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GROOTE SCHUUR HOSPITAL TRAUMA CENTRE: EVENT AND OUTCOME STUDY

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A research report submitted to the School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, in partial fulfillment of the requirements for the degree

of

Master of Public Health (Hospital Management)

Johannesburg

2010

DECLARATION

I, Ria Kirsten, declare that this research report is my own work. It is being submitted for the degree of Master in Public Health (Hospital Management) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other university.

Signature 

26th day of October 2010

This work is dedicated to the memory of my classmate

Martha Putuka

an unfailing inspiration, she died tragically in her line of duty

and

to

Ben and Marci
van Eyk and Josephine
Annette and Anton
Jürgen and Kirsten

trusting that it will inspire them towards life long learning.

ABSTRACT

Introduction

Cape Town in the Western Cape has the highest premature mortality due to injury in South Africa. Groote Schuur Hospital (GSH) is one of three tertiary hospitals in Cape Town with internationally recognised Level 1 Trauma Centres (TCs). It provides adult trauma services to a drainage area representing 51.9% of the Cape Town Metro population.

Objective

The objective of this study is to explore the numbers, demographic characteristics, injury classification and severity of patients reporting to the GSH TC, in order to be able to assess the resources required to manage these patients and the outcome of their treatment.

Methods

A descriptive, non-interventional, observational study method was applied, using retrospective data analysis of patients presenting to the GSH TC during November 2008. TC registers were used as primary data source documents. Epidemiological and other variables of a 1040 total patient cohort and a 131 resuscitation ward subgroup were examined,

Results

Study population demographic findings were similar to those of other recent researchers. The male to female ratio was 3:1; 33.6% patients were 20 to 29 years old, (peaking 17.4% at 20 to 24 years); 59.4% of injuries were violence related and 20.5% traffic related. 0.8% patients left before being seen; most patients were discharged after treatment (58.7%); 38.9% were admitted, and 1.3% died in the TC.

Recommendations

Improved data management is required to underpin enhanced operations management at the GSH TC. Further study is required to establish final outcomes; actual resources required and the real cost of trauma managed. Triage scoring does not adequately reflect injury severity. A severity scoring system appropriate for South African resources should be devised and implemented.

Conclusion

During the course of this study, data was extracted from three different data sources, none of which are validated. I was not able to achieve assessment of resources required to manage the workload or patient outcomes.

Injury patterns at the GSH TC mirror the Cape Town Metropole burden of injury and mortality. This is a major public health problem that requires urgent preventative inter-sectoral collaboration.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACSCOT	American College of Surgeons Committee on Trauma
ADL	Activities of daily living
ALOS	Average length of stay
AIS	Abbreviated Injury Score
CI	Class Interval
COHSASA	Council of Health Service Accreditation of South Africa
CT SCAN	Computed tomography scan
CTS	Cape Triage Score
CQI	Continuous Quality Improvement
DALYs	Deaths and disability adjusted life years
DoH	Department of Health
ED	Emergency Department
GSH	Groote Schuur Hospital
GSH TC	Groote Schuur Hospital Trauma Centre
HIS (Clinicom)	Health Information System (Clinicom)
HIV/AIDS	Human immunodeficiency virus / acquired immune deficiency syndrome
IATSIC	International Association for Trauma Surgery and Intensive Care
ICD 10	International Statistical Classification of Diseases and Related Health Problems, version 10
ICU	Intensive Care Unit
ISS	Injury Severity Score
ISoS	International Society of Surgery
KTS	Kampala Trauma Score
LOC	Level of care
LODOX Statscan	Digital radiography system
MEWS	Medical early warning score
NISS	New Injury Severity Score
PDE	Patient Day Equivalent

PGWCDoH	Provincial Government of the Western Cape Department of Heath
TC	Trauma Centre
TEWS	Trauma early warning score
TRISS	Trauma and Injury Severity Score
TSSA	Trauma Society of South Africa
QA	Quality Assurance
SATG	South African Triage Group
SA	South Africa
SATS	South African Trauma Scale
Statscan	Digital radiography system
TQM	Total Quality Management
USA	United States of America
UCT	University of Cape Town
WCDoH	Western Cape Department of Health
WHO	World Health Organisation
YLL	Years of life lost. The years of life lost compared to a normative standard, due to premature mortality. This is a measure of the mortality gap.
yr /s	year/s

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CHAPTER 1

INTRODUCTION AND OVERVIEW OF THE STUDY

1.1 INTRODUCTION

According to Groenewald *et al.* (2007) South African (SA) injury mortality rates are 6 times higher than the global average, with homicide at 8 times and road traffic incidents double the global averages. In the Western Cape Province, injuries (homicide; violence; road traffic incidents; suicide and fires) account for almost a quarter of the burden of disease (23.9%) with injury mortality 10 times higher than the global average for men and 7 times higher for women (Norman *et al.* 2007).

Bradshaw *et al.* (2005) report that Cape Town in the Western Cape Province has the highest premature mortality due to injury in South Africa, whilst Groenewald *et al.* (2007) note that injuries in Cape Town represent the second highest cause of premature mortality and 24.9% of the years of life lost (YLL) in the city.

The Groote Schuur Hospital (GSH) in Cape Town is one of three tertiary referral hospitals in the Cape Metropole. It contains one of 10 specialized trauma centres in the country with specialist surgical and ancillary services on site and immediately available (Trauma Society of South Africa 2009).

The objective of this study is to explore the numbers, the demographic characteristics, injury classification and severity of patients reporting to the Groote Schuur Hospital Trauma Centre (GSH TC) in order to be able to assess the resources required to manage these patients and the outcome of their treatment.

1.2 BACKGROUND INFORMATION TO RESEARCH

1.2.1 Geographic and demographic information

The Western Cape Province is the most southern province in South Africa and represents 10.6% of the total land surface area of South Africa, housing 10.9% of the South African population (Groenewald 2008) and the Western Cape

population represents 10.1% of the South African population (Day and Gray 2007). Refer to Figure 1.1: A map of the Western Cape District Municipalities.

A 16.7% increase in the Western Cape population between 2001 and 2007 was demonstrated by the Community Survey of Statistics South Africa with this growth mainly driven by migration. The survey sets the population of the Western Cape at 5,278,585 of which 66% (3,497,097) reside in the Cape Town Metropole area (Statistics South Africa 2007).

The Western Cape population pyramid for the 2008 mid year population estimates indicates a relatively large young population with a smaller older population. The Western Cape under 15 year population is 27% compared with the national 32%, and the > 60 years population is at 7.8% compared with 7.32% nationally (Statistics South Africa 2008).

1.2.2 Socio-economic indicators

Groenewald *et al.* (2007) postulate that 25% of the Western Cape population lives below the poverty line, whilst socio-economic indicators from Statistics SA for this province include an 18% unemployment rate, with 19.1% of households residing in informal housing (Day and Gray 2007).

Provincial indices for multiple deprivations were designed by Statistics SA; the University of Oxford and the Human Sciences Research Council and are based on 5 areas of deprivation: income and material; employment; health ; education and living environment (Provincial Government of the Western Cape Department of Health, 2009a). According to these indices, the most deprived areas in the Western Cape are located in the Little Karoo as well as within Cape Town City municipality limits, including Cape Flats' townships located along the N2 highway. Although the Karoo remains the largest geographical area of multiple deprivations, only 1% of the provincial population resides there, as opposed to 66% in the Cape Town Metropole. The Cape Town Metropole thus includes the largest population in the province together with the highest concentration of multiple deprivations (Provincial Government of the Western Cape Department of Health 2009a).

1.2.3 Epidemiological profile

According to Groenewald *et al.* (2007) during 2004, four leading causes of death accounted for 43.6% of premature mortalities in Cape Town and are ranked as homicide; human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), tuberculosis (TB) and road traffic injuries (Groenewald *et al.* 2007). Violence accounts for 12.9% of premature mortality in the Western Cape, as compared with 6.9% due to road traffic injuries (Bradshaw *et al.* 2004). Injury mortality rates are higher In Cape Town than in other major cities in the country and are among the highest in the world (Corrigall *et al.* 2007). In particular, deaths due to homicide and road traffic fatalities are amongst the highest in the world, pertaining especially to male youth (Groenewald *et al.* 2007).

1.2.4 Overview: Groote Schuur Hospital

The Groote Schuur Hospital (GSH) is situated in the Western Cape Province in the Cape Town Metropole. It is the academic and teaching hospital of the University of Cape Town and is one of two public tertiary referral hospitals serving adult patients in the Cape Town Metropole. The formal drainage area of GSH represents 51% of the population of the Cape Town Metropole as well as providing tertiary services to the Southern Cape Region and further afield (Provincial Government of the Western Cape,Department of Health 2009).

Implementation of the 2010 Comprehensive Service Plan for Western Cape Health Services is resulting in changes to the bed composition. According to W. Vorster (personal communication, October 2, 2009) the previous configuration of 695 tertiary beds (Level 3) and 193 secondary (Level 2) beds is in the process of transformation to include 607 Level 3 (L3) and 306 Level 2 (L2) beds by 2010. During the 2008 / 09 financial year 42,969 patients were admitted as in-patients and 396,232 out-patients were attended to at the GSH (Groote Schuur Hospital 2009b).

1.2.5 Overview: Groote Schuur Hospital Trauma Centre

The Groote Schuur Hospital Trauma Centre (GSH TC) receives referred and walk-in patients from formally designated sub-district drainage areas in the Cape Town Metropole, (Southern; Western; Klipfontein and Mitchells Plain) and tertiary referrals from the Southern Cape Region. In reality patients from any drainage

area land at this TC, either by own choice and transport, or when ambulances are diverted from other hospitals. Figure 1.2 represents a map of the Cape Metropole Health Sub Districts.

According to figures obtained from the GSH Health Information System (HIS) Clinicom patient registration system, during the financial year April 2008 to March 2009, the GSH TC managed 9,698 trauma out-patient attendances and 14,068 in-patient days (Groote Schuur Hospital 2009b).

The physical layout of the GSH TC includes reception; radiology; waiting, appraisal and treatment areas; resuscitation stations; wards; offices for clinical management personnel and sleep-in facilities for on-call medical staff. In November 2008 the TC contained a six bed resuscitation station (4 beds with ventilation capacity); a 6 bed High Care Unit (HCU) and 48 ward beds.

The GSH TC includes dedicated radiological services manned by 24 hour resident radiographers and a radiologist for immediate reporting. There are two fixed and one mobile X-ray machines together with a Lodox Statscan, a Computed Tomography (CT) and a Spiral Scanner, according to M. Patton (personal communication, June 22, 2007). The Statscan produces entire body digital X-ray images in less than 13 seconds and was developed by Lodox (Pty) and the University of Cape Town, first used in GSH. It is a digital radiography system originally designed for the de Beers diamond mining company, producing full body ultra low dosage X-ray images. The Statscan represents a major advance in trauma radiology and has resulted in a significant reduction of resuscitation time (Nicol and Navsaria 2007).

According to Z. Matinka (personal communication, March 4, 2009) the GSH TC includes a fully fledged theatre unit with two minor and two major operating rooms. This theatre unit is operational on Mondays to Thursdays 07H00 to 19H00. During other times, trauma patients are moved to GSH main theatres. Due to requirements for in-theatre imaging equipment, specialized instruments and orthopaedic hardware sets, all orthopaedic emergency cases are managed in the hospital main theatre complex.

1.3 PROBLEM STATEMENT

The South African Department of Health (SADoH) has implemented a District Health System, providing comprehensive health care to the estimated 84% of citizens without private health care insurance, by means of appropriate packages of health care at the various levels of service delivery (Burch and Benatar 2006). Each Health District is responsible for delivery of primary or L1 community- and hospital- based services. General specialist care is accessed at L2 secondary / regional hospitals, with highly specialised sub-specialist L3 services provided at tertiary hospitals (Department of Health 2002).

The tertiary GSH in Cape Town contains one of only 10 specialized major trauma centres in the country, with specialist and sub-specialist surgical and ancillary services on site and immediately available (Trauma Society of South Africa 2009).

As part of the Comprehensive Service Plan of the Western Cape Department of Health (WCDoH) during April 2008, all Trauma and Emergency services were categorized as L2 services, including the GSH TC (Provincial Government Western Cape Department of Health 2007). According to W. Vorster (personal communication, October 2, 2009), during 2009, GSH TC capacity was reduced by 6 beds and in the future, it is planned that Trauma and Emergency services will be amalgamated, with a view to being managed by Emergency Medicine Specialists. Full details of this future planning have not been consolidated as yet.

Table 1.1 gives an indication of year-on year changes to the GSH TC bed numbers per level of care, 2007 to 2009. At this time, it is unclear if and how downgrading of the level of care and reduction of beds will effect the continued ability to provide an adequate package of care to an unchanged profile of pathology.

This empirical approach is against the views of Burch and Benatar (2006) who affirm health care service delivery appropriate to local community needs as a key problem faced by health care services across the world. They argue that rational planning requires critical attention to the nature of the clinical workload.

Table 1.1 GSH TC 2007 to 2009: Changes to bed numbers and levels of care

GSH TC 2007 to 2009: Changes to bed numbers and levels of care															
LOC	**2007**					**2008 (1April-1 Jan 2009)**					**2009 (+/- October)**				
	C14 ICU	C12 HCU	C12 WARD	C5 WARD	TOTAL	C14 ICU	C12 HCU	C12 WARD	C5 WARD	TOTAL	C14 ICU	C12 HCU	C12 WARD	C5 WARD	TOTAL
L3	6	6			**12**	6	6			**12**					**0**
L2			24	24	**48**			18	30	**48**	6	6	12	30	**54**
L3 & 2 TOTAL					**60**					**60**					**54**

**L3 (South African classification) = L1 (International classification)

1.4 OBJECTIVES OF THE RESEARCH

The Comprehensive Service Plan of the Western Cape Department of Health (WCDoH) was designed with a view to providing a framework to smooth the progress of reshaping of the service required to ensure a financially sustainable quality health service in the Western Cape. In order to achieve this objective, "the budget must be prudently and optimally utilized by treating patients at the level of care that is most appropriate to their needs and the resources allocated to health care facilities should be aligned with the level and type of care that they are required to provide" (Provincial Government Western Cape Department of Health 2007:1).

This study seeks to examine the characteristics of the GSH TC workload as evidenced by the numbers and demographic features of patients and the classification and severity of injuries treated by the GSH TC during the period 1st to 30th November 2008. It will attempt to assess resources required to manage these patients and establish the outcomes of the treatment.

The objectives of this research are thus to examine and interpret the workload and outcomes; to assess the resources required to treat this workload and to gauge if they are sufficient or if there is a shortfall.

Suitable responses to this information should ultimately enable the management of GSH and of the GSH TC to "Do it right and do the right thing. Make the whole greater than the sum of its parts. Make the trauma system work for the people,

both patients and professionals. Make a commitment to excellence and equity. Use considerable skill to show how modern trauma care deals with urgent social problems. Make service to injured patients the primary goal of each trauma system" (Hassett 1996: 3).

1.5. OPERATIONAL DEFINITIONS USED IN THE STUDY

An emergency centre represents a specific area in a health care facility that has been set aside specifically for the provision of emergency care. This may be in a hospital or as a stand-alone unit and includes dedicated trauma units. These centres can also be known as emergency rooms, emergency departments, casualty centres or departments or accident, emergency and trauma units (Council for Health Services Accreditation of South Africa 2007).

For the purposes of this study the terms "event" and "outcome" are used as follows: EVENT: Each patient that presented to the Groote Schuur Hospital Trauma Center during the study period and the passage throughout the hospital till "departure", e.g. discharge of death. OUTCOME: The clinical result of the medical management of the patient that occurred within the hospital system e.g. discharge or death.

South African terminology related to different levels of public emergency care follows levels of care (LOC) assigned to the South African Department of Health District Health System. This has caused confusion between SA and International terminology (Council for Health Services Accreditation of South Africa 2007).

The tables below have been constructed using Council for Healthcare Accreditation of South Africa (COHSASA), Emergency Centre Standards (COHSASA 2007).

Table 1.2: Central Emergency Centre (COHSASA 2007)

Trauma Society of SA; American College of Surgeons	WHO; ISS; IATSIC	Provincial Department of Health, Western Cape SA
Level 1 centre	Tertiary Hospital	Level 3 centre Tertiary centre
24 hour all major specialities Clinical specialist services Provide education and research in their region Ultimate referral facility		

Table 1.3: Regional Emergency Centre (COHSASA 2007)

Trauma Society of SA; American College of Surgeons	WHO; ISS; IATSIC	Provincial Department of Health, Western Cape SA
Level 2 or Urban trauma centre	Speciality Hospital	Level 2 centre Secondary centre Regional centre
24 hour medical staff availability 24 hour core general specialist care		

Table 1.4: District Emergency Centre (COHSASA 2007)

Trauma Society of SA; American College of Surgeons	WHO; ISS; IATSIC	Provincial Department of Health, Western Cape SA
Level 3 Centre Community Hospital	General Practice Hospital	Level 1 centre Primary centre District centre
Staffed by General Practitioners Should have facilities for resuscitation and stabilization In-patient facilities exist Transfer to a larger facility required for significant problems 24 hour services a day, 7 days per week		

Table 1.5: Primary Emergency Centre (COHSASA 2007)

Trauma Society of SA; American College of Surgeons	**WHO; ISS; IATSIC**	**Provincial Department of Health, Western Cape SA**
Level 4 Centre Primary Healthcare Centre	Basic Facility	Community Health Centre Day Hospital
Primary emergency role: resuscitation; stabilization & appropriate transfer No in-patient facilities May be no medical cover Basic facilities, that form important part of emergency system in communities with limited transport		

1.6 ORGANISATON OF THE REPORT

This report has been organized into eight different chapters.

Chapter 1 contains the introduction to the study including an overview of geographic; demographic; socio-economic and epidemiologic factors of importance. The reader is introduced to some aspects to the structure of WCDoH health services, the GSH and the GSH TC. The chapter contains the problem statement; the objectives of the research and some operational definitions are clarified.

Chapter 2 contains a comprehensive review of literature relevant to this study. It includes the historical background to the development of trauma systems; an overview of trauma centers and trauma registries; the burden of disease contributing to the workload; aspects of injury; triage systems; injury severity scoring systems and finally, quality indicators and benchmarking for trauma centres.

Chapter 3 includes the research methodology used during the study. It contains information related to authorisation of the study and ethics approval. It contains details of the study design; sampling framework; measurements and research

instruments used, together with aspects related to analysis of the data, including validation, bias and limits.

In Chapter 4 all aspects related to the data used as a basis for this study are assessed. The advantages and shortcoming of the different electronic and hard copy data collection systems at the GSH TC are discussed, together with aspects of the data collection, processing and quality of data obtained

Chapter 5 presents results obtained during the examination of data. This includes demographic characteristics of patients presenting to the GSH TC and when and where the injuries occurred. Results related to the nature of injuries, aspects of triage and injury severity are highlighted, together with details of the disposals of patients from the Trauma Centre.

Chapter 6 contains a discussion of the findings of this research with emphasis on aspects related to the burden of disease. Demographic characteristics of patients presenting to the GSH TC are discussed including facets of when and where the injuries were sustained. Results related to the nature of injuries and of injury severity are discussed, together with details of the disposal of patients from the Trauma Centre. Findings related to aspects of data management are discussed.

Chapter 7 contains the limitations to the study, focusing on data availability; completeness and quality. It includes a discussion on limitations to the assessment of human and other resources required for management of the patient cohort, together with limitations to evaluation of the outcomes of treatment.

Chapter 8 concludes with recommendations relating to data management; improvement of services at the GSH TC and suggested topics for further study. This chapter ends with final conclusions to the study.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The main bodies of literature relevant to this research include writings on trauma systems; trauma centres; trauma registries; triage and severity scoring systems, together with quality and benchmarking systems in trauma centres. A review of this literature fosters an understanding of the resultant decreased mortality occurring in parallel with the development of systems underpinning trauma care in countries where they were implemented.

In addition to examination of this literature, aspects of burdens of disease contributing to the large trauma patient numbers managed in South Africa are reviewed. This inclusion is with a view to promoting an understanding for the requirement of well functioning trauma centres in South Africa, with particular reference to the situation in the Western Cape, the Cape Town Metropole and the Groote Schuur Hospital Trauma Centre.

2.2 BURDEN OF DISEASE

2.2.1 Introduction

Comprehension of the burden of disease (BoD) is essential to planning and decision-making processes in health departments with appropriate information enabling Government to address and reduce the BoD, rather than just being reactive to pressures on health systems (Household 2007).

The BoD in a population is an indication of health problems in the community together with the amount of health care provided and the effects of all other aspects that promote or damage health e.g. education; safe water supplies; nutrition; poverty; smoking; and alcohol use (Norman *et al.* 2000). South Africa is experiencing a quadruple BoD comprising the HIV/AIDS pandemic; infectious diseases; emerging chronic conditions, together with injuries resulting from violence, traffic-related and other trauma (Bradshaw *et al.* 2004). The Western

Cape Province is similarly affected and further burdened by the escalating use of substances, especially alcohol and "tik" (Household 2007). In this province the top three contributors to the overall BoD are ranked as major infectious diseases including HIV/AIDS linked with TB (22%YLL); injury (19.8%YLL) and mental disorder (not quantified) (Myers and Naledi 2007). An overview of mortality in Cape Town illustrates a pattern typical of societies in transition. Amongst young children mortality is due to infectious diseases; amongst young adults to violence and injuries and in later life to non-communicable diseases. Gender differences include increased male mortality caused by violence and injuries, with HIV/AIDS accounting for a large percentage of female deaths (Norman *et al.* 2000)

2.2.2 Injury

Urbanization and technological development are acknowledged as being accompanied by increasing per capita injury rates, a problem that does not decrease on its own (Matzopoulos *et al.* (2007a). Universally named risk factors include economic inequality, gender inequality, poverty, unemployment, rapid social change; community violence, substance abuse and high firearm availability (Norman *et al.* 2000). As compared with global averages, mortality rates due to injury in the Western Cape are nearly tenfold greater for males and sevenfold for females (Norman *et al.* 2000), with fatalities due to homicide and road traffic injuries in Cape Town still amongst the highest in the world (Bourne *et al.* 2007).

2.2.3 Injuries due to violence

Violence is the most important contributor to high rates of injury in the Western Cape. It accounts for 12.9% of premature mortality as compared to 6.9% for road traffic injuries (Bradshaw *et al.* 2004).

The ratio of premature mortality due to violence versus road traffic-related injuries in the Western Cape is greater than in most other provinces, except the Northern Cape and Gauteng with comparable ratios. Violence is the second leading cause of years of life lost (YLL) in the province after HIV/AIDS, accounting for 14.1% of YLL, with higher mortality rates than the rest of the country for males (129 per 100,000 versus 115 national average) and females (25 per 100,000 versus 21) (Bradshaw *et al.* 2004).

During a prospective study at the GSH TC, Donson and Peden (2000) established that most patients injured violently had abused either alcohol and/or drugs prior to the injuries and that more than 60% of patients were intoxicated at the time of presentation (Donson and Peden 2000). Bourne et al (2007) reconfirmed the linkage between high homicide and traffic related fatalities and alcohol and substance abuse amongst young males in Cape Town (Bourne *et al.* 2007).

2.2.4 Traffic related injuries

Road traffic systems remain the most complex and most dangerous of all systems that people have to deal with on a daily basis. It is globally recognized that road crash injury is a human made problem that is largely predictable and preventable and can be analysed with implementation of rational counter measures, with speed management as a vital component. More than 85% of deaths due to road crashes occur in low- and middle-income countries, with traffic injuries in South Africa a major and neglected public health challenge requiring participation of all sectors, including Health (Matzopoulos *et al.* 2007a).

Internationally the contribution of road traffic injuries to the global BoD is expected to increase to 5.1% of deaths and disability adjusted life years (DALYs) lost by 2020. In South Africa the trend in YLL is at 5%, with the Western Cape already ahead of the trend at 6.9% YLL in 2000. High mortality patterns associated with traffic related injuries in Cape Town include male deaths; pedestrian deaths; alcohol use related to driver and pedestrian deaths and weekend peaks (Matzopoulos *et al.* 2007a).

