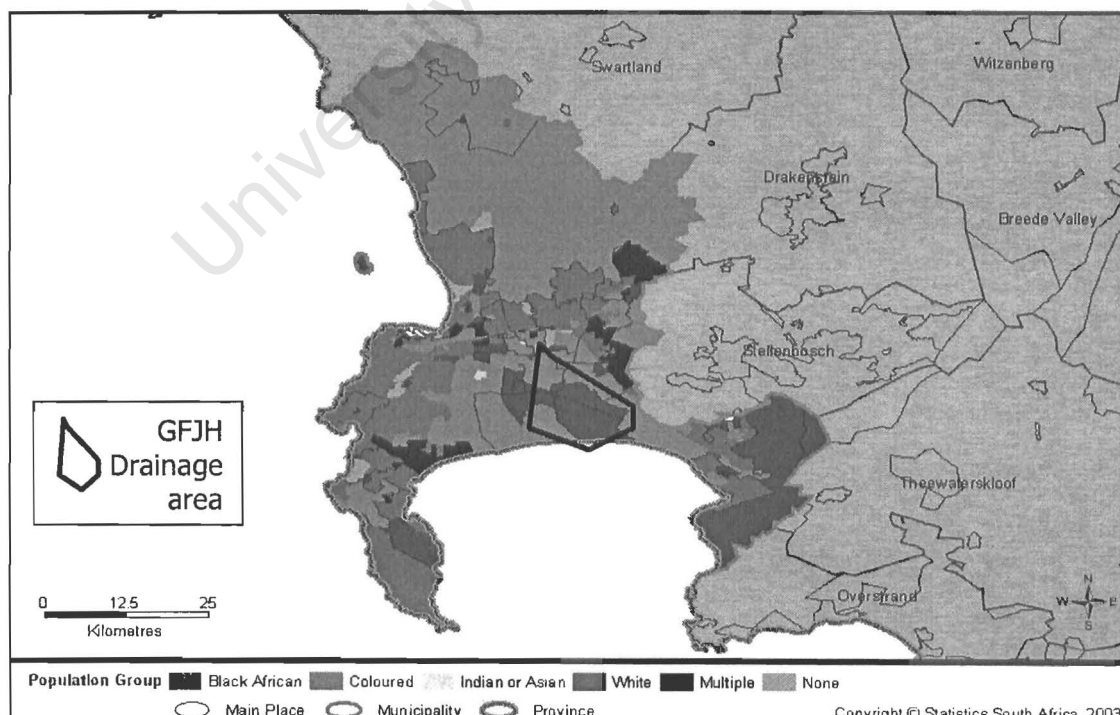

PROF T ZABOW
CHAIRPERSON

Ethnic Break down of Patients



	Total (%)	Black	Mixed-ancestry	Indian	White
Male	389 (45.3%)	157 (40.4%)	213 (54.8%)	13 (3.3%)	6 (1.5%)
Female	470 (54.7%)	215 (45.7%)	248 (52.5%)	6 (1.3%)	1 (0.2%)
Overall	859	372 (43.3%)	461 (53.6%)	19 (2.2%)	7 (0.8)