In a prospective study at the GSH TC, Donson and Peden (2000) confirmed that 52.2% of traffic-related injuries treated during the study period involved pedestrians, 26.1% drivers and 21.7% passengers (Donson and Peden 2000)

2.3 TRAUMA SYSTEMS

2.3.1 Introduction

According to COHSASA, community trauma and emergency services are optimally delivered when forming part of an integrated trauma and emergency

system in stead of operating as autonomous and uncoordinated elements (COHSASA 2007).

Gwinnutt *et al.* (2001) argue that a trauma system must aim to improve the process of care as well the outcome of the trauma patient. They indicate that this is achieved by establishment of integrated co-ordinated care in the community served. All hospitals must be classified according to level of care; all major trauma cases must be treated at major trauma centres; patient care must commence in the pre-hospital environment; triage protocols must be implemented to ensure that patients are taken to the most appropriate hospitals; patient care must be provided by the most appropriate doctors from resuscitation through to rehabilitation, with co-ordination and control of pre- and in-hospital care (Gwinnutt *et al.* 2001).

Blackwell *et al.* (2003) agree that the ultimate objective of a trauma system is to ensure that the most seriously injured patients receive care in correctly designated trauma centres, equipped to deal with their particular injuries (Blackwell *et al.* 2003). Hoydt and Coimbra (2007) define trauma systems as geographically circumscribed, organized approaches providing integrated care to acutely injured patients. They regard the main goal of a trauma system as the ultimate improvement of health of the community and argue that this is achieved through identification of community risk factors and creation of solutions to decrease injury. According to Hoydt and Coimbra (2007) a trauma system includes a continuum of optimal multidisciplinary care during all phases of the injury, whilst maintaining the ultimate objective to decrease injury related morbidity and mortality and years of life lost (YLL) (Hoydt and Coimbra 2007).

2.3.2 Trauma Systems in the United States of America

Formal development of modern dedicated trauma systems in the USA is of international significance and has been evolving since the First World War, with the essential characteristics developed by the USA Military during the first seven decades of the 20th century (Mullins 1999). During World War 2, motorized transport enabled rapid evacuation of the injured, reducing the time between injury and treatment. Resuscitation, a new concept, added another phase to emergency care and treatment of shock prior to surgery, with new surgical

techniques requiring rapid patient prioritization, or triage, terminology gained from the French front lines (Mullins 1999).

Hoydt and Coimbra (2007) discuss the process of evolution of systems, demonstrating the positive effects realized by some landmark events. First was the acknowledgement of the burden of disease in 1966 though publication of the National Academy of Sciences and the National Research Council white paper "Accidental Death and Disability: The Neglected Disease of Modern Society". Mullins (1999) postulates that this publication "publicly announced trauma care as a political issue". (Mullins 1999:3)

Another landmark was the establishment of the five components of the Illinois trauma system during the early 1970's. This included the categorization of selected hospitals as trauma centres; instant communication enabled by new technology; new ambulance design for safe transportation; special training of health professionals; trauma registry information enabling ongoing programmed evaluation of services (Mullins 1999).

During the late 1970's the American College of Surgeons Committee on Trauma (ACSCOT) developed a system for classification of trauma centres (Mullins 1999). This ranges from the least sophisticated (levels 4 and 5) to level 1 tertiary trauma centres in major cities with immediate availability of definitive care for critically injured patients; 24 hour trauma care; 24 hour availability of trauma surgeons; admitting at least 1200 cases per annum of whom more than 20% are severely injured, as well as leading trauma research, education and prevention (Nathens et al. 2004). Level 1 trauma centres are located in tertiary hospitals and may include the concentrated expertise of specialist facilities e.g. paediatric trauma; burns; spinal cord and hand injury units. ACSCOT subsequently developed "Guidelines for Optimal Hospital Resources for the Care of the Seriously Injured" in 1976 (Hoydt and Coimbra 2007)

The California Orange County publicly disclosed the need for improved care for injured patients in the late 1970's, culminating in the formal designation of different levels of trauma centres and implementation of regional trauma care systems in 1984. In 1980 ACSCOT developed the standardized advance trauma life support course; the American College of Physicians compiled "Guidelines for Trauma Care Systems" in 1987; the Trauma Systems Planning and Development

Act was promulgation in 1990 and ACSCOT published "Guidelines for Optimal Care of the Injured Patient" in 2006 (Hoydt and Coimbra 2007).

2.3.3 Trauma Systems in South Africa

Goosen *et al.* (2003) state that SA is the only country on the African continent with an organized statutory system of pre-hospital care but, as in most of the developing world, constraints of distance and time limit access of many South Africans to basic trauma care. In addition, migration and urbanization affects South African trauma services (Goosen *et al.* 2003).

COHSASA acknowledges that trauma and emergency services should preferably be delivered as part of a trauma and emergency system with known catalogued capabilities of individual organizations (COHSASA 2007). They argue that provision of an integrated trauma and emergency service requires support from various in-patient and auxiliary services and they question the ability to assess the functioning of a trauma and emergency centre in isolation from the rest of the organization (COHSASA 2007).

In an appraisal of the organisation and management of emergency department services of the Western Cape, Cummins (2004) supports the concept that an integrated emergency care system ranges from the initial health worker through pre-hospital care and medical transport services; the trauma and emergency department; all in-hospital specialities and services, to discharge and rehabilitation services (Cummins 2004).

2.3.4 Western Cape Department of Health Trauma System

Since 1st April 2008, Emergency Medicine in the Western Cape Province has been classified as a level 2 general specialist service. Emergency Medicine includes the diagnosis and management of acute and urgent aspects of illness and injury. It is envisaged that, at Central Hospitals (SA L3), relationships with other acute and referral services such as trauma surgery, will be dealt with through local policies (Western Cape Department of Heath 2009b). The full extent of the emergency care system in the Western Cape ranges from the initial health worker encountered, through the Emergency Medical Services (EMS) and emergency department to in-hospital specialities, discharge and rehabilitation. EMS relates to emergency ambulance, medical rescue, patient transport and

aero-medical services (Provincial Government Western Cape Department of Heath 2007). Emergency centres that form part of the emergency care system are located in and are under the management of 40 hospitals, 58 community health centres and 229 primary care clinics representing different levels of care throughout the province. There are three L3 hospitals (Groote Schuur Hospital; Red Cross War Memorial Childrens Hospital; Tygerberg Hospital) that provide the full range of general and specialist services required for the most complex emergency conditions; 8 L2 hospitals provide general specialist services and 29 L1 hospitals are covered either by part time or full time medical officers (Cummins 2004).

2.4 TRAUMA CENTRES

2.4.1 Introduction

Gwinnutt *et al.* (2001) argue that a trauma centre on its own does not amount to a trauma system. They define a trauma centre as a hospital where the medical staff (including surgeons, anaesthesiologists and support staff) provide 24 hour in-house cover (Gwinnutt *et al.* 2001).

A USA Level 1 (SA L3) tertiary trauma centre will include 24 hour services as the ultimate referral facility, providing all major specialities and other specialised ancillary clinical services. It provides education and research in its region and could further contain other highly specialized services such as hand and spinal surgery and treatment of burns (COHSASA 2007).

A L2 trauma centre (USA and SA) will provide 24 hour medical staff availability, including 24 hour core general specialist care (COHSASA 2007).

The USA L3 trauma centre (SA L1) provides 24 hour services a day, 7 days per week; is situated in a Community Hospital, staffed by General Practitioners; should have facilities for resuscitation and stabilization; has in-patient facilities and can arrange for transfer to a larger facility required for significant problems (COHSASA 2007).

2.4.2 Trauma Centres in the United Kingdom

According to Gwinnutt *et al.* (2001), the world's first trauma centre was the Birmingham Accident Hospital, opened in 1941. This service was extended in

1964 by establishment of the first mobile surgical team in the United Kingdom (UK), with a specialised vehicle, enabling pre-hospital surgical care, mainly to road vehicle and industrial accident victims (Gwinnutt *et al.* 2001). Studies of the trauma population in the UK have shown that between 24 and 38 major trauma victims are seen per hospital per annum. It is estimated that, in the UK, a population of 2 million persons would potentially provide 1 major trauma case per day. A trauma centre along USA lines was established at the North Staffordshire Royal Infirmary, working together with 5 district hospitals. Disappointing modest reductions in mortality resulted, as compared with the USA (Gwinnutt *et al.* 2001).

2.4.3 Trauma Centres in the United States of America

A large measure of the success in improvement of trauma services in the USA has been ascribed to the establishment of trauma centers as part of the American trauma system (Avery 2004). During the late 1970's ACSCOT developed a classification system for classification of trauma centres in the USA (Mullins 1999). This ranges from the least sophisticated (levels 4 and 5) to level 1 tertiary trauma centres in major cities with the immediate availability of definitive care for critically injured patients, 24 hour trauma care; 24 hour availability of trauma surgeons, admitting at least 1200 cases per annum of whom more than 20% are severely injured, as well as leading trauma research, education and prevention (Nathens *et al.* 2004). Level 1 trauma centres in the USA are located in tertiary hospitals and may include the concentrated expertise of specialist facilities e.g. paediatric trauma; burns; spinal cord and hand injury units (Hoydt and Coimbra 2007).

2.4.4 Trauma Society of South Africa and Trauma Centres

According to the Trauma Society of South Africa (TSSA) (2009), at least 10 dedicated Trauma Centres (TCs) have been established in major cities in South Africa. This includes TCs in the Union Hospital, Charlotte Mexete Johannesburg Academic Hospital, Chris Hani Baragwanath Hospital and Milpark Private Hospital (Johannesburg); Pelonomi Hospital (Bloemfontein); Inkosi Albert Lithuli Hospital (Durban); Groote Schuur, Tygerberg and Red Cross Childrens' War Memorial Hospitals (Cape Town); with the latest established TC at Livingstone Hospital in Port Elizabeth (Trauma Society of South Africa 2009).

The TSSA is in agreement with international definitions of Trauma Centres considering the extended importance of L3 (SA) TCs as referral resources for communities in associated regions. For these TCs the TSSA emphasises the 24 hour in-house availability of the following specialist disciplines: anaesthesiology and critical care, radiology, emergency medicine, internal medicine, neurosurgery, oral and maxillo-facial surgery, orthopaedic surgery and plastic surgery. The Society supports the concept of TCs as leaders in trauma education, system planning, injury prevention and training centres for trauma surgeons (Trauma Society of South Africa 2009). The TSSA is in the process of completing their document "Trauma Centres in the Western Cape" based on internationally recognised principles of trauma care and incorporating relevant South African and Western Cape policy documents (Trauma Society of South Africa 2009).

2.4.5 South African National Department of Health Emergency Centres

The South African National Department of Health is soon to gazette "Regulations Governing Emergency Centres in South Africa" (Provincial Government Western Cape Department of Heath 2009b). In this document it is explained that, prior to publication of the above regulations, there are no policy, norms, standards or guidelines for establishment and operation of emergency centres within public or private health facilities in SA. It is acknowledged that diverse emergency centres with varying competencies offer emergency services under various titles (e.g. trauma centre; casualty department) and that services can vary from trauma management only, to a mixture of trauma and medical conditions. The purpose of these regulations is to launch a framework for verification and licensing of establishments according to levels of care, with the intention that these centres shall include medical and trauma and surgical emergencies. The regulations contain prescriptions related to all aspects of the trauma system; trauma centre criteria; registration and licensing, and offences and penalties with provision for expanded trauma registry data for major emergency centres. (Department of Health 2008).

2.4.6 Western Cape Department of Health Emergency Centres

The Western Cape is currently in the process of formulating their policy document "Emergency Centres in the Western Cape" based on principles contained in the

soon to be gazetted Government of South Africa, Department of Health "Regulations Governing Emergency Centres in South Africa,", (Provincial Government Western Cape Department of Heath 2009b).

There are 3 (SA) L3 hospitals (USA L1) in the Western Cape Province: Groote Schuur Hospital; Red Cross Childrens Hospital and Tygerberg Hospital. These hospitals are also known as central hospitals. (Provincial Government Western Cape Department of Health 2009a). According to the TSSA (2009) Cape Town requires all three of these Tertiary hospitals to deal with the trauma load generated by the population of 3.5 million people and these hospitals are recognized as L3 (SA) Trauma Centres by the Society (Trauma Society of South Africa 2009).

2.4.7 Groote Schuur Hospital Trauma Centre

The GSH TC is compliant with all the requirements of an international (USA) L1 trauma centre with sub-specialist surgical and ancillary services on site and immediately available (Goosen *et al.* 2007) It serves as a referral resource for designated communities in its referral regions, offering 24 hour in-house availability of required specialist disciplines: anaesthesiology and critical care, radiology, emergency medicine, internal medicine, neurosurgery, oral and maxillo-facial surgery, orthopaedic surgery and plastic surgery. It is a training centre for trauma surgeons and is a leader in trauma research (Trauma Society of South Africa 2009).

2.5 TRAUMA REGISTRIES

2.5.1 Introduction

Bradshaw (2006) refers to increasing international recognition of the importance of health information systems and the role of mortality statistics towards monitoring of public health, the development of public health policies and the allocation of resources (Bradshaw *et al.* 2006). This was already recognized by Eastman in 1987 as related to trauma patients, and that it can be achieved by the establishment and maintenance of Trauma Registries as data bases for the collection of trauma data related to trauma patients (Eastman 1987). Nwomeh *et al.* (2006) highlight historical evolution of Trauma Registries in conjunction with

the Quality Assurance (QA) movement that includes the Continuous Quality Improvement (CQI) and Total Quality Management (TQM) concepts. They examine the goal of trauma care QA programmes as continuous measurable improvement and support the concept of a trauma registry as a timely, accurate and comprehensive data source allowing for continuous monitoring of the process of trauma care (Nwomeh *et al.* 2006). Boffard (2006) confirms that internationally, the maintenance of trauma registries is mandatory for any trauma centre.

According to Nwomeh *et al.* (2006), in developing countries, trauma registries have generally not been established and where they do exist, they are often basic and incomplete. In Karachi; Kampala and Addis Abba it has been demonstrated that the maintenance of a daily log of trauma admissions by use of the emergency room register or by way of a one page registry form completed by trained staff can act as an effective basic trauma registry. These trauma registries contain data on demographics, injury causation and treatment outcome (Nwomeh *et al.* 2006).

Eastman *et al.* (1987) underscore that the maintenance of a trauma registry is considered as critical, together with regular comparison of outcomes as a function of the injury severity scores contained in these registries, where agreed norms are set for comparison with other trauma centres (Eastman *et al.* 1987). Similarly, the lack of databases is a meaningful impediment to the effective identification and implementation of changes to existing practices not offering benefit to patients (Nathens 2004).

2.5.2 Purpose of trauma registries

A trauma system has to monitor its performance over time and establish where improvement is required. A system wide trauma registry with compatibility between data collection during different phases of care is a vital component of modern comprehensive trauma care systems requiring continuous reliable data collection and analysis (Hoyt and Coimbra 2007).

Combining trauma registries at different service levels allows for unprecedented opportunities for evaluation of patient outcomes and inter-hospital comparisons (Moore and Clark 2008).

In busy trauma centres and trauma systems, a well designed trauma registry with validated data serves as the hub for quality control queries. It is a channel to

monitor trends in trauma systems and injury and facilitates research. It provides benchmarking data and can be used to integrate financial data and to project resource requirements. Furthermore, it enables reporting of trauma data from institutional to regional and national registries. This data is thus a potent instrument in epidemiology; performance evaluation; trauma centre accreditation; injury control; education; resource allocation and can even support international benchmarking and research (Nwomeh *et al.* 2006).

Edwards *et al.* (2007) assessed the possibility to compare data from trauma services across Europe based on an agreed core dataset. The analysis of results from 14 institutions from 11 countries revealed significant international variations with the potential for the data from this network to support optimal trauma system design across Europe (Edwards *et al.* 2007).

2.5.3 Requirements of trauma registries

According to Nwomeh *et al.* (2006) there are many requirements to enable the collection, storage and management of data related to patient demographics; causes, nature and severity of injuries; treatment and patient outcome information as well as data that can be applied for calculation of injury severity and possibility of survival scores. They call for adequate funding; dependable software; data sets tailored to the level of trauma care; well-defined patient populations; effectively trained personnel; defined processes for data collection, reporting and validation; as well as processes for maintaining confidentiality (Nwomeh *et al.* 2006).

Nwomeh *et al.* (2006) promote the case for specialised trauma registry registrars. They describe the certification process in the US, where the registrar is expected to have 2 years data management experience and must have completed specific courses towards registration as a Certified Specialist in Trauma Registry (Nwomeh *et al.* 2006)

In Japan, Masao *et al.* (2005) surveyed 224 Japanese university hospitals related to problems associated with use of their trauma registries and their willingness to participate in the newly established Japan Trauma Data Bank. Of the 84 respondents, 47 had computerized trauma registers. Of these 47 hospitals, only 9 employed specific personnel for data entry. All these hospitals reported major problems with the work burden of data entry and with data quality (Masao *et al.* 2005).

The Canadian Institute for Health Information (2009) promotes three standardized data sets for their National Trauma Registry. These include the Minimum Data Set containing demographic, diagnostic and procedural information on all injury related acute hospital admissions; The Comprehensive Data Set including data on major trauma related hospital admissions, and the Death Data Set, currently under development, containing data on all injury related deaths. There is a Data Quality Enhancement Programme to ensure integrity of data quality and related information provided to users as well as privacy principles and policies governing data disclosure (The Canadian Health Institute for Information 2009).

2.5.4 Trauma Registries in South Africa

The TSSA recognized the quantity and severity of trauma experienced in this country and facilitated the development of TraumaBank, an electronic trauma registry, the South African National Trauma Registry, as a means of collecting and storing data related to trauma patients seen at South Africa hospitals (Trauma Society of South Africa 2007). This data capturing, processing, storage and retrieval system is developed and maintained by VerticalApps, a private company, using World Health Organization and other internationally recognized and standardized systems and guidelines. Datasets collected include: patient demographics and incident details; transport and response times; trauma centre admission with clinical information and probability of survival calculations; diagnostic and therapeutic procedures performed; theatre and Intensive Care Unit information and hospital outcome information (Trauma Society of South Africa 2007).

TraumaBank was developed in SA to suit the requirements of this country and additionally offers such features as the automatic calculation of the internationally accredited Injury Severity Score (ISS), New Injury Severity Score (NISS) and Probability of Survival (POS) scores, together with other scores relevant to patients in Intensive Care Units. The system was successfully piloted in a few hospitals in the private and public sectors in SA and has been implemented in some public and private sector trauma centres, e.g. Charlotte Mexete Johannesburg General Hospital (public tertiary hospital, Johannesburg) and Christiaan Barnard Hospital, (private hospital, Cape Town) (Boffard 2006). More recently the TraumaBank registry has been augmented as MediBank, to include

all emergency patients, including use of the South African Triage Scale in real time and is used in the trauma and emergency centres of a large private health services group in SA (MediBank 2008).

2.5.5 Western Cape Department of Health Emergency Department data management

According to Cummins (2004) there is no statutory requirement to maintain a handwritten Emergency Department (ED) register as opposed to a computerised register. However, where a handwritten record does exist, as specified by the National Archives Act of 1996, it must be retained for 5 years.

Frankish (2003) reports on problems encountered to obtain 31 months of data, April 2000 to October 2002, during an analysis of Trauma and Emergency services in the Western Cape. Neither the WCDoH Provincial nor Regional offices could provide all of the data. It eventually took 6 weeks to obtain and verify data, with some gaps remaining. No historical data related to ambulance services were available (Frankish 2003).

Cummins (2004) studied 16 emergency service sites in the Western Cape. None of the Western Cape emergency departments (ED's) had access to ED management information software. Some patient information was held on two different electronic patient billing systems, deployed at different sites. This included the DELTA 9 and the Hospital Information Clinicom (HIS Clinicom) patient registration and billing systems. At the time, there were insufficient funds for tertiary hospitals to purchase the HIS ED module. As a result, ED patient attendances were classified as ordinary out-patients or as ward attendances. On the HIS (Clinicom) system, ED, ward and outpatient figures were aggregated, thus causing distortion of the activity data of all three entities and presenting a misleading data base for planning purposes (Cummins 2004). According to Frankish (2003), besides at the academic hospitals, trauma and medical emergency attendances were not separated. Cummins (2004) concluded that "Information is simply not available in a form which is useful to hospital managers for operational planning or evaluation purposes" (Cummins 2004:10).

Cummins (2004) reports the main source of data regarding ED workload and patient throughput to be a handwritten document the accident and emergency register (A&E register). Even though a standard register was prescribed by the

province, 6 different registers were in actual use. There was a large variation in data sets recorded at sites using the non-standard registers, as well as between sites using prescribed registers, together with inconsistencies regarding which data items were being recorded. Registers were not held in a central archive and were located in various areas within the various emergency departments. During this study there was difficulty obtaining registers even for the most recent calendar year (Cummins 2004).

Cummins (2004) further reports that at most sites variations between attendance data in the A&E registers and data produced by the Information Management division of the WCDoH were within 8% of each other. However, at three sites there were significant discrepancies of between 23% and 54% higher, and at one site 35% lower attendances according to provincial figures. Hospital funding in the province is distributed based on the number of patient day equivalents (PDE's), with three ED attendances equaling 1 PDE. This underscores the importance of data accuracy (Cummins 2004).

2.5.6 Groote Schuur Hospital Trauma Centre data management

The TC attendance register in the GSH TC conforms to prescribed minimal requirements for recordkeeping: recording of name; date; mode and time of arrival; treatment administered and information on final patient disposition (COHSASA 2007). In addition, there is the formal electronic HIS (Clinicom) patient registration and billing system (Groote Schuur Hospital 2007).

According to Cummins (2004:12) the GSH A&E registers "were perhaps the most worrying as archivable (sic), as the register is an A2 pad, held together by glue at the top of the page. By the time the pad is finished, some of the early sheets have usually separated from the rest and probably disappeared" (Cummins 2004:12).

Cummins (2004) recommended that HIS casualty and theatre modules should be purchased and implemented as a matter of urgency. A sufficient number of computers should be provided throughout the ED, accessible to all personnel required to make entries. Once this was established, the need for continuation of the handwritten A&E registers should be questioned, together with core data sets required, with revision of the A&E register books. It was additionally recommended that, even before the acquisition of the casualty modules, ICD- 10 coding during two phases of the patient journey e.g. presentation and discharge,

should be implemented in order to collect data towards understanding of the intensity of the emergency workload (Cummins 2004).

2.6 TRIAGE SYSTEMS

2.6.1 Introduction

The word triage derives from the French word, meaning "to sort" or choose (Gottshalk 2004) and triage was already practiced by the Roman military legions and the chief surgeon of Napoleon Bonaparte for the speedy treatment of battlefield trauma victims (Gwinnutt *et al.* 2001). Gottshalk (2004) describes how the French surgeon Baron Jean Larrey prioritised medical care on Napoleon's battlefields by sorting patients according to their possibility of survival to return to the battlefield, rather than by rank (Gottshalk 2004). Hoyt and Coimbra (2007) contend that the most important goal of a triage system is to identify patients in need of immediate or prioritized surgical or medical care and that triage involves initial patient evaluation ensuring that more seriously injured patients are transported to facilities capable of appropriate management (Hoyt and Coimbra 2007).

2.6.2 Kampala Trauma Score

In searching for a triage tool that would be suited to a resource restricted environment, MacLeod *et al.* (2007) investigated the Kampala Trauma Score (KTS) developed in the light of the limited resource base of Sub Saharan Africa. This is a simplified composite of the Revised Trauma Score and the Injury Severity Score, previously validated for ability to predict outcome in Kampala, Uganda during 1996 (MacLeod *et al.* 2003). MacLeod *et al.* (2007) set out to evaluate the ability of the KTS to differentiate injured patients at high risk for poor outcomes from those at low risk. They hypothesised that, even if applied to all injured patients presenting to a health facility, the KTS could be used as a triage tool for health care personnel and would assist with patient referral and treatment; reduce morbidity and mortality and also reduce unnecessary expenditure (MacLeod *et al.* 2007). The KTS is an instrument designed to differentiate severe from non-severe injuries, but the study was unable to determine a cut-off point to set apart severe versus non-severe patients on an individual basis in a way that

would assist health care personnel. Thus, the value of the KTS as a triage tool was found to be limited (MacLeod *et al.* 2007).

2.6.3 Development of Triage Scoring in South Africa

Gottschalk (2004) postulates that "while an estimated 60,000 South Africans are murdered and die in road traffic accidents each year, at least 2.5 million cases of non-fatal injury require emergency care during the same period" (Gottschalk 2004:325). He calls for a triage system that can be applied in a situation where "the number and severity of casualties exceed the medical capacity in that environment", a situation where the triage nurse must be enabled to accurately assess patients in a maximum of 5 minutes (Gottschalk 2004:326).

Wallis *et al.* (2006) describe the colour coded Cape Triage Score (CTS) designed by the Cape Triage Group as a means of prioritising care for use in South Africa. It is appropriate for particular South African personnel resources; large patient numbers and advanced pathology, together with restrictions on training (Wallis *et al.* 2006). Whereas, for instance, the Australasian Triage score, together with the Canadian modification there-of are appropriate in those particular settings, those tools are considered as too complex for use by South African Enrolled Nursing Assistants (ENAs), the health care professionals most probable to perform the triage function. Current studies show that applying the CTS equally accurately, South African ENA's are on a par with doctors and registered nurses. The CTS was launched in 2006 for use in all public hospitals in the Western Cape and is also used nationally throughout the MediClinic private hospital group (Wallis and Balfour 2007).

The CTS is a physiological scoring system with the addition of mobility and injury parameters to make provision for trauma patients and time critical medical conditions e.g. ischemic stroke. The CTS is validated for safe roadside use as well as in emergency and trauma units. Allocation of the colour categories is as follows; (i) Red - immediate priority (resuscitation cases); (ii) Orange – very urgent priority (potentially life \ limb threatening cases); (iii) Yellow – urgent priority (significant pathology) (iv) Green – delayed priority (minor injuries \ illness) and (v) Blue – deceased (Wallis *et al.* 2006).

The South African Triage Group (SATG) was established during June 2006, with the aim to establish the CTS as a national tool. The CTS was refined and

renamed the South African Triage Scale (SATS) (Wallis and Balfour 2007). It is recognized by the Council of Health Service Accreditation of South Africa since 2007 (COHSASA 2007) and has been incorporated into MediBank, the South African developed Trauma and Emergency registry (MediBank 2008).

2.6.4 Application of triage scoring in the GSH Trauma Centre

Wiseman *et al.* (2002) consider the goal of triage systems to enable quick identification of patients most likely to benefit from rapid medical attention. They discuss two different approaches to triage scores including scores based on physiological parameters and others based on injury mechanism and anatomical factors. Physiology based systems are generally preferred above anatomically based scores for detection of currently unstable patients, whilst anatomical and injury mechanism based scores are more suitable to identify trauma patients with the potential for deterioration. Describing the negative effects of potential over- and under-triage, Wiseman *et al.* (2002) argue that no perfect triage system has yet been devised for specific use with trauma patients. They favour the use of triage systems that include priority triage principles. Priority 1 (P1) equates to the Red patient of colour-coded systems signifying "Emergency" for immediate attention; Priority 2 (P2) equates to Yellow, the condition is "Urgent" with a delay in care possible for a "limited period of time without significant mortality" (Wiseman *et al.* 2002:1), Priority 3 (P3) equates to Green, indicating "Non-Urgent", Red and Yellow patients are to be addressed first in that order (Wiseman *et al.* 2002).

According to A. Nicol (personal communication, October, 2009) the GSH TC applies the CTS (physiology based) triage in combination with priority triage principles of anatomical and injury mechanism triage systems. He argues that the CTS is not entirely suited for use as a tool in the trauma environment, with issues of concern also raised by other SA trauma surgeons. As an example, according to the CTS score "haemorrhage – uncontrolled" is classified as Orange indicating that attention to this category of patient can be delayed by 20 minutes. A. Nicol (personal communication, October, 2009) is of the opinion that the CTS is a practical tool for immediate use by TC front room junior nursing personnel in order to give them direction, but requires medical back-up in the trauma situation to prevent dangerous under-triage. He points out certain clinical trauma

conditions requiring immediate attention that are not listed on the CTS e.g. O2 saturation of 90% or less; temperature of 33 C or less; penetrating neck and / or torso injuries (chest and abdomen); spinal injury; suspected vascular injury; traumatic amputations; all helicopter transfer arrivals; paediatric patients; and chest pain in the presence of ECG changes. In the GSH TC, Orange patients with these clinical manifestations are immediately placed in the Red (P1) category.

2.7 INJURY SEVERITY

2.7.1 Introduction

A significant advance culminating in improvement of the survival of injured persons was the development of objective methods of calculating the severity of a patient's injuries (Pohlman *et al.* 2007). MacLeod *et al.* (2007) describe how data in trauma registries is made universally comparable by the routine use of standardised trauma scores, such as the Injury Severity Score (ISS). Injuries have been coded by severity instruments which enables comparison of injury severity, despite injury diversity and can be applied for policy development; resource allocation, and for quality assurance purposes. It has been hypothesized that injury severity scores can be used as triage tools. (MacLeod *et al.*2003). An attempt to prove this was recently refuted by a study of the Kampala Trauma Score by MacLeod *et al.* (2007).

2.7.2 Injury severity scoring in the USA

According to Pohlman *et al.* (2007) the categorisation of injury severity is critical to the scientific study of trauma. Despite this, measurement of injury severity by grading the severity of individual injuries only started 50 years ago with development of the Abbreviated Injury Score (AIS). The AIS formed the basis for the Injury Severity Score (ISS) developed in 1974, the most widely used measure for injury severity in trauma patients. The Injury Severity Score (ISS) is a simple numerical method to summarise multiple injuries by anatomical characterization of injuries (Pohlman *et al.* 2007). Despite the evolution of a multitude of other severity scoring methods, notably the New Injury Severity Score (NISS) and the Trauma and Injury Severity Score (TRISS), the ISS remains the international golden standard for injury severity scoring (Husum 2002).

Eastman *et al.* (1987) postulate that the ISS was developed as a method of objectively defining the risk of death as a function of the extent of the injury, with an agreed risk threshold. They indicate that injury severity scores are critical to the definition of major trauma patients, the numerical score used for the prediction of probabilities of death and the calculation of preventable deaths (Eastman *et al.* 1987).

Pohlman *et al.* (2007) point out the most fundamental application of trauma scoring as the ability to predict trauma outcome. They indicate that other more recent applications are related to end-of-life decision making, together with resource allocation. They argue that, because injury severity is so difficult to quantify, outcome prediction will never be perfect, the reason for the emergence of multiple scoring systems (Pohlman *et al.* 2007).

According to Nathens (2004) analyses of preventable death rates have successfully been used to assess the effectiveness of trauma systems and for comparative purposes. Reliable data are thus required to provide rational bases for system configuration and to facilitate comparisons of outcomes between different trauma centres (Nathens 2004).

2.7.3 The Cape Triage Score as measure of injury severity scoring in the Groote Schuur Hospital Trauma Centre

According to A. Nicol (personal communication, October, 2009) injury severity scoring is not routinely applied on patients received at the GSH TC. He indicates that, although not ideal, the Cape Triage Score amalgamated with principles of priority triage systems have to suffice as the only available formally coded measure of injury severity at present.

2.8 BENCHMARKING AND QUALITY

2.8.1 International

Mock *et al.* (2004) consider their "Guidelines for Essential Trauma Care" as attainable in almost any setting worldwide. These guidelines were designed with a view to ensuring a worldwide minimum level of trauma care and include specifications for human and other resources. The ultimate objective of these

guidelines is to promote an infrastructure that will decrease the number of trauma-related preventable deaths Mock *et al.* (2004).

According to Welch (2006) historically, the tracking of patients who leave before being seen together with time interval measurement in ED's have evolved as quality and efficiency markers of emergency care. However, these markers have been devoid of standerdised definitions and other operational benchmarks for emergency medicine have been slow to evolve. Hospitals must additionally have the infrastructure to track their quality improvement data (Welch 2006).

During February 2006 ACSCOT conducted an Emergency Department Performance Measures and Benchmarking Summit, culminating in the publishing of their Consensus Statement (Welch 2006). Welch (2006) postulates that there are convincing reasons why emergency practitioners should make use of standerdised language and terminology and why they should implement performance measures and benchmarking practices. This includes the development of quality improvement data as core measures and flow standards that should ultimately support regulated accreditation. The Consensus Statement is a comprehensive document containing wide-ranging time, process and space definitions and performance measures. It is championed by ACSCOT and has been widely disseminated (Welch 2006).

2.8.2 South Africa

The South Africa National Department of Health has developed "Regulations Governing Emergency Centre in South Africa" for attachment to the National Health Act no 61 of 2003. These regulations contain extensive prescriptions related to all aspects of the trauma system, trauma centre criteria, registration and licensing, and offences and penalties with provision for expanded trauma registry data for major emergency centres. According to the Western Cape DoH gazetting of these regulations is expected in the near future (Western Cape Department of Health 2009).

The Council for Health Services Accreditation of South Africa (COHSASA) has devised a document, "Emergency Centre Standards". The post pilot version, November 2007, is endorsed by the Emergency Medicine Society of SA. The comprehensive document includes suggested standards for all aspects of

emergency services including: management, leadership and administration; clinical functions and support services (COHSASA 2007).

2.8.3 Western Cape Province

Two important benchmarking documents for local purposes are presently in the process of being finalized:

- The Trauma Society of South Africa (2009): "Trauma Centres in the Western Cape.
- The Western Cape DoH (2009): "Emergency Centres in the Western Cape".

2.9 SUMMARY

Available literature on trauma care is extensive and covers all aspects of development, management and clinical care of trauma patients in different environments across the world. For the purposes of this research, this review is focused on writings specific to trauma systems; trauma centres; trauma registries; triage and severity scoring systems.

A review of literature regarding the burden of disease for trauma in South Africa, the Western Cape and Cape Town provides insight into the injury load; mechanisms of injury and injury patterns in these areas.

Finally a review is included of the development of landmark documents related to more recent attempts to formalise quality and benchmarking issues in trauma care: internationally, in South Africa and in the Western Cape.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This descriptive study is based on the retrospective analysis of data related to patients presenting to the GSH TC during the period 1st to 30th November 2008. This chapter provides information on the methodology used during the completion of this study. Included are aspects of study approval; ethics issues; study design; study period; sampling; instruments used and data analysis.

3.2 AUTHORISATION, ETHICS APPROVAL AND CONSENT

3.2.1 Authorisation

Approval to conduct this study in the GSH TC was obtained from Professor A. J. Nicol, Head of the Trauma Centre, Groote Schuur Hospital. There-after authorisation to conduct research in the Trauma Centre as part of Groote Schuur Hospital was obtained from Dr S. Kariem, Chief Executive Officer of Groote Schuur Hospital.

3.2.2 Ethics approval for the research

Ethics approval to conduct this study was obtained from the University of the Witwatersrand, and the University of Cape Town:

University of the Witwatersrand, Division of the Deputy Registrar (Academic and Research), Human Research Ethics Committee (Medical).
Reference numbers of this approval are:
Human Research Ethics Committee (Medical) reference: R14 / 49 Kirsten
Clearance Certificate Protocol Number: M080552

University of Cape Town, Health Sciences Faculty, Research Ethics Committee.
Reference numbers of this approval are:

Research Ethics Committee (Medical) reference:	RECREF 222/2009
Federal Wide Assurance Number	FWA 00001637
Institutional Review Board	IRB 00001938

UCT ethics approval was confirmed, conditional on compliance of the study with the World Medical Association Declaration of Helsinki, Seoul version 2008 (World Medical Association 2008)

3.2.2 Ethics issues related to patient identification

Patient identity by way of names, surnames and hospitals numbers is contained in the source documents. Some data that was transcribed onto Microsoft Excel spreadsheets contain hospital numbers for cross reference purposes. During this study, data from patient files was not used at all. All data reported is anonymous. All source documents containing individual patient identification is kept in the strictest confidence by the primary researcher.

3.2.3 Patient consent

This is a retrospective study, based on examination of hospital data and there was no patient contact. This survey forms part of an anonymous audit, not requiring patient consent.

3.3 STUDY DESIGN

A descriptive, non-interventional, observational study method was used in this study, with the intention to develop a body of knowledge to increase information about characteristics within a particular field. Examination of the epidemiological variables of time, place and person were incorporated.

A descriptive study method was chosen as study design, with a view to providing service providers and planners with information that will assist them to design services and allocate resources efficiently (Katzenellenbogen and Joubert 1997).

3.4 SAMPLING

3.4.1 Study target population

The study target population consists of all patients presenting to the GSH TC during the period 1st to 30th November 2008.

3.4.2 Selection of study sample

A 100% sample was used of all patients who presented to the GSH TC during the period 00H00 on 1st November 2008 to 24H00 on 30th November 2008 and were entered into the GSH TC attendance register.

A specific subgroup of these patients admitted to the GSH TC C14 resuscitation ward was more intensively studied, as representative of the most severely injured patients treated in this TC.

A 100% sample was used of all patients admitted to the TC C14 resuscitation ward during the period 00H00 on 1st November 2008 to 24H00 on 30th November 2008 and who were entered into the TC C14 resuscitation ward register.

The month of November 2008 was selected for specific reasons:

- Data collection started in earnest during March 2009. The search was for the most appropriate complete recent month of data.
- The months of December and January represent the year-end festive season in Cape Town with an influx of holiday makers from the South African interior. There is an increase in risky recreational activities and revelry, often associated with imbibing of alcohol and drugs, resulting in higher than normal trauma cases.
- Schools and Higher Education Institutions break up for annual holidays, resulting in thousands of youngsters at large.
- 15th December heralds the start of the 4 week 'builders' holiday' with payment of annual bonuses and increased over indulgence and high risk behaviour.
- December has three public holidays (16th, 25th, 26th) and January (1st) leading to extended weekends. In Cape Town, January 2nd heralds the Cape Minstrel festival and is still regarded as a public holiday by many. During these times there is more traffic on the roads which leads to increased road traffic incidents.

- During mid- December to mid-January normal routine functioning of other services in the hospital are de-escalated (excluding trauma and emergency services). This leads to patients who cannot access ordinary services, making their way to emergency services.
- The month of February has only 28 days as opposed to the 30 to 31 days of other months of the year.

3.4.3 Inclusion Criteria

100% patients presenting to the GSH TC 00H00 on 1st November 2008 to 24H00 on 30th November 2008 that were entered into the GSH TC attendance register and TC C14 resuscitation ward register were included in the study.

These patients included:

- All referrals from other clinics and hospitals
- All re-attenders to the GSH TC, as they represent an integral part of the workload for personnel.
- Personnel treated for sharps injuries and other injuries sustained whilst on duty. Treatment of these patients in the TC is due to convenience and does not comply with international standards for trauma patients. These patients represented 0.6% of the workload, are not a BoD issue.
- All case types were included.

3.4.4 Sample Size

A total of 1040 patients in the GSH TC attendance register and 131 patients in the GHS TC resuscitation register for the period 1st to 30th November 2008 have been included in this study.

3.5 MEASUREMENTS

3.5.1 All patients reporting to the GSH TC, 1st to 30th November 2008

3.5.1.1 Number of patients reporting to GSH TC, 1st to 30th November 2008

3.5.1.2 Day and time of presentation of GSH TC patients

3.5.1.3 Mode of arrival at hospital

3.5.1.4 Demographic details: gender, age, population group, place of injury

3.5.1.5 Injury details: body region injured; mechanism of injury

3.5.1.6 Classification of clinical diagnoses: ICD-10 Coding

3.5.1.7 Severity of patient clinical status: Cape Triage Score

3.5.1.8 Admissions to the C14 resuscitation ward

3.5.1.9 Admissions to other TC Wards

3.5.1.10 Admissions to other hospital wards

3.5.1.11 Admissions to Intensive Care Units

3.5.1.12 Transfers to Operating Theatre

3.5.1.13 Number of in-patient days per patient

3.5.1.14 Referrals to other services

3.5.1.15 Discharges home

3.5.1.16 Deaths

3.5.2 All patients admitted to the GSH TC C14 Resuscitation ward, 1st to 30th November 2008

3.5.2.1 Number of patients reporting to GSH TC, 1st to 30th November 2008

3.5.2.2 Day and time of presentation of GSH TC patients

3.5.2.3 Mode of arrival at hospital

3.5.2.4 Demographic details: gender, age, population group, place of injury

3.5.2.5 Injury details: body region injured; mechanism of injury

3.5.2.6 Classification of clinical diagnoses: ICD-10 Coding

3.5.2.7 Severity of patient clinical status: Cape Triage Score

3.5.2.9 Admissions to other TC Wards

3.5.2.10 Admissions to other hospital wards

3.5.2.11 Admissions to Intensive Care Units

3.5.2.12 Transfers to Operating Theatre

3.5.2.13 Number of in-patient days per patient

3.5.2.14 Referrals to other services

3.5.2.15 Discharges home

3.5.2.16 Deaths

3.6 STUDY INSTRUMENT

3.6.1 Data source

Selection of the GSH TC attendance register (Appendix 5) and the GSH TC C14 resuscitation ward register (Appendix 6) as primary data sources was due to problems with the integrity of data of the Health Information System (Clinicom) and the TraumaBank databanks.

3.6.2 Data

Copies were made of the GSH TC attendance register and the GHS TC resuscitation register for the period 1st to 30th November 2008.

Data were cleaned and analysed using Microsoft Excel software. Spreadsheets were complied with selected data transcribed into electronic format. Other data fields were manually counted and the results entered onto Microsoft Excel spreadsheets.

Despite only containing 852 patients HIS (Clinicom) electronic data were used for illustration of certain trends during the study month and for other periods, as appropriate.

3.6.3 Interviews

During the course of 2007 to 2009, unstructured interviews were conducted with a variety of personnel responsible for management of different aspects of functioning of the GSH TC. These personal communications have been formally referenced in the text.

3.6.4 Field workers

Due to the absence of funding for the appointment of research assistants, no field workers were associated with this project.

3.7 VALIDATION, BIAS AND LIMITATIONS

3.7.1 Validation

At the onset of this study it was intended to employ the TraumaBank databank as a primary source of data, drawing on the Health Information System (Clinicom) for

validation, with the possibility to use the GSH TC attendance register and the TC C14 resuscitation ward register to validate HIS (Clinicom) data.

During the course of the research, according to A. Nicol (personal communication, October, 2009) it transpired that, for the period 1st to 30th November 2008, TraumaBank data reflected approximately 33% of patient attendances as compared with the 1040 attendances recorded in the GSH TC attendance register. For the same period of time, the HIS (Clinicom) system contained data for 852 patient attendances (Groote Schuur Hospital 2009).

The GSH TC attendance register and the TC C14 resuscitation ward register thus appeared to be the most complete data sources without the option of validation. However, there was no reason to believe that the nurses would have fabricated this data.

Completeness of the GSH TC attendance register and the GHS TC C14 resuscitation register for the period 1st to 30th November 2008 was tested by confirmation of continuity of dates and times. Data related to patients admitted to the TC C14 resuscitation ward is contained in both registers. This data was reconciled between the two registers.

3.7.2 Bias

The most conspicuous area of bias was reflected in completion of the register field related to "race". According to W. Bryant (personal communication, August 2009), some scribes completely ignored these fields whilst others entered the patient's spoken language in stead of the race. HIS (Clinicom) data in his respect is equally incomplete.

Some registry entries only contained the mechanism of injury e.g. "MVA pedestrian" without indicating the nature of the injury; some entries only included the body region injured e.g. "head injury" without including the mechanism of injury.

There may have been other more subtle biases related to entries made by individual nurses and not noticed by the primary researcher.

3.7.3 Limitations

Hard copy data had to be transcribed into electronic format. Most data was manually counted and checked before transcription, a time consuming task.

Two electronic data sources were not suitable for use in this study.
In the HIS (Clinicom) system only 852 patient attendances were captured during the study period (Groote Schuur Hospital 2009), and TraumaBank data reflected approximately 33% of patient attendances according to A. Nicol (personal communication, October, 2009).

3.8 ANALYSIS

Data were checked, coded and cleaned by the primary researcher who also transcribed data into electronic format as Microsoft Excel spreadsheets and tables. Calculations; charts and graphs were completed in Microsoft Excel. The services of a statistician were not used.

3.9 SUMMARY

Authorisation to conduct this study in the Groote Schuur Hospital Trauma Centre was obtained from the Head of the GSH TC and the GSH CEO. Ethics approval was obtained from the WITS and UCT ethics committees.

- University of the Witwatersrand, Division of the Deputy Registrar (Academic and Research), Human Research Ethics Committee (Medical).
- University of Cape Town, Health Sciences Faculty, Research Ethics Committee.

A descriptive, non-interventional, observational study method was used in this retrospective study of data related to patients who attended the Groote Schuur Hospital Trauma Centre during the period 1st to 30th November 2008.
The GSH TC attendance register and the GHS TC resuscitation register served as primary sources of data. Data were managed by transcription into Microsoft Excel electronic format.
Altogether 1040 patients recorded in the GSH TC attendance register were included, together with more intensive examination of a subsection of 131 of these patients contained in the GSH TC resuscitation ward register. Measurements examined included patient demographic characteristics; injury characteristics; in-hospital accommodation and disposals.

CHAPTER 4

DATA COLLECTION AND PROCESSING

4.1 INTRODUCTION

On initial investigation of potential sources of data for use during this research project, it was pleasing to establish three different data sources, namely the handwritten GSH Trauma Centre attendance register (TC attendance register); the electronic provincial Health Information System (Clinicom) (HIS Clinicom) patient registration and billing system and the commercial TraumaBank trauma registry. Much later, I was pleasantly surprised to additionally discover the existence of another handwritten Trauma Centre C14 resuscitation ward register (C14 resuscitation ward register). Reality only set in once I started the process of physical data collection and my enthusiasm was soon to be tested.

As reported by Frankish (2003 & 2004) and Cummins (2004), collection of data for the GSH Trauma Centre, was a considerable challenge. As opposed to collecting 31 months' of data, starting 31 months back (Frankish 2003) and one summer and one winter months' data, 6 months to 1 year back (Cummins 2004), I was searching for data of one month only, 5 months back. As with Cummins (2004), 5 years later, I still encountered problems with access to and interpretation of the HIS (Clinicom) data, together with all the same time-consuming problems and frustrations in locating handwritten register parts in store-rooms; offices; cupboards and shelves dispersed all over the hospital. The most significant positive difference between the Frankish and Cummins experiences and mine was that ICD-10 coding had been implemented.

In this chapter I will describe the three different systems used for data collection at the Groote Schuur Hospital Trauma Centre (GSH TC), the efforts to obtain data from the different sources, together with advantages and shortcomings of the individual sources and problems encountered.

4.2 HEALTH INFORMATION SYSTEM, CLINICOM (HIS Clinicom)

4.2.1 Description

The electronic HIS (Clinicom) patient registration and billing system is managed by GSH Finance and Information Management departments and manned by registration; billing and account payment personnel stationed at different places during the patient journey e.g. different hospital reception areas; wards; out-patient departments; billing and account payment offices. Data that can be captured in this system includes the patient name; date of birth; ID number; gender; language of choice; residential and postal addresses; financial classification; ICD-10 coding; special radiological and laboratory investigations performed; blood products and pharmaceuticals received; operations and procedures performed; admission and out-patient details; transfers within the hospital e.g. to ICU's; together with disposal details e.g. transfer to other institutions; discharge or death (Bryant 2009).

4.2.2 Shortcomings of HIS (Clinicom) at the GSH TC

Cummins (2004) reported distortion of GSH TC activity data with creation of a misleading data base for planning purposes. This was due to the failure of the Western Cape Department of Health (WCDoH) to purchase the HIS Trauma and Emergency module, making do with the out-patient and ward modules instead. GSH TC patients were thus simply classified as out-patient attendances and ward admissions. Cummins (2004) recommended the urgent purchase of HIS (Clinicom) Trauma and Emergency and theatre modules together with installation of computers throughout the ED. This would enable clinical and nursing personnel to enter data in real time, together with on-line data access (Cummins 2004).

In 2009, patients presenting to the GSH TC are still classified as "out patient attendances", thus, despite the extreme resource requirements of TC patients, carrying the same weight as a normal out patient. Out-patient attendances on HIS (Clinicom) are divided by 3, representing 1 patient day equivalent (PDE) which equals one ward admission for one day. Patients treated in the TC C14 resuscitation area, TC C12 High Care Unit and ward and the TC C5 ward are classified as "admissions". (Bryant 2009).