Predominant population group by area

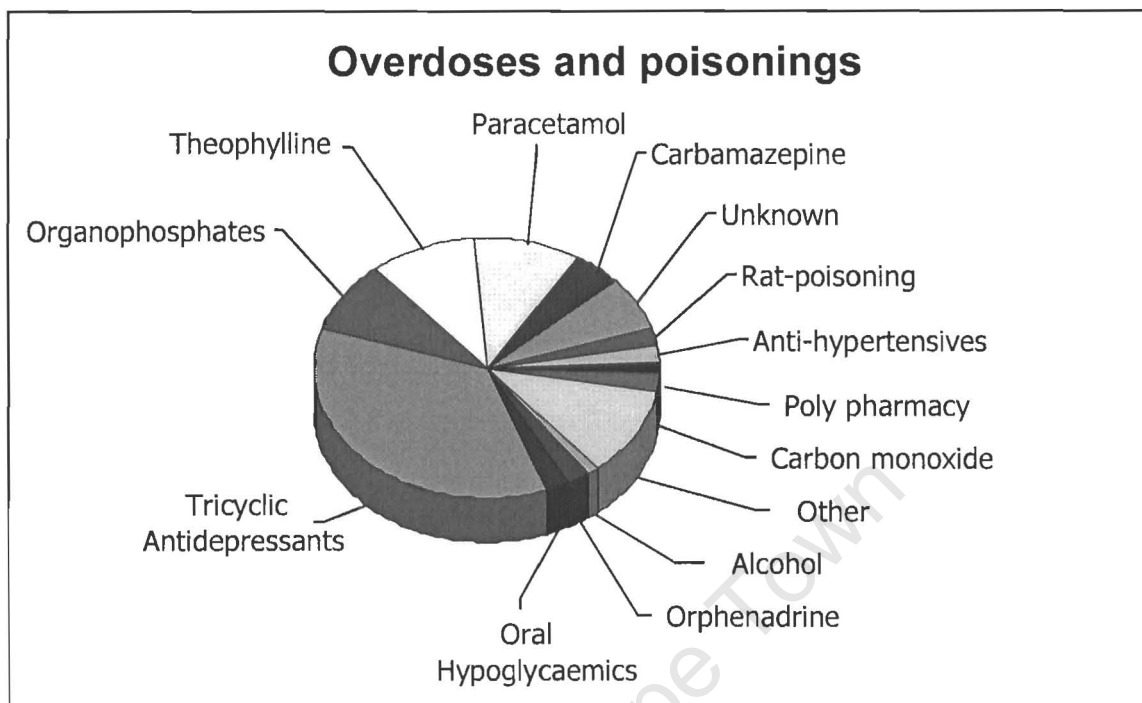


List of Admission* diagnoses and outcome

Diagnosis	Number of patients	HCU mortality (%)	In-Hospital mortality (%)
Acute coronary syndrome	247	13 (5.3%)	13 (5.3%)
Acute liver failure	7	3 (42.9%)	3 (42.9%)
Acute severe asthma & COPD	70	6 (8.6%)	7 (10%)
Anaemia	1	0	0
Cardiac arrhythmia	9	0	0
Cardiogenic shock	4	4 (100%)	4 (100%)
Cardiomyopathy	6	1 (16.7%)	1 (16.7%)
Cor pulmonale	3	1 (33.3%)	1 (33.3%)
DKA (Diabetic ketoacidosis)	202	19 (9.4%)	25 (12.4%)
Electrolyte abnormalities	3	1 (33.3%)	1 (33.3%)
Encephalopathy	1	0	0
Enteritis	1	0	0
Gullaine Barré syndrome	3	1 (33.3%)	1 (33.3%)
HONK (Diabetic hyperosmolar)	18	2 (11.1%)	4 (22.2%)
Hypoglycaemia	9	1 (11.1%)	3 (33.3%)
Lactic acidosis	1	0	0
Malignant hypertension	6	1 (16.6%)	2 (33.3%)
Meningitis	12	6 (50%)	7 (58%)
Myasthenia gravis	1	0	0
Neuropathy	1	0	0
Overdose/ poisoning	92	2 (2.2%)	3 (3.2%)
PCP(pneumocystis jiroveci)	4	1 (25%)	3 (75%)
Pericardial effusion	3	0	0
Pneumonia	53	12 (22.6%)	15 (28.3%)
Pulmonary embolism	2	0	0
Pulmonary oedema (cardiogenic)	35	2 (5.8%)	4 (11.4%)
Pulmonary oedema (renal failure)	4	0	1 (25%)
Pulmonary oedema (neurogenic)	1	0	0
Pulmonary tuberculosis	4	1 (25%)	1 (25%)
Renal failure	11	1 (9.1%)	1 (9%)
Respiratory arrest	2	0	0
Septic shock & septicaemia	14	8 (57.1%)	11 (78.6%)
Severe malaria	2	0	0
Stroke	13	5 (38.5%)	10 (76.9%)
Subphrenic abscess	1	1 (100%)	1 (100%)
Syncope	1	0	0
Uncontrolled epilepsy	12	0	3 (25%)
Total	859		

*Admission diagnoses do not reflect diagnostic criteria used for specific group analysis such as Diabetic ketoacidosis.

All overdoses and poisonings at GF Jooste Hospital



Compound	Number	Compound	Number
Tricyclic antidepressants	32	Alcohol	1
Paracetamol	9	Baclofen	1
Theophylline	9	Benzodiazepines	1
Organophosphate	8	Cocaine	1
Unknown	6	Digoxin	1
Carbamazepine	4	Ecstasy	1
Anti-hypertensive	2	Haloperidol	1
Carbon monoxide	2	Largactil	1
Oral hypoglycaemic	2	Mandrax	1
Orphenadrine	2	Morphine	1
Rat poison	2	Multiple drugs	1
Traditional medication	2	Wafarin	1

Diagnostic groupings of elderly (≥ 65 years) patients

Diagnosis	Number of patients
Acute coronary syndromes	56
Diabetic emergency	15
Pulmonary oedema	12
Asthma/COPD	12
Stroke	4
Cardiac arrhythmia	4
Pneumonia	4
Septicaemia	4
Acute renal failure	1
Dilated cardiomyopathy	1
Respiratory arrest	1
Overdose (digoxin)	1
Syncope	1
Total	116

Outcome of patients requiring mechanical ventilation

Admitting Diagnosis	Patients n (%)	In-Hospital Mortality (%)	Transferred to Groote Schuur
Drug overdose	35 (16.4)	2.9%	5
Asthma	23 (10.8%)	13.0 %	5
Pneumonia	21 (9.9%)	47.6%	3
Diabetic Ketoacidosis (DKA)	18 (8.4%)	72.2%	2
Pulmonary oedema	16 (7.5%)	12.5%	3
Myocardial Infarct	14 (6.6%)	28.6%	1
Stroke	11 (5.2%)	81.8%	0
Septic shock	10 (4.7%)	90%	1
COPD	10	20%	1
Status epilepsy	9 (4.2%)	33.3%	3
Meningitis	7 (3.3%)	71.5	1
Hypoglycaemia	7	42.9%	0
Acute liver failure	6 (2.8%)	100%	3
PCP	4 (1.9%)	75%	0
Pulmonary tuberculosis	3 (1.4%)	33.3%	2
Hyperglycaemia (non-DKA)	3	66%	0
Gullain-Barré syndrome	2 (0.9%)	50%	1
Malignant hypertension	2	50%	1
Cor pulmonale	2	50%	0
Respiratory arrest	2	0%	0
Cardiogenic shock	1 (0.4%)	100%	0
Cardiac arrest	1	100%	0
Hypokalaemia	1	100%	0
Respiratory failure	1	100%	0
Warfarin toxicity	1	100%	0
Carbon monoxide poisoning	1	0%	0
Post partum cardiomyopathy	1	0%	0
Organophosphate poisoning	1	0%	0
Total	213		