4.2.3 Problems encountered with HIS (Clinicom) at the GSH TC

Data input: There are not enough clerks allocated to manage the workload generated by the trauma and emergency departments: out-patient attendances; head counts; visits; admissions; transfers within the departments and transfers out. When data entry is not completed during a shift, if there is a power interruption, or the HIS (Clinicom) system is "down" it is often not possible to return. In this way, patients and patient details "get lost". (GSH Information Management Department 2009a)

Completeness of data: For years, nursing personnel have indicated substantial discrepancies between data collected from their handwritten trauma registers and that produced by the HIS (Clinicom) system. According to A. Nicol and M. Patton (personal communications, June 22, 2007 and May 4, 2009), in comparisons of HIS (Clinicom) and GSH TC register figures, these monthly discrepancies could add up to the omission of hundreds of patients per month.

ICD-10 coding: Coding must be done by doctors and clerks may only capture codes once this has been completed. Unfortunately a generally low proportion of patients are coded.

Descriptive data related to the cause of injuries, e.g. gunshot wounds; traffic related incidents and assaults cannot be retrieved from the HIS (Clinicom) databank and are manually collected from the nurse managed TC registers.

Data retrieval: Data from the HIS (Clinicom) system are not readily accessible and can only be managed by a selection of graded authorized personnel with different levels of access, authorized by individualized access codes as related by W. Bryant (personal communication May 2008). The format of data produced in response to unconventional queries can be user unfriendly to the extreme, resulting in unwieldy spreadsheets that are particularly difficult to manipulate.

Data quality: According to W. Bryant (personal communication May 2008) data accuracy and integrity is dependent on quality input by individual clerks on duty at the time of entry. Due to large patient numbers, geographic spread of departments and scarcity of supervisory posts, it is not possible for supervisors to do regular quality checks.

Patient classification, trolley patients: Some patients are treated on trolleys in the TC C14 holding area with capacity for up to 11 trolleys. Trolley patients can

spend anything from a few hours up to a few days in this area, receiving the same treatment as admitted ward patients e.g. they could have intravenous infusions; urinary catheters; they receive regular observations and medication and regular attendance by nurses and doctors. Reasons why these patients are nursed on trolleys instead of in beds include no TC ward beds available; short term stay expected; beds reserved for more serious patients; awaiting special investigation results; awaiting observation of the effect of treatment as related by M. Patton (personal communication, June 22, 2007). These patients were always entered into the HIS Clinicom system as out-patient attendances. The rationale of the HIS (Clinicom) system was that, in the absence of access to a ward with change of patient status to an "admission", the "trolley" patient status remains "out-patient attendance". According to W. Bryant (personal communication, December 10, 2009), since about October 2009, patients who have been nursed on trollies for longer than 6 hours are now recorded as "admissions".

ICD-10 Coding: W. Bryant (personal communication May 2009) indicates that ICD coding of GSH TC patients is entered onto the system by non-clinical clerical personnel, provided that coding has been completed by doctors treating the patients. Unfortunately the coding percentage is especially low. This means that retrieval of ICD-10 codes does not necessarily give an accurate reflection of the profile of cases treated in the GSH TC.

4.2.4 Advantages of HIS (Clinicom) at the GSH TC

Data security and patient confidentiality of HIS (Clinicom) is ensured through selective data access by differently graded authorized users. Large volumes of data can be electronically manipulated and retrieved from this system. In previous studies, HIS Clinicom GSH TC data was described as incomplete and distorted (Cummins 2004) and (Frankish 2004). It unfortunately appears that data in this system for the TC remains underreported and unvalidated.

4.3. TRAUMA CENTRE ATTENDANCE REGISTER

4.3.1 Description

In the GSH TC there is a handwritten Trauma Centre (TC) attendance register accommodating prescribed minimal requirements for recordkeeping: recording of

name; date; mode and time of arrival; treatment administered and information on final patient disposition (COHSASA 2007). Additional recorded data in the TC attendance register includes the patient hospital number; age; gender; race; nature of injury; mode of arrival; time and nature of disposal and name of responsible doctor. Over and above data recorded under formal headings, added entries include the Cape Triage Score (CTS) entered as R, O, Y or G, signifying red, orange, yellow or green; Xrays, Lodox; CT Scan; referral for surgery and which theatre; out-patient appointments.

According to S. Plaatjies (personal communication, February, 2009) due to high costs and recurrent unavailability of formal registers from the stores, the TC attendance register is manufactured by TC nursing staff. It consists of a random number of A3 pages photocopied from a bound register, held together with string or a metal clip and is supported with bleached Xray films. A single register unit does not represent a predictable time period. This register is usually completed by a dedicated nurse per shift, as can be deducted from the handwriting According to M. Patton (personal communication, May 4, 2009) this register is not formally used by hospital administration, but is maintained and used by the TC clinical personnel as a real-time patient information and flow document and for the maintenance of nursing statistics. As of late, attempts are being made to systematically store completed registers in the medico-legal department in the Old Main Building.

4.3.2 Advantages of the TC attendance register

Applications: According to M. Patton (personal communication, May 4, 2009), in the absence of access to a real-time electronic data source, this register serves as a valuable patient information and flow document used by TC medical and nursing personnel. Data is used by a variety of researchers and also served to inform aspects of the HIS (Clinicom) and TraumaBank systems.

Data collected: This register is a veritable gold mine of rich data, covering patient demographics; reason for attendance; injury data e.g. mechanism of injury and injured region; triage and treatment particulars together with patient disposal details. Much of this information would otherwise only be available from patient folders.

Access: Once the different parts of the register for the required period have been assembled and copied, this is an in-hand hard copy source of extremely rich valuable data, highly prized by researchers of varied topics related to this TC.

Completeness and data quality: According to M. Patton (personal communication, May 4, 2009), TC nursing and clerical personnel take a personal pride in the completeness and accuracy of data in this register. This can be seen from the continued maintenance of the register despite lack of formal recognition; allocation of the task to a dedicated nurse per shift, addition of backdated entries, together with their dedication to complete monthly Nursing stats. GSH Information Management retrieves data related to injury types from these statistics for formal use.

4.3.3 Shortcomings of the TC attendance register

Self manufactured format: Cummins (2004) described the trauma centre attendance register as "an A2 pad, held together by glue at the top of the page. By the time the pad is finished, some of the early sheets have usually separated from the rest and probably disappeared" (Cummins 2004:12). Although in 2009, the format is slightly different, the same problems remain.

Archiving: The TC attendance register is not included in the GSH formal archiving system. In the Medico-Legal Department TC registers are now informally held as a favour to TC nursing management. It thus depends on the individual who takes ownership at the time, where and how the registers are stored. together with access control to stored registers; loans; recording of borrower particulars and retrieval of loaned registers.

Validation: Validation of data contained in the TC attendance register may be possible through reconciliation with HIS (Clinicom) data and data in patient folders, though this would clearly be a monumental task.

4.3.4 Problems encountered with the TC attendance register

Discrepancies between TC Attendance register and Clinicom data: As communicated by M. Patton (personal communication, June 22, 2007) for many years there have been regularly reported discrepancies in counting. This has amounted to up to 200 and more out-patient attendances in the TC attendance register than captured in the official HIS (Clinicom) system.

Archiving: Despite legal requirements for a prescribed period of safe retention of these registers (COHSASA 2007), as communicated by S. Plaatjies (personal communication, February, 2009), there is no formal archiving of these registers. Due to the convenience of rich data in these registers there is a high demand for access to these registers from persons doing research and thus a high rate of disappearance. Previously, full registers were kept in a TC store room, but lately they are now informally stored in the hospital medico-legal department. It was extremely time consuming, during February and March 2009, to successfully locate all the sections of this register for the period of 1st to 30th November 2008. It was eventually assembled from three different places dispersed across the GSH Old Main Building and the New Main Building

Data management: As this is a hard copy with no equivalent electronic counterpart, data has to be manually counted and transcribed into electronic format.

4.4 TRAUMA CENTRE C14 RESUSCITATION WARD REGISTER

4.4.1 Description

As communicated by S. Plaatjies (personal communication, February, 2009), in conjunction with the TC Attendance Register, in similar fashion, a TC resuscitation register is manufactured and maintained by TC nursing personnel. In this register, columns and headings are drawn and entered by hand. The hospital patient "sticker" provides the name and date of birth; hospital folder number; gender; language of choice and financial classification. Handwritten entries include date and time of arrival; nature of injury; time and nature of disposal, drugs and blood products administered. In addition there are tick boxes for clinical treatment and special investigations e.g. intubation; ventilation; catheter; intercostal drain; naso-gastric tube, various radiological investigations e.g. Xrays; CT and Lodox scans; angiogram and ultrasound (Plaatjies 2009).

This register contains valuable demographic, clinical and workload and patient flow data related to the most seriously injured patient cohort received in the GSH TC. It forms an even lesser part of the formal hospital data set than the TC attendance register.

According to S. Plaatjies (personal communication, February, 2009) TC nursing management has repeatedly debated the value of continued maintenance of this register considering lack of formal recognition; administrative duplication and additional nurse workload. On each occasion the value as a user friendly real-time clinical information document and nurse workload indicator overshadows other considerations.

4.4.2 Advantages of the TC C14 resuscitation ward register

Applications: According to S. Plaatjies (personal communication, February, 2009), in the absence of access to a real-time electronic data source, this register mainly serves as a valuable patient information and flow document used by TC medical and nursing personnel. It is used as a nurse workload indicator for nursing management purposes.

Data is used by a variety of researchers and also served to inform the TraumaBank system

Data collected: Most of the information in this register would otherwise only be available from patient folders and this register is another veritable gold mine of rich data. It forms an invaluable addition to data contained in the TC attendance register, as well as serving as a double-check back-up for certain data in this register.

Access: Once the different parts of the register for the required period have been assembled and copied, this is an in-hand hard copy source of extremely valuable, especially clinical data.

Differentiation: This represents a concentrated record of different aspects of patients admitted to the GSH TC resuscitation ward.

Validation: Validation of data in the TC C14 resuscitation ward register is possible by cross reference in the TC Attendance Register

Completeness: As related to inclusivity, during the period 1st to 30th November 2008, only three patients identified in the TC attendance register as being "RESUS" patients had not been included in the TC resuscitation register. Fields relating to demographic data, nature of injury; date and time of arrival in the resuscitation area, time and nature of disposal appear comprehensively complete. Tick boxes for ventilation; naso-gastric tube; catheter; inter-costal drain; naso-gastric tube; Xrays and CT scan; angiogram and ultrasound also

appear to be dependably completed. There is no specific column for Lodox scans, but this appears to be consistently entered across other, lesser used columns.

4.4.3 Shortcomings of the TC C14 resuscitation ward register

Administrative load on nurses: There is considerable duplication of data also entered into the TC attendance register.

Archiving: As with the TC attendance register, there is no formal archiving of these registers. It was even more difficult and time consuming to piece together TC resuscitation register bits for the relevant time period.

4.4.4 Problems encountered, TC C14 resuscitation ward register

Completeness and data quality: Especially during times when the TC resuscitation area is full or beyond capacity, nursing personnel find it extremely difficult to complete all the fields in this register. Though most fields in this register appeared to be consistently completed, columns labeled "ECG", "CVP", and "Drugs" appear suspiciously incomplete and were thus omitted from the study. Triage data and gender were often not completed.

Archiving: As confirmed by M. Patton (personal communication, May 4, 2009), this "home-made" register represents a part of TC nursing management documentation, not identified for formal archiving. There is a high demand for access to these registers from persons doing research and thus a high rate of disappearance. Previously, full registers were held in different spaces under control of TC nursing management but lately registers are informally stored in the hospital medico-legal department. After I discovered the existence of this record, CPN S. Jantjies was extremely helpful in assembling different parts of this record for the period of 1st to 30th November 2008, found in different nursing controlled areas in the emergency department.

Data management: As this is a hard copy with no equivalent electronic counterpart, data has to be manually counted and transcribed into electronic format.

4.5 TRAUMABANK TRAUMA REGISTRY

4.5.1 Description

According to A. Nicol (personal communication, June 22, 2007) the TraumaBank Trauma Registry and databank was to be installed in the GSH TC during July 2007. TraumaBank was financed by the University of Cape Town Surgical Research Fund, and included computer hardware; TraumaBank clinical software package installation and annual licensing fees, training and maintenance, together with payment for services of a data input clerk. Active data capturing occurred from July 2007 until mid- 2009 and is under control of the head of the GSH Trauma Centre, Prof A Nicol, as related by A. Nicol (personal communication, October, 2009).

TraumaBank is an electronic Trauma Registry for accurate recordkeeping of trauma patients in the hospital emergency environment initiated under the auspices of the Trauma Society of South Africa. This data capturing, processing, storage and retrieval system is developed and maintained by VerticalApps, a private company, using World Health Organization and other internationally recognized and standardized systems and guidelines, tailored for use in the South African context. Available datasets include: patient demographics and incident details; transport and response times; Trauma Centre admission details with clinical information, injury severity scoring and probability of survival calculations; diagnostic and therapeutic procedures performed; theatre and Intensive Care Unit information and hospital outcome information (Trauma Society of South Africa, 2007).

4.5.2 Shortcomings of the TraumaBank trauma registry at GSH TC

Independent status; The TraumaBank Registry is completely independent from the GSH information management systems and does not form part of the hospital's official data set. There is no interface between TraumaBank and the formal electronic HIS (Clinicom) registration and billing system, inevitably leading to duplication of the data capturing process.

Data capturing: The TraumaBank system has its own set of paper-based data collection sheets underpinning the electronic data input process (Appendix 7). These sheets are for completion, preferably in real time or within 24 hours

retrospectively, by doctors responsible for patient treatment. GSH experience underscores the opinion of S. Mestriner (personal communication, August, 2008) that, in order to make use of the entire system, especially in the face of a large patient load, data capturing for this system is labour intensive, with certain sections requiring input from clinically qualified data capturers.

A. Nicol (personal communication, October, 2009) reports October 2008 as the month of the highest achieved % data capture (77%), requiring the manpower of the regular TraumaBank data capturer together with 3 volunteer Canadian doctors .

Missing data: In the absence of an electronic HIS (Clinicom) interface and of authorized access to the system, missing data has to be gleaned from the paper-based GSH TC and / or C14 resuscitation registers; favours asked from authorized GSH clerks or, ultimately, by retrieval from patient folders.

4.5.3 Problems encountered, TraumaBank trauma registry at GSH

Completeness and data quality: According to A. Nicol (personal communication, October, 2009), during the time that data capturing occurred (July 2007 to mid-2009) the mean % of monthly data captured is reported as approximately 33%, with a single best month of concerted effort leading to 77% in October 2008.

Access: Based on projected comprehensive data availability and internationally recognized injury severity scores, I had initially entertained high expectations for access to data related to this study by way of information retrieved from the TraumaBank Registry. During the period December 2008, until the departure of the TraumaBank data capturer, mid-2009, I was unfortunately singularly unsuccessful in obtaining any data whatsoever for the period 1st to 30th November 2008 from the TraumaBank data capturer.

Continuity: According to A. Nicol (personal communication, October, 2009), in the absence of financial support from the WCDoH or GSH management, and in the face of limited funding from the University of Cape Town Surgical Research Fund, it was not possible to fund the required manpower to ensure comprehensive data capturing into the GSH TraumaBank. It was also not possible to support limited data capturing managed by the former data capturer.

4.5.4 Advantages of the TraumaBank trauma registry at GSH

October 2009: The theoretical advantages of access to comprehensively detailed information in a Trauma registry are vividly demonstrated by some of the graphs resulting from the October 2008 TraumaBank data capture initiative in the GSH TC and are attached as Appendix 8 (Cinnamon 2008). This data has purposefully not been used to underpin research for this project, as it would not reflect the realities of GSH TC data capturing, storage, processing and retrieval. It would not be possible to retrospectively validate the data captured and it represents approximately 77% of the patient numbers registered in the GSH TC attendance register, despite requiring the efforts of 4 data capturers.

4.6 DATA COLLECTION

Despite my initial high expectations of ready access to data from at least two electronic systems, it has been essential to return to the handwritten nurse managed TC attendance register for the study period (41 x A3 pages, average of 25 entries per page, total of 1040 patients) and resuscitation register (12 x A3 pages, 11 entries per page, total of 127 patients) for the greater part of the data required for this study. Once located and assembled, these registers thus represent the single most user-friendly; accessible, accurate and comprehensive collection of rich data related to the events and outcomes in the GSH Trauma Centre during the month of November 2008.

4.7 DATA PROCESSING

Data processing for the purposes of this study was managed by the primary researcher. The November 2008 TC attendance register (41 x A3 pages, average of 25 entries per page, total of 1040 patients) and the TC C14 resuscitation register (12 x A3 pages, average of 11 entries per page, total of 127 patients) were assembled.

The A3 format hard copy registers were photocopied and handwritten data were manually transcribed into electronic format by the compilation of Microsoft Excel spreadsheets and tables. Some elements were first collated by manual counts (verified by recounts) before transcription.

4.8. SUMMARY

There has been longstanding concern related to the accuracy of data collection at the GSH Trauma Center (Cummins 2004) and (Frankish 2003, 2004). GSH TC medical and nursing management has repeatedly reported profound discrepancies between data that is manually collected by GSH TC nursing personnel and data recorded on the GSH HIS (Clinicom) patient registration system as reported by A. Nicol and M. Patton (personal communications, June 22, 2007 and May 4, 2009). The absence of current, specific and accurate data about the numbers, type, severity and complexity of injured patients received at the GSH TC severely hampers accurate planning towards the allocation of appropriate resources to this critical service. It could also have a negative impact on the classification or grading of the Trauma Centre.

CHAPTER 5

RESULTS

5.1 INTRODUCTION

According to the Trauma Society of South Africa (2009), physical trauma refers to a physical injury; a trauma patient is some-one who has suffered the physical effects of a transfer of energy, whilst trauma care is the management of physical injuries sustained by trauma patients (Trauma Society of South Africa 2009).

This research is aimed at examining data related to injured patients managed at the GSH TC during one calendar month (November 2008). This data includes characteristics of the total GSH trauma patient population for that month e.g. demographic and arrival details; injury mechanism; injury severity; specialist disciplines and other resources required, together with disposal of patients from the TC.

An important subsection of GSH trauma patients are admissions to the TC C14 resuscitation ward, representing the most severely injured patients. Throughout this chapter, data related to these patients are examined as a subsection of the total.

5.2 OVERVIEW

5.2.1 Cape Town population served by GSH TC

Table 5.6 GSH TC 2010: Estimated Drainage Population (WC DoH 2009b)

GSH TC **2010**: Estimated Drainage Population		
Sub Districts	Sub-district Drainage Population	% Drainage, Cape Town Population
Southern	527,896	14.9%
Western	398,859	11.3%
Klipfontein	424,429	12.0%
Mitchells Plain	484,964	13.7%
Total GSH Drainage	1,836,148	51.9%
Total Cape Town Pop.	3,539,661	

As demonstrated in figure 5.6 the GSH TC formally serves 51.9% of the 3.5 million Cape Town population, with the majority of these patients living in the Southern sub-district (14.9%), followed in descending order by Mitchells Plain (13.7%), Klipfontein (12.0%) and the Western sub-district (11.3%) (Western Cape DoH 2009a)

The GSH TC has no international L1 (RSA L3) trauma beds (Vorster personal communication 2009) per 1,836,148 persons, and 1 international L2 (RSA L2) trauma bed per 34,003 persons

5.2.2 GSH TC November 2008 total number of patients

Nov 2008 Nr of patients recorded in the GSH TC register (n=1040)

Table 5.7 GSH TC Register Nov 2009: Patients recorded in GSH TC register

GSH TC Register Nov 2009: Patients recorded in GSH TC register			
Patient type	Fresh Trauma	Re-attenders	Total Patients
Nr Patients	1009	31	1040
Percentage	97.0%	3.0%	100.0%

During November 2008 1009 patients (97%) with fresh trauma presented to the GSH TC, together with 31 (3%) re-attenders, as illustrated in Table 5.7.

Nov 2008 Nr patients admitted to the TC C14 Resuscitation Ward (n=131)

During the period, 00H00 on 1st November 2008 to 24H00 on 30th November 2008, 131 (12.6%) of the total 1040 patients were admitted to the C14 resuscitation ward. This group of patients represents the most critically injured requiring immediate attention to avoid deterioration.

Two groups of patients are researched:

1. Patients in the GSH TC register (n=1040)

2. Patients admitted to the TC C14 Resuscitation Ward (n=131)

It is important to keep in mind that the second group is a subsection of the first group and is included in studies of that group

5.3 DEMOGRAPHIC DATA

5.3.1 Gender

Table 5.8 GSH TC Nov '08: Total Patients: Gender

GSH TC Nov '08: Total Patients: Gender			
Male	Female	Unknown	Total
768 (73.8%)	268 (25.8%)	4 (0.4%)	1040

Table 5.9 GSH TC Nov '08: C14 Resuscitation Ward: Gender

GSH TC Nov '08: C14 Resuscitation Ward: Gender			
Male	Female	Unknown	Total
120 (91.5%)	11 (8.5%)	0 (0.0%)	131

Tables 5.8 and 5.9 demonstrate patient gender in the GSH TC total patient and the C14 resuscitation ward cohorts respectively. Where the gender is unknown, there were no data in the registers and gender could not be deducted from patient names.

Both profiles demonstrate a predominance of males, total patient cohort (73.8%) and resuscitation patient cohort (91.5%). There is a significantly higher ratio of males to females in the resuscitation patient cohort (11:1) than in the total patient cohort (3:1).

5.3.2 Age

Figures 5.3 and 5.4 below, show the ages of patients in the total patient cohort in 5 year class intervals, 0 years to 80+ years in numbers and percentages respectively. No ages were obtainable from the GSH TC register for 156 (15.0%) patients. There was a peak at 20 to 24 years (yrs), 181 patients (17.4%), with other substantive class intervals in descending order 25 to 29 yrs 168 patients (16.2%); 15 to 19 yrs, 97 patients (9.3%); 30 to 34 yrs, 91 patients (8.8%) and 35 to 39 yrs, 83 patients (8.0%). There-after there is a steady decline in numbers in the different class intervals, excepting for a slight increase of 5 patients more in the 65 to 69 yr group than the 60 to 64 yr group.

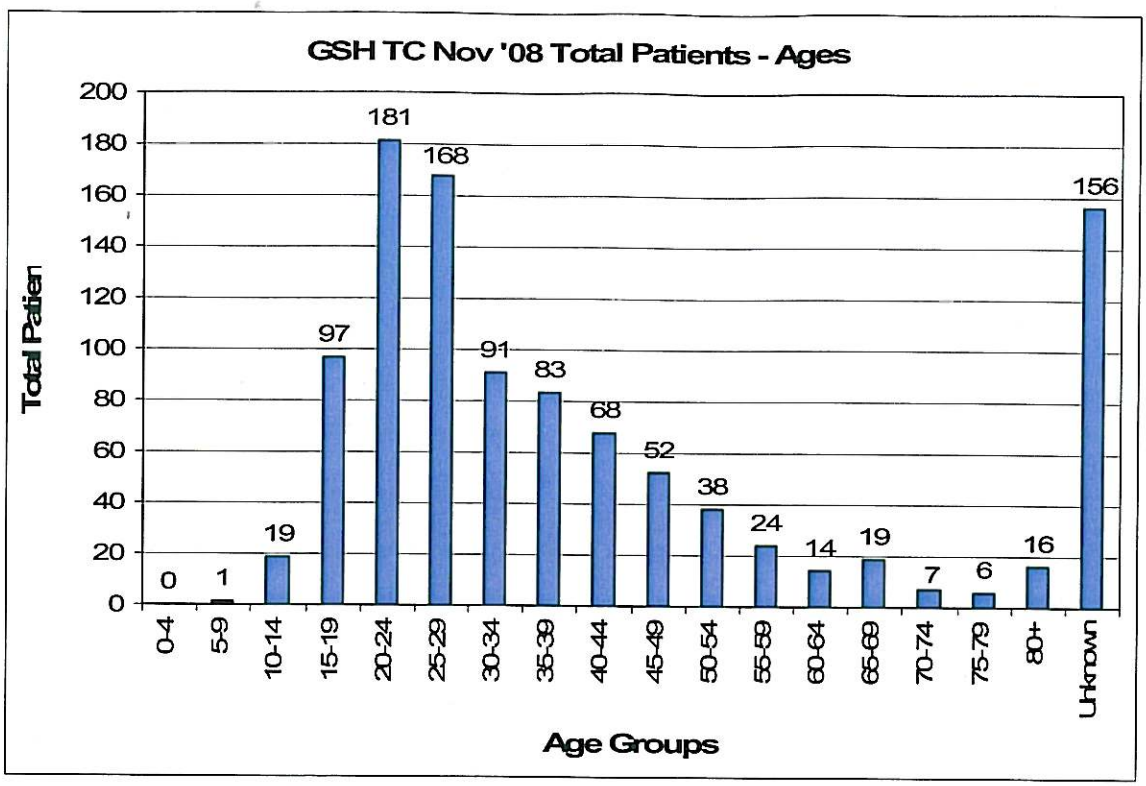

Figure 5.3 GSH TC Nov '08 Total patients: ages in numbers

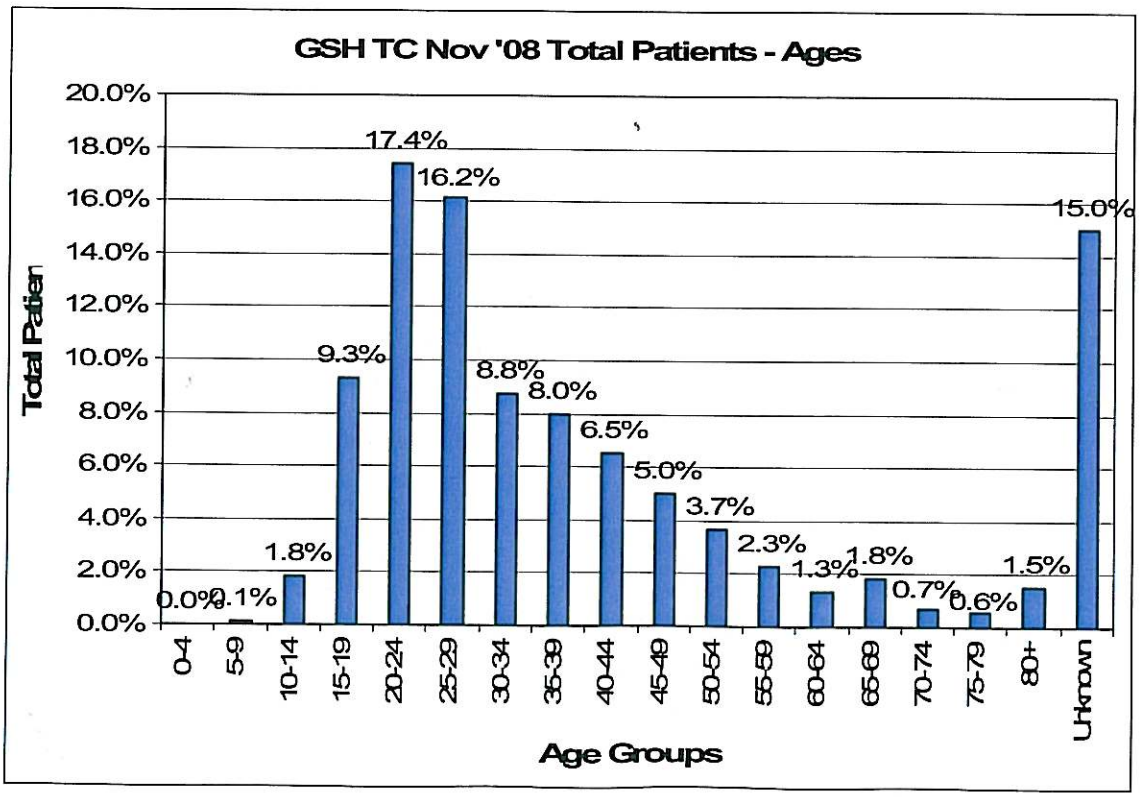

Figure 5.4 GSH TC Nov '08 Total patients: ages in percentages

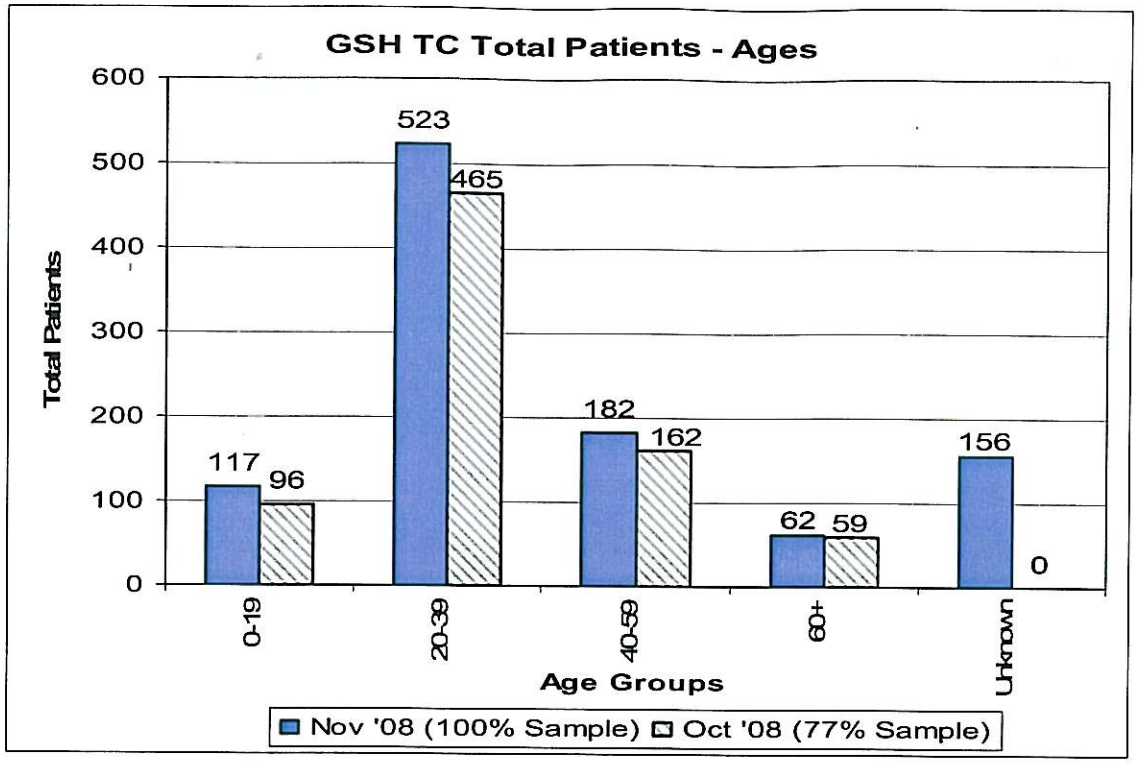

Figure 5.5 GSH TC Comparative Oct and Nov 2008 patient ages in numbers

Figure 5.5 contains a comparison of trends in patient ages placed in 19 year class intervals, selected by Cinnamon (2008) Trends compared are between the November 2008 GSH TC total patient cohort (100% of patients) and a 77% sample of the October 2008 GSH TC patients captured in the GSH TraumaBank registry (Cinnamon 2008).This clearly demonstrates similar trends in both these patient cohorts, a peak in the 20 to 39 yr group, followed in descending order by the 40 to 59 yr; 0 to 19 yr and 60+ yr groups.

Ages of the GSH TC C14 resuscitation ward patient cohort are illustrated in Figure 5.6 in 5 year class intervals from 0 to 80+ yrs old. No age was obtainable for one patient only (0.8%). As with the total patient cohort, C14 patient numbers peaked at 20 to 24 yrs (yrs), 40 patients (30.5%). Other class intervals in descending order were 30 to 34 yrs, 19 patients (14.5%); 25 to 29 yrs 18 patients (13.7%); 15 to 19 yrs, 11 patients (9.3%); and 35 to 39 yrs, 10 patients (7.6%). There-after there is a steady general decline in numbers in the different class intervals.

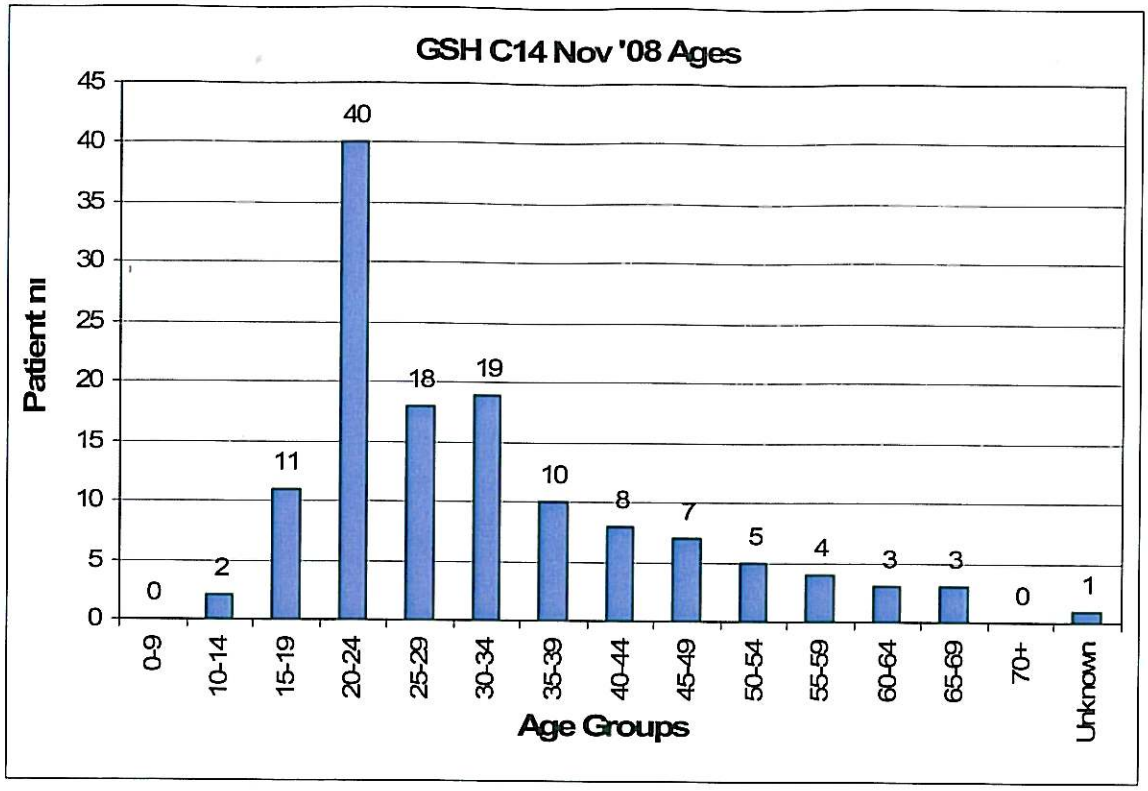

Figure 5 6 GSH TC Nov '08: C14 Resuscitation Ward: Ages

5.3.3 Population groups

Table 5.10 GSH TC Nov '08 :Total Patients: Population groups

GSH TC Nov '08 :Total Patients: Population groups				
Black	Coloured	White	Unknown	Total
189 (18.2%)	159 (15.3%)	31 (3.0)	661 (63.6)	1040

Table 5.11 GSH TC Nov '08: C14 Resuscitation Ward: Population groups

GSH TC Nov '08: C14 Resuscitation Ward: Population group							
Black	Coloured	White	Xhosa	English	Afrikaans	Unknown	Total
59 (45.4%)	25 (19.2%)	3 (2.3%)	7 (5.4%)	17 (13.1%)	4 (3.1%)	16 (11.5%)	131 (100%)

As illustrated in Table 5.10, there was an extremely high percentage of missing data for 661 patients (63.6%) in the GSH TC cohort. The following trends in out patient attendances by 189 Black patients (18.2%); 159 Coloured (15.3%) and 31 White patients (3.0%) may thus be skewed.

As shown in Table 5.11, in the C14 resuscitation ward cohort there were only 16 patients (11.5%) with missing data, but some data capturing nurses used spoken language as a proxy for population group. Comments on trends in population groups admitted to the C14 resuscitation ward have thus been compromised.

5.3.4 Patient source by address code

Table 5.12 GSH TC Nov 2008: Where did patients come from? Sub-districts

GSH TC Nov 2008: Where did patients come from? Cape Metropole Sub-districts *(HIS Clinicom Nov 2008: 852 GSH TC Out-patient attendances)										
CSP Sub-district	Western	Klipfontein	Southern	Mitchells Plain	Khayelitsha	Tygerberg	Out Metro	Eastern	Northern	Total
Patient nr	245	228	156	78	65	38	19	15	8	*852
%	28.8%	26.8%	18.3%	9.2%	7.6%	4.5%	2.2%	1.8%	0.9%	100%

Table 5.12 represents patients captured in the HIS (Clinicom) system. This comprises 81.9% of the total patients in the GSH TC attendance register. For the purposes of this study, patient address codes are accepted as the patient source and as the place of injury. A map of sub-districts is contained in Figure 1.2.

Most patients presenting at the GSH TC originated from the formal GSH TC sub-district drainage areas. In descending order 245 (28.8%) patients came from the Western; 228 (26.8%) from Klipfontein; 156 (18.35%) from the Southern and 78 (9.2%) from the Mitchell's Plain sub- districts.

Table 5.13 GSH TC Nov 2008: Where did patients come from? Municipalities

GSH TC Nov 2008: Where did patients come from? Top 10 Municipalities (HIS Clinicom Nov 2008: 852 GSH TC Out-patient attendances)										
Municipality	Athlone	Guguletu	Woodstock	Hanover Park	Observatory	Philippi	Salt River	Site B	Langa	Milnerton
Patient nr	55	51	44	42	40	39	36	32	30	20
%	6.5%	6.0%	5.2%	4.9%	4.7%	4.6%	4.2%	3.8%	3.5%	2.3%

In Table 5.13 the top 10 municipalities are shown from which GSH TC patients captured in the HIS (Clinicom) system originated during November 2008. All these municipalities fall within the formal GSH drainage area. In descending order Athlone (6.5%); Guguletu (6.0%); Woodstock (5.2%); Hanover Park (4.9%); Observatory (4.7%); Philippi (4.6%); Salt River (4.2%); Site B (3.8%); Langa (3.5%) and Milnerton (2.3%).

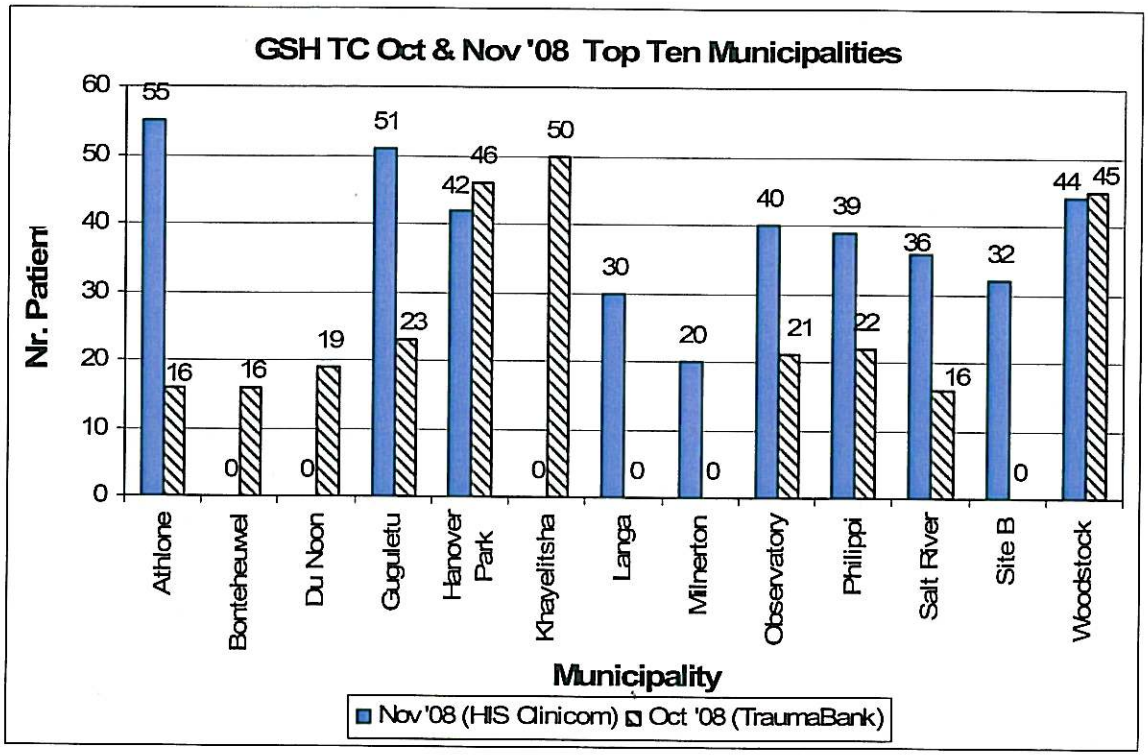

Figure 5.7 GSH TC Comparative Oct and Nov 2008 patient ages in numbers

Figure 5.7 demonstrates the top ten municipalities of GSH TC patient origin for the months of October (TraumaBank, 77% sample) and November 2008 (HIS Clinicom, 82% sample) respectively. There are significant differences, e.g. Khayelitsha, the top municipality for the October cohort is not represented in the November group at all. Athlone, the top November municipality is ranked 8th in the October group. The last ranked municipality in either group, does not appear in the other. As none of these data bases are audited, it is not possible to comment on either.

5.4 WHEN AND WHERE INJURIES OCCURRED

5.4.1 Patient arrivals by days of the week

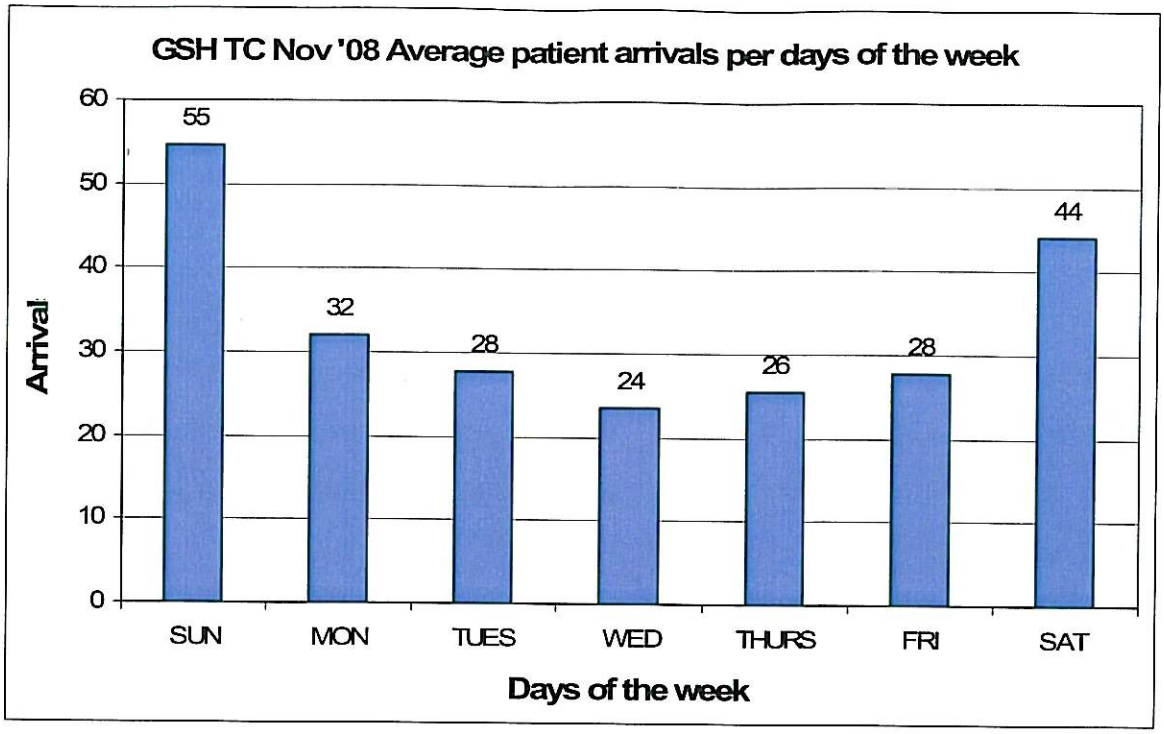

Figure 5.8 GSH TC Nov '08: Average patient arrivals by days of the week

Table 5.14 GSH TC Nov '08: Total Patients: Total arrival by days of the week

GSH TC Nov '08: Total Patients: Total arrivasl by days of the week								
Day of Week	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Total for Month	Average for Month
Sun		68	51	64	40	50	223	55
Mon		37	32	29	30		128	32
Tues		24	29	30	28		111	28
Wed		28	17	24	25		94	24
Thurs		30	16	29	27		102	26
Fri		32	27	28	24		111	28
Sat	55	39	43	46	38		166	44
Total	55	258	215	250	212	50	1040	34

Tables 5.14 and Table 5.15 represent the arrival of patients by days of the week for the GSH TC total patient and the C14 resuscitation ward cohorts respectively. Due to the fact that November 2008 was extended over 6 weeks, average patient arrivals were used as opposed to totals. There are distinct patterns in both these patient cohorts, with the C14 resuscitation ward cohort virtually acting as a mirror for the total patient cohort. The busiest days of the week in descending order are

Sundays, Saturdays and Mondays, with the first weekend of the month showing higher attendances than during the rest of the month. In the total patient cohort there was a distinct "dip" in the middle of the week on Wednesdays, with the resuscitation cohort showing a more shallow "dip", Tuesdays to Fridays.
Tabulated results are further illustrated in Figures 5.8 and 5.9.

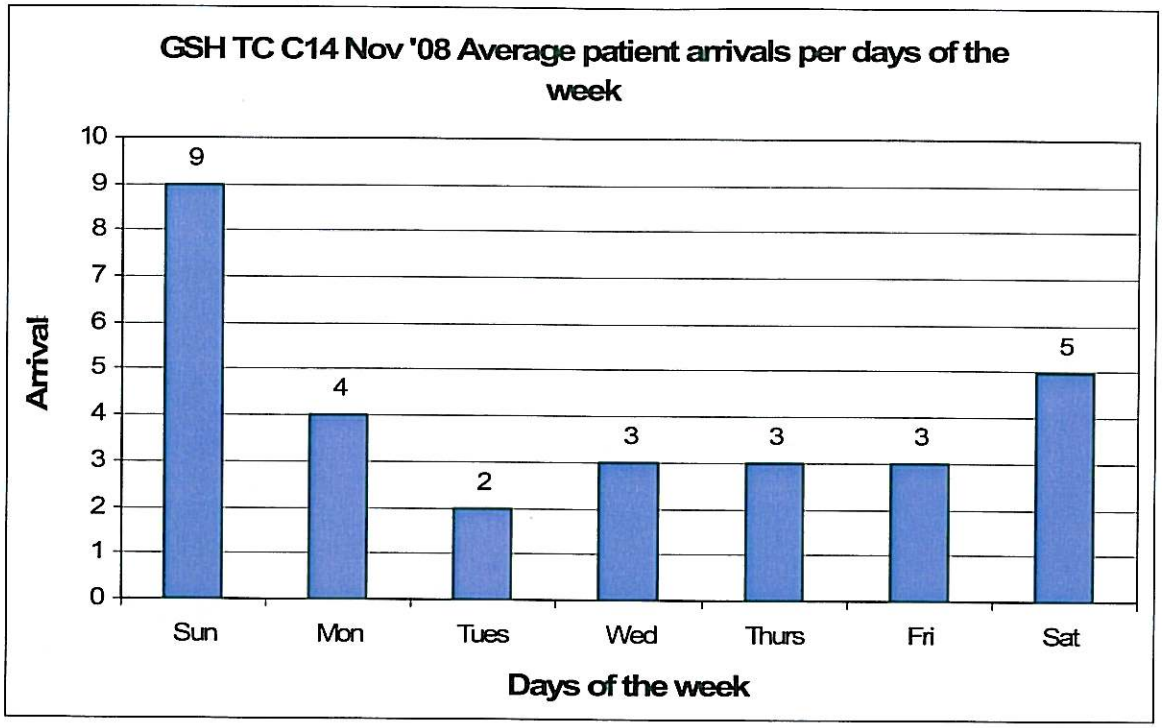

Figure 5.9 GSH TC Nov '08: C14 Resuscitation Ward Arrival by days of week

Table 5.15 GSH TC Nov '08: C14 Resuscitation Ward Arrival by days of week

GSH TC Nov '08: C14 Resuscitation Ward: Arrival by days of the week									
Day of Week	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Total for Mnth	Avge for Week	Avrg week, 4 week month
Sun		10	7	11	6	9	43	9	9
Mon		6	4	3	2	0	15	3	4
Tues		3	3	1	0	0	7	1	2
Wed		2	5	2	2	0	11	2	3
Thurs		2	3	3	5	0	13	3	3
Fri		1	1	2	8	0	12	2	3
Sat	10	4	3	8	5	0	30	5	5
Total	10	28	26	30	28	9	131	25	28

5.4.2 Body region injured

Table 5.16 GSH TC & C14 Ward Nov '08: Total Patients: Body Region Injured

GSH TC Nov '08: Total Patients: Body Region Injured		
Body Region	Nr Injuries	%
Head	235	22.2%
Lower Extremity	183	17.3%
Upper extremity incl 101 Hands	207	19.6%
Face including 40 eye injuries 32 max-facial	138	13.0%
Thorax	113	10.7%
Cervical Spine	12	1.1%
Neck	31	2.9%
Abdomen	30	2.8%
Polytrauma	15	1.4%
IOD Needlestick	9	0.9%
Unknown	85	8.0%
Total injuries	1058	

GSH TC Nov '08 C14 Resuscitation Ward : Body Region Injured		
Body Region	Nr injuries	%
Head	39	29.8%
Thorax	25	19.1%
Neck	16	12.2%
Other Multiple Injures	13	9.9%
Polytrauma	12	9.2%
Lower extremity	8	6.1%
Abdomen	6	4.6%
Spine	4	3.1%
Upper extremity	3	2.3%
Face	1	0.8%
Unknown	4	3.1%
Total injuries	131	

Table 5.16 represents body regions injured in the GSH TC total patient and the C14 resuscitation ward cohorts. In the total patient cohort injuries to the head were sustained by 22.2% of patients; upper extremity 19.6%; lower extremity 17.3% and the facial area 13%. 49% of upper extremity injuries were to hands; 29% of facial injuries to the eyes, and 23% in the maxillo-facial field.

In the C14 resuscitation ward cohort the groups described as polytrauma and other multiple injuries should be added together, representing 19.1% of injuries. Injuries to the head were sustained by 29.8%; thorax 19.1%, followed by the lower extremity at 6.1%.

5.5 MODE OF ARRIVAL

Table 5.17 GSH TC Nov '08: Patient mode of arrival

GSH TC Nov '08: Patient mode of arrival				
Place	GSH TC: Total Patients		C14 Resuscitation Ward	
Mode of Arrival	Number	%	Number	%
Ambulance	571	(55%)	119	(90.8%)
Self / Escort	469	(45%)	11	(8.4%)
Helicopter			1	(0.8%)
Total	1040			131

Table 5.17 demonstrates the mode of arrival of November 2008 GSH TC patients. 55% of the total patient cohort and 91% of C14 resuscitation ward patients arrived at the GSH TC by ambulance during November 2008. Only 1 patient was transported by helicopter and the rest (45% total patients; 8% C14 patients) made their own way to the hospital.

5.6 INJURY DATA

5.6.1 Mechanism of injuries

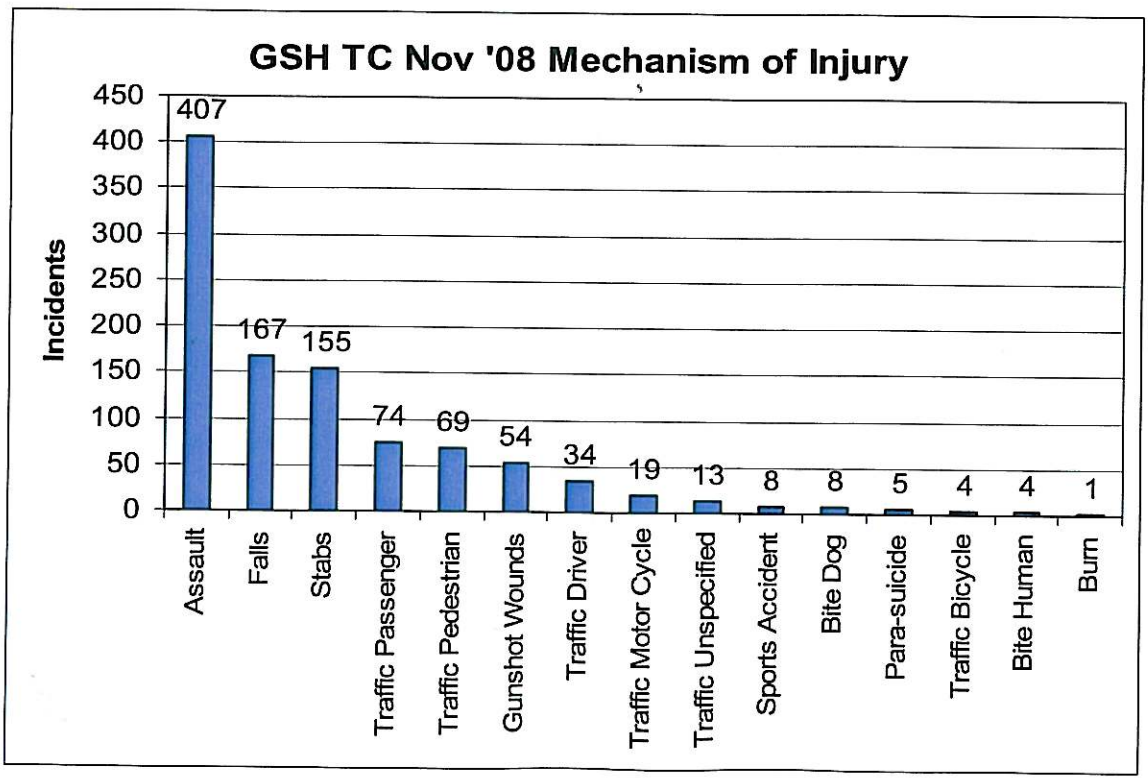

Figure 5.10 GSH TC Nov '08 Total patients: Mechanism of injuries

Figure 5.10 illustrates the mechanisms of injuries sustained by the 1040 GSH TC total patients during November 2008. 618 patients were injured due to violence. In descending order these injuries were due to assaults (407), stabs (155) and gunshots (54). There are 213 traffic related injuries. The 192 non-traffic related injuries are represented by 167 falls accounting for the next highest category of injuries, followed by sport injuries (8); dog bites (8); para-suicide (5); human bites (4) and 1 burn injury.

5.6.2 Violence related injuries

Table 5.18 GSH TC Nov '08: Total Patients: Violence related injuries

GSH TC Nov '08: Total Patients: Violence related injuries				
Assault	Stabs	Gun Shots	Total Patients Violence	Total Patients Total
407 (39.1%)	155 (14.9%)	56 (5.4%)	618 (59.4%)	1040

Table 5.19 GSH TC Nov '08: C14 Resuscitation : Violence related injuries

GSH TC Nov '08: C14 Resuscitation Ward: Violence related injuries				
Assault	Stabs	Gun Shots	TC C14 Resus Violence Total	TC C14 Resus Patients Total
21 (16%)	33 (25.2%)	27 (20.6%)	81 (61.8%)	131

Table 5.18 shows the profile of violence related injuries in the total patient cohort, where the 618 patients are represented in descending order by patients assaulted (407), stabbed (155) and those who sustained gunshot wounds (54).

In Table 5.19, 81 violence related injuries in the C14 Resuscitation Ward cohort are represented in descending order by stabs (33) gunshot wounds (27) and assaults (21).

5.6.3 Traffic Related Injuries

Table 5.20 GSH TC Nov '08: Total Patients: Traffic related injuries

GSH TC Nov '08: Total Patients: Traffic related injuries			
Type of Incidents	Nr Injured	% of Traffic Injured	% of Total Patients
Traffic Passenger	74	34.7%	7.1%
Traffic Pedestrian	69	32.4%	6.6%
Traffic Driver	34	16.0%	3.3%
Traffic Motor Cycle	19	8.9%	1.8%
Traffic Unspecified	13	6.1%	1.3%
Traffic Cycle	4	1.9%	0.4%
Traffic Total	213	100.0%	20.5%
Total Patients			1040

Table 5.21 GSH TC Nov '08: C14 Resuscitation Ward: Traffic related injuries

GSH TC Nov '08: C14 Resuscitation Ward: Traffic related injuries			
Type of Incidents	Nr Injured	% of Traffic Injured	% of C14 Resus Patients
Traffic Pedestrian	19	47.5%	14.5%
Traffic Passenger	9	22.5%	6.9%
Traffic Driver	6	15.0%	4.6%
Traffic Motor Cycle	3	7.5%	2.3%
Traffic Unspecified	3	7.5%	2.3%
Traffic Total	40		30.5%
Total C 14 Patients			131

Table 5.20 illustrates the November 2008 GSH TC total patient traffic related injuries where 20.5% (213) sustained traffic related injuries. In descending order 34.7% (74) of the injured were passengers; 32.4% (69) pedestrians and 16% (34) drivers.

Table 5.21 shows that 30.5% (40) of patients in the C14 Resuscitation Ward cohort sustained traffic related injuries. In descending order 47.5% (19) of these injured were pedestrians; 22.5% (9) passengers and 15% (6) drivers.

5.6.4 Non-traffic related injuries (falls, sport, "accidents" or mishaps)

Table 5.22 GSH TC Nov '08: Total Patients: Non-traffic related injuries

GSH TC Nov '08: Total Patients: Non-traffic related injuries			
Type of Incidents	Nr patients	% of Non traffic Injuries	% of Total Patients
Falls	167	86.5%	16.1%
Sports Injuries	8	4.1%	0.8%
Bite, dog	8	4.1%	0.8%
Bite, human	4	2.1%	0.4%
Para-suicide	5	2.6%	0.5%
Burn	1	0.5%	0.1%
Total incidents	193	100.0%	18.6%
Total Patients			1040

Table 5.23 GSH TC Nov '08 C14 Resuscitation: Non-traffic related injuries

GSH TC Nov '08 C14 Resuscitation Ward: Non-traffic related injuries			
Type of Incidents	Nr Injuries	% of Non-traffic Injuries	% of C14 Resus Patients
Falls	6	50%	4.6%
Parasuicide	1	8.3%	0.8%
Other	5	41.7%	3.8%
Total incidents	12	100%	9.2%
Patient Total	131		131

As illustrated in Table 5.22, in the total patient non-traffic related cohort, 167 falls account for 86% of injuries. This is followed by sport injuries 8 (4.1%); dog bites 8 (4.1%); para-suicide 5 (2.6%); human bites 4 (2.1%) and 1 burn injury (0.5%). representing 193 non-traffic related injuries. This is demonstrated in Table 5.23. Table 5 23 shows details of 12 patients with non-traffic related injuries in the C14 Resuscitation ward. There were 6 (50%) falls; 1 (8.3%) para-suicide and 5 (41%) other incidents.

5.7 CAPE TRIAGE SCORE

Table 5.24 GHS TC Nov '08: Total Patients: Triage data

GHS TC Nov '08: Total Patients: Triage data						
Code	Red	Orange	Yellow	Green	No Data	Total
Total/Colour	71	39	423	335	172	1040
% of Total	6.8%	3.8%	40.7%	32.2%	16.5%	

Table 5.25 GHS TC Nov '08: C14 Resuscitation Ward: Triage data

GHS TC Nov '08: C14 Resuscitation Ward: Triage data						
Code	Red	Orange	Yellow	Green	No Data	Total
Total/Colour	73	27	14	1	16	131
% of Total	55.7%	20.6%	10.7%	0.8%	12.2%	

Table 5.24 shows details of triage coding for the November 2008 GSH TC total patient cohort. There was no indication of triage coding in the TC attendance register for 16.5% (172) of the total patient cohort. Most patients 40.7% (423) were in the Yellow group, followed by Green 335 (32.2%), Red 71 (6.8%) and Orange 39 (3.8%).

In the C14 resuscitation Ward, 16 patients (12.2%) had no triage coding. The majority of patients were in the Red category 73 (55.7%), followed by Orange 27 (20.6%) and Yellow 14 (10.7%) and 1 Green (0.8%). This is demonstrated in Table 5.25.

5.8 PATIENT DISPOSAL

5.8.1 Total patient disposals

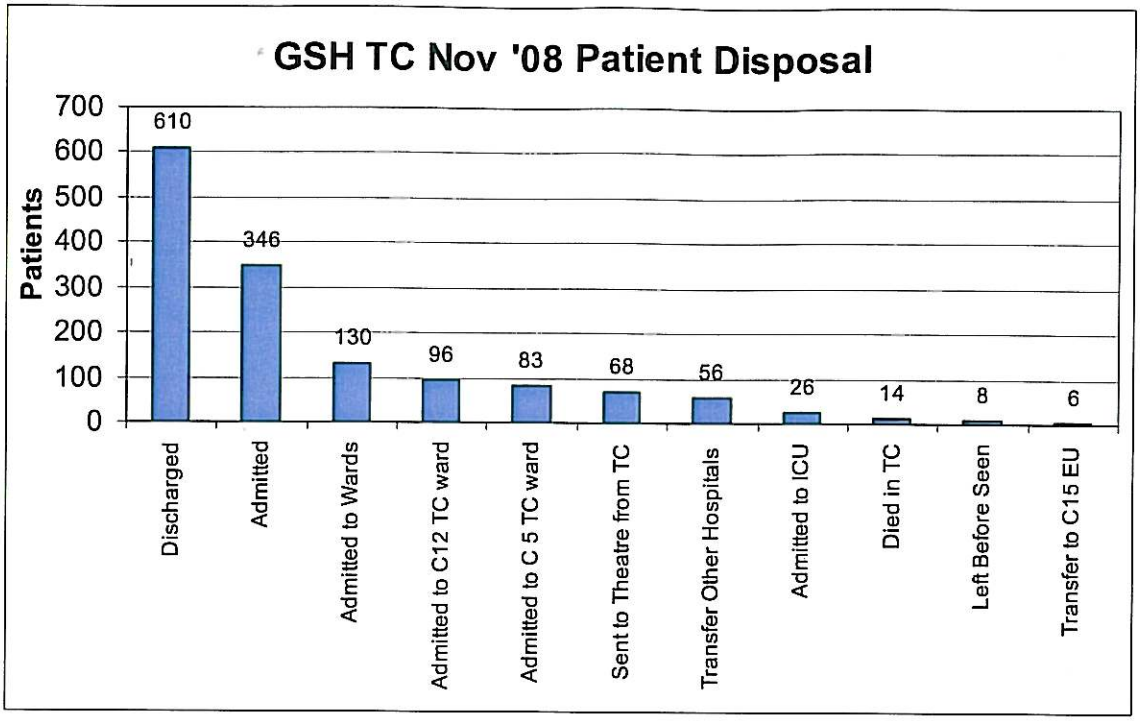

Figure 5.11 GHS TC Nov '08: Total Patients: Patient Disposal

Table 5.26 GSH TC Nov '08 C14 Resuscitation Ward: Disposal

GSH TC Nov '08 C14 Resuscitation Ward: Disposal									
Disposal	Dis-charge	Admit GSH Wards	Admit TC Ward C5	Admit TC Ward C12	Admit to ICU's	Transfer Other Hosp's	Died in TC	Sent to Theatre C6	Sent to Theatre D16
Nr patients	9	10	25	44	22	7	14	4	23
% of C14 patients	6.9%	7.6%	19.1%	33.6%	16.8%	5.3%	10.7%	3.1%	17.6%
Total C14 Resus pxs									131
% of Total patients									12.6%

Figure 5.11 illustrates that GSH TC total patient disposals for November 2008 included 610 (58.7%) discharges; 346 admissions (33.3%); 56 (5.4%) transfers to other hospitals; 6 (0.6%) transfers to the medical emergency department; 8 (0.8%) left before being seen and 14 (1.3%) deaths. Of the admissions, 96 (27.7%) were admitted to the C12 trauma ward, 83 to C5 trauma ward (24%); 130 (37.6%) to hospital wards and 26 (2.5%) to specialised ICU's. The destinations of 11 (3.2%) admissions are not known.

In Table 5.26 it is shown that the C14 resuscitation ward cohort represented 12.6% of total patients. 9 (6.9%) patients were discharged from this ward and all the patients who died 14 (1.3% of total pxs; 10.7% of C14 Resus Ward pxs) were treated in this ward. 69 (52.7%) were admitted to TC wards (C5 and C12); 10 (7.6%) patients to hospital wards; 7 (5.3%) were transferred to other hospitals. 27 (20.7%) of these patients went for surgery directly from the C14 resuscitation ward.

5.8.2 Patient admissions in GSH

Table 5.27 GSH TC Nov '08: Patient admissions by ward designation

GSH TC Nov '08: Patient admissions by ward designation																	
Ward	C5	C12	C23	C27	D4	D12	D13	D14	D22	F7	F8	F22	F23	F26	No Data	Total	C14
Ward Type	Ward Trauma	HDU & Ward Trauma	Ward Acute Psych	ICU Spinal Surg Resp	Ward Eyes	ICU Surg	ICU Neuro surg	Ward Ortho elect	ICU Card thorx	Ward Neuro surg	Ward ENT	Ward Trauma & Ortho	Ward Trauma & Ortho	Ward Urol MaxF Plast			ICU TC Resus
Nr Admit	83	96	1	6	19	8	8	2	4	21	3	55	22	7	11	346	131
% Admit	24.0	27.7	0.3	1.7	5.5	2.3	2.3	0.6	1.2	6.1	0.9	15.9	6.4	2.0	3.2	100	

Table 5.28 GSH TC Nov '08 C14 Resuscitation ward: Admissions

GSH TC Nov '08 C14 Resuscitation ward: Admissions												
Ward	C5	C12	C14	C27	D12	D13	D22	F7	F8	F22	G5	Total
Ward Type	Ward Trauma	Ward Trauma	Trauma Holding	ICU Spinal Surg Resp	ICU Surg	ICU Neuro surg	ICU Card thorx	Ward Neuro surg	Ward ENT	Ward Trauma & Ortho	Paeds	
Nr Admit	25	44	2	5	10	5	2	3	1	3	1	101
% Admit	24.8%	43.6%	2.0%	5.0%	9.9%	5.%	2.0%	3.0%	1.0%	3.0%	1.0%	100%

Table 5.27 shows that 51.7 % (179) of November 2008 GSH TC total patients admitted went to the trauma wards (C5 & C12); 22.3% (77) went to the two general trauma and orthopaedic wards (F22 & F23); 7.3% (26) patients were

admitted to specialist ICUs and 5% (19) to the eye ward. There was no data for 3% of these patients.

Table 5.28 represents admissions of the C14 resuscitation ward cohort where 69 (68.4%) were admitted to the trauma wards (C5 & C12) and 22 (21.9%) went to the specialist ICU's.

5.8.3 Patients who received surgery

During November 2008, 68 (6.5%) of patients were dispatched for surgery directly from the GSH TC. 27 of these 68 patients (20.7%) had been dispatched for emergency surgery directly from the C14 Resuscitation Ward.

5.8.4. Deaths

Table 5.29 GSH TC Nov '08 TC C14 Resuscitation Ward: Deaths

GSH TC Nov '08 TC C14 Resuscitation Ward: Deaths							
Demographic Information					Mechanism of Injury		
		Nr	%			Nr	%
					Assault	6	43%
Gender	Male	14	100%		Stabs	2	14%
Race	Black	8	57%		Gun shots	2	14%
	Coloured	1	7%		Traffic Incident	3	21%
	Unknown	5	36%		Falls	1	7%
Age	16 -20	2	14%		Total Deaths	14	100%
	21-25	6	43%				
	26-30	3	21%				
	45-50	1	7%				
	Unknown	2	14%				
Day of week	Sat	3	21%				
	Sun	7	50%				
	Mon	2	14%				
	Wed	2	14%				
Total deaths		14					

Table 5.29 illustrates details related to deaths of 14 of the total (1040) patients seen at the GSH TC during November 2008. All of these patients were admitted to the C14 resuscitation ward on arrival and subsequently succumbed there. This represents a 1% fatality of all trauma patients *in the GSH TC* for that month. During the month of November 2008, deaths in the TC C14 Resuscitation Ward included 14 males and no females. 8 patients were from the black ethnic group, 1 coloured and 5 unknown. The highest number of deaths (43%) occurred in the 21

to 25 yr age group, followed by 26 to 30 yrs (21%); 16 to 20 yrs (14%) and 45 to 50 yrs (7%) with 14% unknown.

50% (7) of patients died on Sundays; 21% (3) on Saturdays and 14% (2) on Mondays and Wednesdays respectively.

Violence led to the death of 10 patients (71%), this included assault 6 (43%); Stabs 2 (14%), Gunshots 2 (14%). Traffic related injury led to 3 (21%) deaths and 1 fall to (7%) of deaths.

5.8. C14 RESUSCITATION WARD: NURSE WORKLOAD INDICATORS

Table 5.30 GSH TC Nov '08 C14 Resuscitation: Nurse Workload Indicators

GSH TC Nov '08 C14 Resuscitation Ward: Nurse Workload Indicators						
Indicator	Intubated	Ventilated	Naso gastric tube	Inter-Costal Drain	Urinary Catheter	Total Patients
Nr patients	54	54	54	17	92	131
Percentage	41%	41%	41%	13%	70%	

Table 5.30 demonstrates that nurse workloads in the C14 Resuscitation Ward during November 2008 included 41% of the patients who were intubated and ventilated and had naso-gastric tubes inserted. 70% of patients had urinary catheters and 13% had inter-costal drains inserted.

5.10. C14 RESUSCITATION WARD: RESOURCE INDICATORS

Table 5.31 GSH TC Nov '08 C14 Resuscitation Ward: Resource Indicators

GSH TC Nov '08 C14 Resuscitation Ward: Resource Indicators							
Indicator	Xrays	Lodox Scans	CT Scans	Angio-grams	Barium swallow	Ultra Sound	Blood Products
Nr patients	13	66	63	8	4	4	32 Units Blood 5 Units FFP
Percentage of total pxs	9.9%	50.4%	48.1%	6.1%	3.1%	3.1%	

In Table 5.31 it is shown that TC C14 Resuscitation Ward patient requirements during November 2008 included 66 Lodox scans (50.4% of patients); 63 CT scans (48.1% of patients); 13 Xrays (9.9% of patients); 8 angiograms (6.1% of patients); 4 Barium swallows (3.1% of patients) and 4 ultrasound examinations (3.1% of patients)

5.12 SUMMARY

A snapshot overview of the results of this GSH TC study reveals the following:

- The GSH TC provides adult trauma services to a drainage area representing 51.9% of the Cape Town Metro population.
- The GSH TC has nil international L1 (RSA L3) trauma beds for a population of 1,836,148 persons, and 1 L2 (RSA L2) trauma bed per 34,003 persons.
- Total patients received during November 2008 were 1040.
- 131 (12.6%) of these patients required resuscitation.
- 55% of patients arrived by ambulance.
- The male to female ratio was 3:1.
- 33.6% of the total patient cohort was between 20 to 29 years old.
- 44.2% of the resuscitation cohort was between 20 to 29 years old.
- Busiest days were Sundays, Saturdays and Mondays (in that order).
- Most deaths occurred on Sundays and Saturdays (in that order).
- Body regions injured in descending order: heads (22%); upper extremity (19.6%); lower extremity (17.3).
- 49% of upper extremity injuries were to hands.
- Violence was responsible for 59.4% of injuries.
- Traffic related incidents were responsible for 20.5% of injuries.
- Falls represented 86.5% of non-traffic related injuries
- Cape Triage Score: Unknown 16.5% (172); Red 71 (6.8%); Orange 39 (3.8%); Yellow 423 (40.7%); Green 335 (32.2%).
- Disposal: 610 (58.7%) discharges; 346 admissions (33.3%); 56 (5.4%) transfers to other hospitals; 6 (0.6%) transfers to medical emergency; 8 (0.8%) left before being seen and 14 (1.3%) deaths.
- Deaths: 100% males; Violence (71%) Traffic related (21%).

CHAPTER 6

DISCUSSION

6.1 INTRODUCTION

Baker (1997) writes that injury is derived from the Latin word meaning "not right". He agrees that it is a fitting term for the leading cause of death between 1 to 44 years, and "the thief of productive years of life" (Baker 1997: 369) and expresses concern that it represents the source of annual expenditure of multi- billion dollars (Baker 1997).

In the Western Cape, Bradshaw *et al.* (2004) attribute 12.9% of premature mortality to injuries due to violence and 6.9% to road traffic injuries (Bradshaw *et al.* 2004), whilst the TSSA (2009) expresses concern that the highest injury mortality rate of all major cities in South Africa (145 deaths per 100,000) occurs in Cape Town. This mortality includes the highest violence-related deaths and the second highest traffic-related deaths in the country. In order to manage the trauma burden of the Cape Town population (3.5 million), the TSSA emphasises the requirement for three International Level 1 (RSA L3) TCs (Groote Schuur Hospital; Tygerberg Hospital and the Red Cross War Memorial Children's; Hospital) (Trauma Society of South Africa 2009).

In this discussion, researched findings of data related to events and outcomes at the GSH TC for November 2008 will be reviewed. Comparisons will be drawn with results of previous studies of some other researchers. Particular attention will be given to aspects related to the burden of disease in the Western Cape in general and Cape Town in particular and how that impacts on events at GSH.

Due to the critical role of data management and availability of timely accurate information for management planning purposes, a discussion on data management is included at the end of this chapter. Discussions related to other researched topics have been included in the chapter on limitations to this study.

6.2 OVERVIEW

6.2.1 General

51.9% (1,836,148 persons) of the 3.5 million Cape Town population formally drain to the tertiary trauma services provided at the GSH TC, with 68.4% uninsured for health services. Regional drainage areas for tertiary (RSA L3; USA L1) trauma services also include patients from the Southern Cape and West Coast Regions. Patients from areas where sub-specialist services are not available are also formally referred for trauma care, e.g. Neurosurgery and Spinal Surgery cases from the Eastern and Northern Cape. However, when hospitals are overfull and patient diversions are implemented, patients from any drainage areas could land at the GSH TC. This TC is not responsible for paediatric trauma care, which is provided by the Red Cross War Memorial Childrens' Hospital to that population section. However, at the GSH TC during November 2008, it was disconcerting to discover that of the altogether 32 children who had been treated during the study period, 10 (13 to 15 yrs) were assaulted (including 4 stabs), 8 sustained traffic-related injuries. The youngest was a child of 5 years treated for a fall. One other (13 yrs) had cut her wrist.

At the other end of the scale were 15 patients older than 80 years and 3 patients older than 90 years. Of the octogenarians there had been 11 falls; 1 traffic-related incident and 1 dog bite. 2 of the ninety year olds had fallen and 1 was involved as pedestrian in a traffic related incident. The eldest patient was 99 years and had taken a fall, as had the youngest of 5 years.

Other mechanisms of injury included violence (59.4%), Traffic related injuries (20.5%) and non-traffic related injuries (18.6%).

The above information gives a modest indication of the versatility required from personnel working in the GSH TC, not only as related to the treatment of the presenting injuries, but also regarding the people who cross their paths.

6.2.2 Patient numbers

During the period 00H00 on 1st November 2008 to 24H00 on 30th November 2008, 1040 patients attended the GSH TC of whom 131 patients (12.6%) were admitted to the TC C14 resuscitation ward. These patients include 1009 persons with fresh trauma together with 31 re-attenders. Re-attenders were unscheduled,

presenting for management of acute symptoms related to previously treated injuries. Re-attenders comprise 3% of the patients in the GSH TC attendance register for the study period. The profile of previous injury sustained by these patients includes: assault (16); traffic (7); falls (3); sport (1) and other (4). All re-attending patients were triaged, examined and treated and 19% were admitted (GSH:5; transferred to another hospital:1). 1 patient was scheduled for emergency surgery and 28 patients were examined, treated and discharged. Re-attenders represent an integral part of the GSH TC workload and are included in this study. The WCDoH accepts up to 10% of re-attenders provided they are not for simple procedures such as removal of stitches (Provincial Government Western Cape Department of Health 2009c)

Frankish (2004) examined trends in trauma and emergency services in the Western Cape over a period of 31 months, 2000 to 2002. He demonstrated that provincial trauma attendances had nominally decreased during the period 2000 to 2002 (-0.9%). However, at the GSH TC, attendances for the combined months of June and December for the period of study had remained relatively stable: 2000 (3803) 2001 (3917) and 2002 (3877) Frankish (2004). Average monthly patient attendances for these periods can be calculated as 2000 (1901); 2001 (1958) and 2002 (1938).

Cummins (2004), collated trauma attendance numbers of the most recently available winter and summer months (June and December) for 2002 / 2003. An average based total was then calculated for the two year period. At GSH TC, this total for 24 months equaled 38,352 attendances (Cummins 2004). Averaged monthly attendances for 2002 / 2003 are calculated as 1598

Based on the above research, between 2000 and 2002, the average monthly attendance at the GSH TC was calculated as 1932 patients (Frankish 2003 & 2004) and between 2002 and 2003, calculated as 1598 per month.

Data used for this study was collected in the same manner as data used for the Cummins study, i.e. manually counted from the hard copy trauma attendance register. Recent total attendances at the GSH TC for one month (November 2008) amounted to 1040. Should this reflect the average monthly numbers for 2008 from the same data source, it would then be safe to say that, since 2000, there has been a steady downward trend in trauma patient numbers at the GSH

TC: 2000–2002 average of 1932 per month; 2002 to 2003 average of 1598 per month and November 2008 1040 for the month.

6.3 DEMOGRAPHICS

6.3.1 Gender

Donson and Peden (2000) reported 75% males and 25% females for both their studies at the GSH TC, 1999 and 2000 and Frankish (2003 and 2004) did not examine gender data during his study. Cummins (2004) did not specifically examine GSH TC data for gender, but reports a "preponderance of male over female attenders at emergency departments" attributed to the higher proportion of males than females as victims of assault or traffic incidents (Cummins 2004:49). Groenewald *et al.* (2007) report the gender ratio for homicide in Cape Town (2001 to 2004) as 7.5 male deaths for every female death.

The Medical Research Council (1990), in their National Trauma Research Programme, Cape Metropolitan Study, reported a typical gender distribution with a 2:1 male preponderance and added that this ratio was also recorded by other national and international researchers (Medical Research Council 1990). This means that a significant shift in trauma gender distribution in Cape Town has occurred during the last 20 years.

According to data collated from the GSH TC attendance registers, November 2008, the gender profile of total GSH TC attendances (1040 patients) was 74% males and 26% females, representing a ratio of 3 males to every one female. This is corroborated by data in the TraumaBank registry related to a 77% sample of 785 GSH TC patients for October 2008 with a 3:1 ratio of males to females (75% males to 25% females).

In contrast, during November 2008, the GSH TC C14 resuscitation ward cohort representing the most seriously injured patients had a ratio of 11:1 males to females. There were 120 males (91.5%) and 11 females (8.5%) of which 14 males (1%) died in the C 14 resuscitation ward. The overall ratio of male to female deaths in the GSH TC was 14:0 and the ratio for deaths due to violence was 10 males to nil females. Examination of data for a longer period of time would confirm if this is an expected trend amongst this subsection of patients.

From the above data, it appears that there has been a change in the ratio of males to females during the period 1990 to 1999 from 2:1 to 3:1 and that the ratio of male to female attendances at the GSH TC has remained reasonably stable for the 10 year period 1999 to 2009 at 3:1. In addition, the reported high ratio of male to female deaths in Cape Town ascribed to violence, as reported by Groenewald *et al.* (2007), is also experienced at this TC.

6.3.2 Age

During their Cape Metropolitan Trauma Study, the Medical Research Council (1990) reported a higher frequency of injuries amongst the 15 to 29 year age group, adding that this corresponded with findings in other national and international literature. Donson and Peden (2000) during their surveillance of substance abuse and trauma at the GSH TC reported a mean age of 31.5 ±13.2 years of selected patients seen during an idealised week, with the largest proportion in the 13 to 24 age group.

Groenewald *et al.* (2007) during a comparison of homicide related mortality in Cape Town (2001 to 2004) indicate a peak in the 15 to 24 year age group, tapering off with age and increasing again after 65 years.

Age related data for the GSH TC during November 2008 is not separated by mechanism of injury, thus relating to injury in general. There were 15% unknowns. Data reveals a major peak in the 20 - 29 yr group (33.6%) with 15 - 19 yrs (9.3%) and 39 - 34 yrs (8.8%); steadily tapering off through older age groups.

As with the total patient cohort, C14 patient numbers peaked at 20 - 24 yrs (30.5%) followed by 30 - 34 yrs (14.5%); 25 - 29 yrs (13.7%); 15 - 19 yrs, (9.3%); and 35 - 39 yrs (7.6%). There-after there is a steady general decline in numbers.

Cinnamon (2009) reports TraumaBank data for a 77% sample of patients for October 2008 (Figure 5.5). The peak is 20-39 years (465 patients; 59%), with the majority of patients in these CI's between 20 to 59 years old (627 patients; 80%) and mean age recorded as 34 years. These trends are mirrored by the GSH November 2008 total patient cohort, illustrated in Figure 5.5.

Clearly, in order to make meaningful comparisons, standardised age series must be used, with a caution against too large age ranges. There is much scope for further studying of multiple trends related to the age of patients reporting to the

GSH TC, especially associated with different mechanisms of injury and the design of upstream preventive interventions.

7.3.3 Population group

In the GSH TC attendance register, there are tick-blocks for population group identification with data in the C14 resuscitation ward register recovered from hospital "patient stickers". Tick-blocks for population group identification are the only fields conspicuously omitted by nurses and many "stickers" have incomplete race fields. Some clerks substitute ethnic identification with spoken language as an alternate e.g. Xhosa; English or Afrikaans. In a country with 11 official languages, with most individuals multilingual, spoken language is not a reliable proxy for ethnicity' Unknowns represent 63.6% of the total patient cohort. In the resuscitation cohort, unknowns plus spoken language individuals represent a total of 33.6% unknowns.

It was not possible to produce any reliable information on ethnic differentiation of this cohort of patients. However, it was significant that 8 of the 14 deaths (57%) in the TC during that month were black males.

During their respective research projects related to trauma services at GSH, neither Donson and Peden (2000), Frankish (2003 and 2004), nor Cummins (2004) examined demographics related to ethnicity, and in the recent Western Cape Burden of Disease Reduction Project, negligible reference is made to population distribution (Myers and Naledi 2007).

Collation of GSH TraumaBank registry data October 2008, population particulars of 786 patients; (77% sample of total patients) were as follows: Black: 308 (39%); Coloured: 247 (31%); White: 46 (6%) Unknown185 (24%) (Cinnamon 2009).

The GSH Information Management Department concurs that there are shortcomings in the HIS (Clinicom) data base related to the ethnic profile of GSH patients. This is ascribed to the refusal of significant numbers of personnel to complete these fields. Under pressure, GSH Information Management may use address codes as a proxy for patient ethnicity. Black patients would mainly reside in Guguletu, Site B, Langa, and in large new black townships on the outskirts of Milnerton. Historically, coloured patients reside in Athlone, Hanover Park, Observatory, Salt River and Woodstock. Phillipi could be considered as mixed

residential, coloured and black. Whites would most probably reside in Milnerton, Observatory, Salt River and Woodstock.

6.3.4 Place of injury, patient origin

Data related to address codes was retrieved from the HIS (Clinicom) databank which registered only 852 trauma out-patient attendances for the study period representing 81.9% of the patients in the TC attendance register. For the purposes of this study, patient address codes are accepted as the patient source and as the place of injury.

Comprehensive service plan (CSP) sub-districts represent the substructure of the Cape Metropole for the Provincial Government of the Western Cape Department of Health. Theoretically only the Southern, Western, Mitchell's Plain and Klipfontein sub- districts form part of the formal drainage area for the GSH TC (Figure 1.2). However, there are explanations for the 16.1% of patients from outside the formal drainage areas. Ambulance diversions are regularly called for when any of the Cape Metropole hospitals are functioning beyond full capacity, together with 45% of patients who make their own way to the trauma centre.

- Donson and Peden (2000), determined the top 6 suburbs of injury (60%) of their of GSH TC sample, in descending order:
  Woodstock; Athlone; Khayelitsha; Guguletu; Mitchells Plain; Mowbray.
- GSH HIS (Clinicom) Data for 852 GSH TC November 2008 attendances demonstrates the top 10 suburbs of patient origin in descending order:
  Athlone; Woodstock; Hanover Park; Observatory; Phillipi; Salt River.
- GHS TC TraumaBank registry data for 787 patients (77% sample) October 2008 TC attendances indicates the top 6 suburbs in descending order as:
  Khayelitsha; Hanover Park; Woodstock; Guguletu; Phillipi; Observatory.

A host of factors determine patient origin data e.g. size of the sample; method of data collection; number of ambulance diversions; season. Ongoing routine data collection would be required to determine shifting trends of patient origin and determination of the specific place of injury would require prospective study together with examination of ambulance records.

6.4 TIME AND MODE OF ARRIVAL

6.4.1 Patient flow patterns

Cummins (2004) indicates that individual emergency department workloads differ according to social and economic circumstances of their drainage areas. Despite staff protests about workload unpredictability, patterns of expected patient flow according to time of the month; day of the week and time of the day can be demonstrated over time. Furthermore, routine data collection enables detection of seasonal trends required by managers for rational resource scheduling (Cummins 2004).

Donson and Peden (2000) demonstrated that more than half the patients presenting at the GSH TC during their 1999 and 2000 studies had sustained their injuries from Friday evenings to Monday mornings. Both their studies revealed distinct peaks between 16H00 and 19H59. Frankish (2003 and 2004) did not examine patient flow data in this detail, whilst Cummins (2004) also demonstrated weekend peaks at the GSH TC during June 2002.

Examination of data related to the GSH TC November 2008 patient cohort confirms weekend peaks, with the majority of patients arriving in descending order on Sundays (223); Saturdays (166); Mondays (128); Fridays and Tuesdays (111 respectively), the lowest number on Wednesdays (94) and the first weekend of the month showing higher attendances than during the rest of the month. The TC C14 resuscitation ward cohort for the same period mirrors this picture

Cummins (2004) argues that pattern consistency over time should enable managers to rationally schedule staff and resources, even more so, should the injury model be known e.g. GSH TC gunshot patients (June 2002) arrived predominantly on weekends: Sundays (24); Saturdays (17), with moderately descending arrivals during the week, Mondays and Wednesdays (16 each) Tuesdays and Thursdays (14 each) and Fridays (11). Times of arrival peaked between 04H00 and 06H00 (Cummins 2004).

6.4.2 Mode of transport

55% of the total patient cohort and 91% of C14 resuscitation ward patients arrived at the GSH TC by ambulance during November 2008. Only 1 patient was

transported by helicopter and the rest (45% total patients; 8% C14 patients) made their own way to the hospital.

Neither Donson and Peden (2000), Frankish (2003 and 2004), nor Cummins (2004) examined method of transport to the hospital.

The high percentage (55%) of November 2008 GSH TC total patients transported by ambulance may be an indication of overall injury severity or may alternatively be an indication of adverse socio-economic circumstances with no suitable private or public transport available. Further interrogation would be required to establish individual merit of ambulance transfers. This could theoretically be managed retrospectively by reconciliation of triage data with mode of arrival data in the TC attendance register.

There are strict clinical criteria for admission to the C14 resuscitation ward. It can thus be accepted that the 90.8% ambulance and 1 helicopter transfers during this period were merited, indicating high injury severity.

6.5 INJURY DATA

6.5.1 General

According to Groenewald *et al.* (2007) injury mortality rates in South Africa are about six times higher than the global average, with homicide eight times and traffic injuries double the global rates. They comment that homicide accounts for a considerable burden of injury throughout Cape Town, ranking second in main causes of premature deaths for the total population and remaining the highest cause of YLL in males, ascribed to the culture of gang violence in the province. They attribute the fourth main cause of premature mortality to road traffic injuries and indicate that, in Cape Town, "one in five people die prematurely due to homicide or road traffic injuries" (Groenewald *et al.* 2007:33).

Examination of the gender and age distribution of mortality related to injury shows considerable variation between different groups.

6.5.2 Body region Injured

Descriptive data were manually retrieved from the GSH TC attendance register. A possible proxy for this data on the HIS (Clinicom) system is ICD 10 codes. As reported by W. Bryant (personal communication October, 2009) problems

associated with this source include incomplete data due to incomplete % of patients entered on the system; low % coded patients and body regions injured not specified in all codes. Another data source would be patient folders, impractical for the purposes of this study

Donson and Peden (2000) reported an increase in injuries to the upper extremities, face, thorax and abdomen with a decrease in injuries to the head and lower extremities between the two study periods at the GSH TC, 1999 and 2000. Cummins (2004) commented on the top 10 ICD-10 codes in the 3297 patients seen in the GSH Trauma and Emergency departments, December 2002. These included 134 head injuries; 68 hand and wrist injuries and 63 eye injuries. The number of Trauma patients is unknown, meaning that the proportions of these injuries to the total trauma patients cannot be calculated.

In the GSH TC November 2008 total patient cohort, 22% sustained injuries to the head; upper extremity 20%; lower extremity 17.% and the facial area 13%. 49% of upper extremity injuries were to hands; 29% of facial injuries to the eyes, and 23% in the maxillo-facial field.

In the C14 resuscitation ward cohort injuries to the head were sustained by 30%; thorax 19%, polytrauma 19%, followed by lower extremity at 6%.

The only meaningful comparison that can thus be made between November 2008 and previous research findings is that in 2008 head injuries topped the list in both 2008 patient cohorts. There was a rise in the proportion of head injuries between 2000(+/-17%) and 2008 (22%).

In the absence of other more sophisticated measures, the use of information related to body regions injured, lies in the ability to apply this data as a rough indicator of resources required for patient management, e.g. clinical specialities; speciality ICUs; corresponding ward capacity; special investigations (e.g. CT scans for head injured patients); out-patient and ambulatory surgery (e.g. certain hand-; plastic- and maxillo-facial injuries). Each discipline has its own idiosyncrasies associated with workload, e.g. a meaningful proportion of hand and maxillo-facial surgery patients presenting to the Trauma Centre are managed as day surgery cases on regular lists created for that purpose, as soon as possible after presentation

Another example is the correlation between the body region injured and the radiological examinations performed e.g. in November 2008 235 head injuries required 254 CT head scans; 40 injured eyes required 41 CT orbit scans.

A far more sophisticated and accurate method of proactively establishing resource requirements is ICD-10 data, provided that this data is complete and accurate using ICD-10 codes of more that two digits.

6.5.3 Mechanisms of injury

Descriptive data for this section were manually retrieved from the GSH TC attendance register. There is a formal column for this data, "nature of injury". The aggregated data is routinely recorded by nurses, forms a part of the monthly nursing statistics and is incorporated in the formal GSH data. Abbreviations of choice used by nurse scribes include MVA (Motor Vehicle Accident) adding particulars e.g. pedestrian / passenger or driver, and vehicle data if not a motor vehicle. A possible proxy HIS (Clinicom) is ICD 10 codes provided that entries were entered correctly and completely. Patient folders represent another data source, clearly not feasible for the scope of this study.

Meyers and Naledi (2007) add their voices to concerns about Cape Town trends in mortality related to homicide and road traffic incidents still being amongst the highest in the world, with predominance amongst male youth, linked to alcohol and substance abuse. Although a certain percentage of ICD-10 entries are in the HIS (Clinicom) databank, at the GSH TC the most comprehensive record of mechanisms of injury is contained in the TC attendance register and is regularly reported to the GSH Information Management. For the purposes of this study, I manually transcribed entries from the register into electronic format. Although it was not possible retrospectively to establish the alcohol and substance linkage, it was possible to demonstrate male predominance (male:female ratio 3:1) together with violence (59%) and traffic related injury (21%) as the highest mechanisms of injury during the study period.

6.5.4 Violence related injury

The WHO defines violence as:

> "The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, phsychological harm, maldevelopment or deprivation."
> (Krug 1996:5)

Matzopoulos *et al.* (2007b) concur that the effects of violence are not only confined to physical injuries, but may extend to behavioural and emotional problems, such as post traumatic stress disorder that, in turn, may fuel continuation of cycles of violence, extending into psycho-social outcomes. They support a public health approach to the management of the burden of injuries related to violence which should include biological, behavioural, societal and structural aspects of the causes of violence (Matzopoulos *et al.* 2007b).

In both the November 2008 GSH TC study patient cohorts, violence was the leading cause of injury including 59% of total patients and 62% of resuscitation patients. In the total patient cohort assaults were highest mechanism (39%) followed by stabs (15%) and gun shot injuries (5%). In the resuscitation patient cohort stabs (25%) were followed by gun shots (21%), and assaults (16%).

6.5.5 Traffic related Injury

Matzopoulos *et al.* (2007a) describe the rising contribution of road traffic related injuries to the international burden of injury, expected to be at 5.1% of DALYS lost by 2020. In the Western Cape in 2000, YYL already reached 6.9%. They comment about the burden of traffic injuries in Cape Town and highlight distinctive mortality patterns as high percentages of male (78%) and pedestrian deaths (>60%); high alcohol relatedness to driver deaths (>50%) and pedestrian deaths (>60%), with distinct weekend peaks in the mornings and early afternoons amongst adults and school-going children (Matzopoulos *et al.* 2007a).

During this retrospective study it was not possible to investigate alcohol and substance relatedness to traffic injuries treated at the GSH TC during the study period. However, during their studies of trauma patients at the GSH TC during

1999 and 2000, Donson and Peden (2000) did demonstrate increased positive breath alcohol concentrations (BrACs) during 2000 and an increase of 14% of patients with BrACs at or above the legal driving limit. Additionally, during their 2000 studies, the incidence of acute alcohol intoxication amongst the patient cohort was 50%, whilst 34.8% of patients tested positive for usage of at least one drug (Donson and Peden 2000).

During examination of the November 2008 GSH TC total patient cohort, there was a predominance of males to females at a ratio of 3:1. Weekend peaks of patient arrivals were demonstrated, with road traffic injuries as the second highest mechanism of injury, accounting for 21% of all injuries, represented by passengers (35%), pedestrians (32%) and drivers (16%) of road traffic injuries. The most seriously injured patients are admitted to the TC C14 resuscitation ward, traffic related injuries represented 31% of this cohort. Pedestrians represented the highest proportion (48%) of traffic related injuries followed by passengers (23%) and drivers (15%).

6.5.6 Non-traffic related injuries (falls, sport, "accidents" or mishaps)

Matzopoulos eds (2001) report that during 2001 in South Africa, deaths due to falls accounted for 13% of non-traffic injuries and were a major cause of death in persons 65 years and older. Fall deaths predominantly occurred in private homes and industrial areas; throughout the week; slightly more frequently on Sundays and Mondays and mostly at 10H00; 14H00 and 16H00 (Matzopoulos eds 2001).

At the GSH TC during November 2008, falls accounted for 167 (16%) of total patients, with 6 admitted to the resuscitation ward and 7% of deaths. Both the youngest (5 years) and the oldest (99 years) patients were injured due to falls, together with 76% of patients older than 80 years.

In the non-traffic related injury cohort, 167 falls accounted for 86% of injuries, followed by 8 (4%) sport injuries; 8 (4%) dog bites; 5 (3%) para-suicide; 4 (2%) human bites and 1 burn injury (0.5%), in total representing 193 non-traffic related injuries.

6.6 TRIAGE AT THE GSH TRAUMA CENTRE

Triage coding is entered down the side of the GSH TC register column "How Patient came to the Hospital" by means of capital letters "R"; "O"; "Y" or "G" indicating the colour codes Red, Orange, Yellow or Green. Patient folders represent another data source although not feasible for the purposes of this study

The CTS is a physiological scoring system with added mobility and injury parameters to make provision for trauma patients and time critical medical conditions e.g. ischemic stroke (Wallis *et al.* 2006).

Wallis *et al.* (2006) explain the development of the CTS, with inclusion of Orange with the intent to limit numbers of red patients to the resuscitation category and to reduce the potentially large yellow category. Bruijns *et al.* (2008) report on a prospective evaluation of the CTS that established a tendency to under-triage at 24% and over-triage at 25%. Amendments to the discriminator list and alterations to the colour code parameters with the addition of a trauma factor subsequently resulted in an acceptably lower under-triage rate (Bruijns and Wallis *et al.* 2008).

According to provincial policy the colour coded Cape Triage Score (CTS), is applied in the GSH TC. This is applied in combination with priority based anatomical and injury mechanism triage principles to prevent under-triage, especially of Orange coded trauma patients (Nicol 2009).

During examination of data in the GSH TC attendance register for November 2008 there was no indication of triage coding for 17% (172) of the total patient cohort. Most patients 41% (423) were in the Yellow group, followed by Green 335 (32%), Red 71 (7%) and Orange 39 (4%).

In the TC resuscitation cohort, 12% of patients (16) had no triage coding. The majority of patients were in the Red category 73 (56%), followed by Orange 27 (21%) and Yellow 14 (11%) and 1 Green (0.8%). The green coded patient was a 43 year old male admitted with polytrauma traffic-related injuries and died within 1 hour of admission, so it is apparent that this was an erroneous annotation in the register and this patient should have been annotated as Red.

In the GSH TC the CTS provides a practical tool for the sorting of injured patients into different clinical categories and is suited to use by junior nursing staff. It also provides a measure of injury severity and, albeit simplistic, it also provides a measure of injury severity.

6.7 MEASURING INJURY SEVERITY AT THE GSH TRAUMA CENTRE

Frankish (2004) examined trends in trauma and emergency services in the Western Cape over a period of 31 months, 2000 to 2002. Although he established that trauma attendances in the province during this period had nominally decreased during the period 2000 to 2002 (-.9%), he concluded that there had been an increased severity of injury based on the increased rate of admissions in the province. He notes that L3 hospitals provide trauma services to the entire province, but that the bulk of the patients originate in the Cape Town Metropole. In L3 hospitals (2000 to 2002) he demonstrated a year on year decrease (-5.7%) in the number of L3 trauma patients (11,695 to 11,029) with an increased admission rate (33.3% to 38.9%) From this he also deducted that this was to be expected as a sign of functional referral policies and protocols of the province.

In November 2009, provided admissions are calculated as patients admitted at GSH together with those transferred for admission elsewhere, the admission rate during the study period was 37.8%, increased from 33.4%; 29.3% and 30.3% during 2000, 2001 and 2002 respectively. When only GSH admitted patients are included, the rate remains at 33.3%.

In the absence of other measures, GSH management used increased numbers of gunshot victims treated at the GSH TC (789 during 2003 / 4 to 916 during the 2005 / 6 financial years) as indicative of increased severity and complexity of injuries (Groote Schuur Hospital 2006).

In December 2009 no formal internationally recognised injury severity scoring system is applied in the GSH TC yet, with the present measure of injury severity, the colour coded Cape Triage Score (Nicol 2009). The CTS provides a practical tool for the sorting of injured patients into different clinical categories, suited for use by junior nursing staff. Albeit simplistic, it also provides a measure of injury severity.

6.8 PATIENT DISPOSAL

6.8.1 Total patient disposals

It is important to note that this discussion only represents patients disposed from the Trauma Centre and not from the hospital as such. Additionally, patients

treated in the C 14 Resuscitation Ward area, have not been added to the total admissions. These admissions have been accounted for together with the other patients. This is to prevent double counting as admissions or alternatively to have to show these patients as transfers out from the C14 resuscitation ward.

The term "disposal" indicates the destination of the patient on departure from the GSH TC e.g. discharge from the hospital (implying to home); admission to an ICU; admission to a ward in the TC or elsewhere in the hospital; transfer to another hospital or death. Other terminology used for this action include, "patient departure" or "patient disposition". The term "disposal" is used in the TC attendance and the C14 resuscitation ward registers and is thus also used in this report.

Total patient cohort disposals from the GSH TC for the study period included 610 (58.7%) discharges; 346 admissions (33.3%); 56 (5.4%) transfers to other hospitals; 6 (0.6%) transfers to the medical emergency department; 8 patients (0.8%) left before being seen and 14 (1.3%) deaths.

If admissions are counted as admissions into GSH alone, the admission rate is 33.3%. In the event that admissions are calculated as GSH admissions added to transfers to other hospitals, this accounts for 402 patients, increasing the admission rate to 37.8%. Frankish (2004) used the TC admission rate as a measure of patient severity. During the period 2000 to 2002, (June and December), he demonstrated year on year admission rates of 33.4%; 29.3% and 30.3% respectively. Should the GSH TC November 2008 admissions be calculated as admissions into GSH only the admission rate of 33.3% concurs with the Frankish (2004) 2000 findings. When considering GSH admissions together with transfers to other hospitals, there is a considerable increase in the admission rate to 37.8%. Not knowing if Frankish (2004) included or excluded patient transfers to other hospitals in his calculations, complicates direct comparisons.

Of the 346 admissions, 26 (7.5%) patients were admitted to specialist ICUs; 179 (51.7 %) went to the trauma wards (C5 & C12); 77 (22.3%) went to the two general trauma and orthopaedic wards (F22 & F23); 21 (6.1%) to the neurosurgery ward and 19 (5%) to the eye ward. The rest were admitted to Urology (7); ENT (3) Psychiatry (1). There was no data for 11 (3.2%) of admitted patients.

During November 2008, the C12 ward consisted of 6 trauma HCU beds (SA Level 3) and 18 general trauma beds (Level 2). It was not possible to accurately separate numbers of patients admitted to the HCU and to the L2 beds.

The C14 resuscitation ward cohort represents 12.6% of total patients. 9 (6.9%) patients were discharged from this ward and all the patients who died 14 (1.3% of total pxs; 10.7% of C14 Resus Ward pxs) were treated in this ward. 69 (52.7%) were admitted to TC wards (C5 and C12); 10 (7.6%) patients to hospital wards; 7 (5.3%) were transferred to other hospitals. 27 (20.7%) of these patients went for surgery directly from the C14 resuscitation ward.

The above examination of patient disposals from the GSH TC is simplistic, to say the least. A comprehensive examination would include all the patient transfers within the hospital for the duration of the patient stay e.g. to and from different ICU's and wards; transfers out to other hospitals; eventual discharges and any further deaths. Due to data constraints, this was unfortunately not possible.

6.8.2. Deaths

According to Groenewald *et al.* (2007) routine examination of cause of death and premature mortality trends informs City of Cape Town public health programmes "for more than 100 years" (Groenewald *et al.* 2007:19) and serves as a foundation for City of Cape Town and DoH service prioritization In an overview of premature mortality in Cape Town, Groenewald *et al.* (2007) highlight a changing picture of the four leading causes of years of life lost (YLL) for the total population between 2001 and 2004. In 2001, YLL causes were ranked as homicide; HIV/AIDS, Tuberculosis and road traffic injury. By 2004, HIV/AIDS replaces violence as the leading cause for YLL. However, YLL patterns for males remain static as for the total population in 2001, with homicide the main cause of YLL, albeit decreasing from 26% to 16.8% (Groenewald *et al.* 2007).

Matzopulos *et al.* (2007b) discuss the relationship of age to violence related mortality and indicate that (as typical internationally) Cape Town male deaths show a sharp rise from the age of 15 years, but with a peak in the 25 to 29 year group.

The 14 deaths recorded in the TC resuscitation ward during November 2008 only represent immediate mortality in that area. It is quite possible that other patients transferred to ICU's, GSH wards or other institutions could also have succumbed

to their injuries. For the purposes of this study, it is not practical to follow-up on the remaining patients. The 14 patients who died were male, there was a peak of 43% in the 21 - 25 year age group with 21% in the group of 26 - 30 years.
The profile of injuries that led to the demise of these patients follows mortality trends in Cape Town e.g. violence related 71%; traffic related 21% and falls 7%. The majority of deaths occurred on Sundays (50%) followed by Saturdays (21%)

6.9 SURGERY

According to data retrieved from the GSH TC attendance register and the C14 Resuscitation Ward register, 68 patients were dispatched for surgery directly from the Trauma Centre. 27 of these 68 patients (20.7%) had been dispatched for emergency surgery directly from the C14 Resuscitation Ward. These patients only represent surgery that was scheduled from the TC which could have been performed either in the C6 trauma theatre or in the GSH main theatre complex.
Other surgery originating from trauma patients may be scheduled from a TC ward; from any another ward or ICU in the hospital; as day cases (especially hands, minor plastic surgery and maxillo-facial cases).To complicate matters even further, general trauma surgery is handled by trauma surgeons as part of the "trauma to completion" approach whilst orthopaedic and other specialized surgery is managed by the respective sub-specialities. As it is not unusual for delays of up to 72 hours for surgery for so-called "hot elective" cases, these patients are admitted to wards under jurisdiction of the specific disciplines and scheduled on the theatre "emergency board" from the wards.

6.10 DATA MANAGEMENT

Frankish (2004: 3) in his report on trauma and emergency departments in the Western Cape commented on data of "questionable accuracy", stating that it should be expected that institutional headcounts should correspond with those at Head Office. At GSH, during April 2000 to October 2002 the difference in numbers for 5 months was 38% less sent to Head Office than recorded at the institution. He expressed concern about the inaccuracy of trauma and emergency data provided by institutions in the Western Cape. He recommended ongoing

monitoring of trends in trauma and emergency care and that data to this effect should be routinely collected by institutions and analysed by the DoH as part of its routine monthly patient activity analysis.

Cummins (2004) reported on the failure to purchase the HIS (Clinicom) Trauma and Emergency module, making do with the out-patient and ward modules instead so that GSH TC patients were thus classified as out-patient attendances and ward admissions. Cummins (2004) commented on the resultant distortion of GSH TC activity data with creation of a misleading data base for planning purposes.

Meyers and Naledi (2007) in their overview of the study of the Burden of Disease in the Western Cape caution that information infrastructure systems are underdeveloped with important implications for the planning process; success in reduction of the burden of disease and selection of cost-efficient interventions (Meyers and Naledi 2007). They emphasise **"the primary and critical importance of information systems and their indispensability in the process of planning and implementing interventions"** (Meyers and Naledi 2007: 30).

W. Bryant (personal communication, October, 2009) informs that the HIS (Clinicom) module for trauma patients has not been installed yet and confirms that patients presenting to the GSH TC are still classified as "out-patient attendances". Out-patient attendances on HIS (Clinicom) are divided by 3, representing 1 patient day equivalent (PDE) which equals one ward admission for one day. Patients treated in the C14 resuscitation area, C12 High Care Unit and the C5 ward are classified as "admissions". The current cost per patient day, B. Jacobs (personal communication, August, 2009) is averaged as R2 293.00 for a ward bed and R3 706.00 for an ICU bed. This means that the estimated budget allocated for three trauma out-patient attendances is equivalent to R2 293.00

The frustration in gathering complete and correct data related to the Trauma and Emergency Services in the Western Cape in general and the GSH TC in particular has been well documented by past researchers. The same constraints were still faced during the course of this research 2007 to 2009. Quite simply, the greatest concern lies in the failure to record the correct numbers of patients in the first place, together with the inappropriate weighting allocated as just the same as ordinary out-patients. Added to these concerns follows disquiet about the

implications of failure to correctly record and weigh the range, complexity and intensity of patients.

6.11 SUMMARY

This chapter contains a discussion of the results of the study. Besides the demographic characteristics, injury profiles and disposal of patients seen at the GSH TC during the study period, it also contains discussions on problems encountered with data management; aspects of triage and aspects of patient severity.

It is interesting to note the change in the ratio of males to females, 2:1 in (1990) and 3:1 (1999 to 2009), and the downward trend in average monthly patient numbers at the GSH TC: 2000–2002 average of 1932 per month; 2002 to 2003 average of 1598 per month and November 2008 1040 for the month. Provided admissions are calculated as patients admitted at GSH together with those transferred for admission elsewhere, the admission rate during the study period was 37.8%, increased from 33.4%; 29.3% and 30.3% during 2000, 2001 and 2002 respectively. When only GSH admitted patients are included, the rate remains at 33.3%.

Burden of disease aspects of injury were specifically included in this chapter to highlight public health issues associated with work done in the GSH TC. In retrospect, the discussion contained in this chapter barely touches the tip of the iceberg of public health consequences of the risks taken by the population of the Cape Town Metropole, day after day and year after year.

CHAPTER 7

LIMITATIONS TO THE STUDY

7.1 INTRODUCTION

This chapter contains a discussion of the main issues that have proven to be constraints to realisation of the full expectations of this study. This relates mainly to problems associated with data sources and with the assessment of resource requirements for the management of patients who presented to the GSH TC during November 2008.

7.2 DATA COLLECTION

7.2.1 General

The main limitations to realization of the full extent this study were major obstacles related to the completeness and integrity of data in the two different electronic data sources, the HIS (Clinicom) hospital registration and billing system and the freestanding TraumaBank trauma registry.

Frankish (2004) argues that it should be expected that Trauma and Emergency (T&E) head counts by institutions should correspond with relevant head counts submitted to the DoH. In a 5 month sample 2000 to 2002, he describes data of "questionable accuracy" (Frankish 2004:4) and discovered differences of up to 38% between registered T&E patients and departmental statistics (Frankish 2004). In my study of GSH TC patients for the month of November 2008, data related to 1040 patients were contained in the GSH TC attendance register, with 852 in the HIS (Clinicom) data bank, a difference of 178 less patients. According to A. Nicol (personal communication, October, 2009), data related to approximately 33% of patients would be in the TraumaBank databank for that period.

Both Cummins (2004) and Frankish (2003 and 2004), commented extensively on their problems to gain access to accurate and complete data related to T&E departments in the Western Cape. Little was I to know at the outset of my study

that, despite their firm recommendations in three different reports, not much had changed since then. I was to encounter the same difficulties as described by Cummins (2004), and Frankish (2003 and 2004), right up to having to search high and low for relevant parts of the nurse-manufactured and nurse-managed handwritten GSH TC attendance register and the TC C14 resuscitation ward register. These registers proved to be the most comprehensive source of data for the purposes of this study.

7.2.2 Data capturing and transcription

No funding was available for appointment of research assistants or data capturers. All cleaning and sorting of data, together with transcription from handwritten registers into electronic format was done by the primary researcher. This proved to be extremely labour intensive and time consuming.

7.3 RESOURCE REQUIREMENTS

One of the objectives of this research project was to establish the resources required to manage the trauma patients reporting at the GSH TC during the period 1st to 30th November 2008. Attempting this assessment for 1040 TC patients, especially in the absence of a reliable electronic data base, was obviously beyond the scope of this project and I thus set out to examine the TC C14 resuscitation ward patient cohort of 131 patients.

The TC C14 resuscitation ward register contains columns annotated inter alia "CT scan"; "Lodox" scan; IVP"; "Ultrasound"; "Barium swallow"; "Angiogram"; "ECG"; "CVP" "Schedule 5 & 7 Drugs"; "Blood Products. With a view to examination of this data as indicators of resource requirements in the most acute TC treatment area, data for November 2008 were transcribed into electronic format. From this data it was established that the following resources were used for examination of 131 TC C14 resuscitation ward study patients: 66 Lodox scans; 63 CT scans; 5 angiograms; 4 ultrasounds; 4 barium swallows; 13 patients had X ray examinations. Additionally, 32 units of blood and 5 units of fresh frozen plasma were administered to 13 patients and altogether 67 patients received schedule 5 and 7 drugs, mainly "Morphine" and "Dormicum", with 4 patients receiving "Propofol".

Allard and Burch (2005) and Norberg *et al.* (2009) studied in-patient costs of firearm injuries in South Africa at Level 2 and L3 respectively. Allard and Burch (2005) used five variables: operating theatre time; duration of hospital and High Care Unit stay; pharmaceutical and blood products; laboratory services and diagnostic imaging studies. Norberg *et al.* (2009) attempted to cost real expenses of care including operating theatre time; duration of hospital and Intensive Care Unit stay; blood products; laboratory services; diagnostic imaging studies and ambulance services. Both sets of researchers acknowledged that their costing models excluded significant other cost drivers (e.g. labour costs) and at best, their research findings represented minimum costs (Allard and Burch 2005), (Norberg *et al.* 2009).

Data available for the cohort of patients in my study was totally insufficient and would require further extensive examination of individual patient data, together with costing of a representative set of variables. This was clearly outside of the scope of this project and a limitation to the initial objectives of this study.

7.4 HUMAN RESOURCE REQUIREMENTS Nurse Workload indicators

According to Scribante and Bhagwanjee (2007b), "Nurses are the backbone of any health care system. The quality of nursing directly affects patient outcomes i.e. morbidity and mortality, adverse events and total cost of care" (Scribante and Bhagwanjee 2007b:1315). My efforts to establish the nature of human resources required to manage GSH TC workload thus started with examination of requirements related to nursing personnel.

The most acute fresh trauma patients are admitted to the GSH TC C14 resuscitation ward. This ward has 6 beds and accommodates Cape Triage Score red coded patients, and some orange patients allocated red status due to priority coding trauma modifiers. There is formal capacity for 4 ventilated patients in this unit, but up to six ventilated patients are often simultaneously accommodated. The TC C14 resuscitation ward thus functionally serves as an ICU, but with more of an ebb and flow of patients than the customary ICU.

The TC C14 resuscitation ward register is designed manufactured and managed by nursing personnel and does not form part of the formal hospital data set. According to Plaatjies (2009) it is used by clinical personnel as a patient flow

document and by nurse management as a measure of nursing workload in that area. For this purpose the register contains columns annotated inter alia "intubated", "ventilated", "NGT" (naso-gastric tube), "catheter", "oxygen", "ICD" (inter-costal drain). With a view to examination of this data as indicators of nursing workload in the most acute TC treatment area, data for November 2008 were transcribed into electronic format. In this way it was established that 41% of the patient cohort were intubated and ventilated and had naso-gastric tubes; 70% had urinary catheters and 13% intercostals drains.

It was abundantly clear that this simplistic information alone did not remotely do justice to reflecting the extent and complexities of the nursing workload in the C14 resuscitation ward. Scribante and Bhagwanjee (2007b) advocate ICU nurse staffing ratios based on international norms, taking individuals' training and experience into account and adjusted for South African constraints. Other areas of differing workload intensity in the GSH TC would require different allocations.

Estimation of nurse and other human resource requirements to manage the GSH TC workload prove to be a limitation to the initial objectives of this study and outside of the scope of this research. It is worthy of a completely separate study.

7.5 PATIENT DISPOSAL

Due to incomplete patient numbers registered in the electronic data systems it was only possible to examine patient disposal details contained in the GSH TC attendance and TC C14 registers, representing disposal from the GSH TC and not from the hospital after in-patient stay. ICU patient day equivalents (PDEs); ward in-patient PDEs; out-patient visits and physiotherapy and occupational therapy treatments could not accurately be tracked. This proved to be another limitation to assessment of resources required for treatment of these patients.

It was also not possible to establish the total number of deaths of trauma patients, only the number of patients who died in the TC.

7.6 SUMMARY

Limitations associated with completeness and accuracy of electronic data resulted in the two handwritten trauma registers being used as the main source of data for the purposes of this study. These registers, voluntarily maintained by nursing personnel, contain a comprehensive data set with rich data providing a wealth of information, otherwise only accessible through examination of patient files and other departmental registers.

Although it initially appeared feasible, inclusion of resource assessment in the study objectives of this research was clearly much too ambitious for the scope of this project and justifies further independent research.

The study of patient outcomes was restricted to the disposal of patients from the GSH TC.

CHAPTER 8

RECOMMENDATIONS AND CONCLUSIONS

8.1 INTRODUCTION

According to the Atlanta Emergency Department Performance Measures and the 2006 Benchmarking Summit, Consensus Statement, leaders in emergency care are increasingly challenged beyond the parameters of time-honoured clinical medicine and beyond customary staffing ratios (Welch 2006). There is mounting pressure on emergency doctors and nurses to provide safe, well-timed, efficient and cost-effective care, whilst basic measures to determine their success are deficient, and even basic definitions have not been promulgated. Emergency physicians are searching for techniques to improve trauma and emergency department patient flow and processes. Conventional elementary markers for quality and efficiency, such as the measurement of time-intervals and tracking of patients leaving before being seen are insufficient. Even the elementary standardization of language, terminology and performance measures is an important requirement towards the improvement of operations management (Welch 2006).

In this chapter recommendations are made for the improvement of services to patients reporting to the GSH TC in particular and for the management of trauma and trauma prevention in the Cape Metropole and the Western Cape in general. These proposals are based on findings of previous researchers of the GSH TC; findings of this study, as well as from the international and local literature and include but a fraction of possible recommendations.

8.2 RECOMMENDATIONS

8.2.1 Trauma Systems and Trauma Centres

It is encouraging that various South African statutory and other bodies have recently embarked on initiatives to formalise regulations, standards, policy and position documents (some of which are still in draft format) related to trauma and

emergency systems and centres in South Africa and in the Western Cape as listed below:

- National Department of Health (2007): Regulations Governing Emergency Centres in South Africa. These Regulations are soon to be promulgated (WCDoH 2009)
- The Council for Health Services Accreditation of South Africa (2007): Emergency Centre Standards, Post Pilot Document, November 2007.
- Trauma Society of South Africa (2009): Trauma Centres in the Western Cape, Draft Document 12th October 2009
- Western Cape Department of Health (2009): Emergency Centres in the Western Cape, Draft V10 1 25th August 2009

During preparations for this study, it took considerable effort to locate the documents of previous researchers (Frankish 2003 & 2004; Cummins 2004) who had provided valuable recommendations on trauma and emergency centres in the Western Cape and at the GSH TC. It was sad to note that, with minimal exceptions, the very same recommendations are relevant in 2009.

It is thus strongly advised that the above noted new documents become part and parcel of managerial and clinical desktops and are used as living documents. It is strongly recommended that stipulations in these documents as comparable with international standards and applicable to the well researched Cape Town urban context and burden of injuries are implemented. This applies specifically to the major trauma centres in Cape Town, but not excluding the rest of the Metropole and Province.

8.2.2 Data Management and Trauma Registries

Recommendations by past researchers to address problems associated with complete and correct data for Western Cape Trauma and Emergency units in general and the GSH TC in particular, are well documented.

Frankish (2004) recommended ongoing monitoring of trends in trauma and emergency care. He advised routine collection of data by institutions with analysis by the WCDoH, as part of routine monthly patient activity analyses.

Cummins (2004) recommended the urgent purchase of HIS Clinicom Trauma and Emergency and theatre software modules for the GSH TC, together with installation of computers throughout the ED with on-line data access to clinical and nursing personnel to enter data in real time.

As related to surveillance systems, Meyers and Naledi (2007) highlight the extremely rapid change currently experienced in population, district and sub-district levels under jurisdiction of the Western Cape Department of Health (WCDoH) and argue that this requires "**a reliable and valid information system institutionalized within Provincial government structures**" (Meyers and Naledi 2007: 30) They emphasise that this system must have the capacity to supply rapid information in response to queries from managers and policymakers, available down to the "finest level of geographical and administrative categories." (Meyers and Naledi 2007: 30). They stress **"the primary and critical importance of information systems and their indispensability in the process of planning and implementing interventions"** (Meyers and Naledi 2007: 30), and express concern about the underdeveloped nature of the information infrastructure. They recommend that the DoH should create appropriate permanent and routine structures with necessary resources for such information systems to be placed within the normal routine operations of government (Meyers and Naledi 2007: 30).

The same constraints related to data availability as experienced by previous researchers were faced during the course of this research 2007 to 2009 and I would like to add my voice to their recommendations.

As a minimum recommendation, HIS (Clinicom) casualty management software should be bought and implemented in the GSH TC as a matter of urgency with computers accessible to staff for on-line entries.

In particular, I would like to recommend the implementation of trauma registries, as has proved successful in many other countries across the world and, according to Boffard (2006) are indeed considered as mandatory for any trauma centre

I would however, also like to add my voice to some caveats related to different critical aspects of trauma registries, succinctly summarized by Nwomeh *et al.* (2006). They recommend adequate funding; dependable software; data sets

tailored to the level of trauma care; well-defined patient populations; effectively trained personnel; defined processes for data collection, reporting and validation; as well as processes for maintaining confidentiality. Together with Nwomeh *et al.* (2006) I support a certification process for training of specialised trauma registry personnel with prior data management experience and completion of specific courses towards registration as a Certified Specialist in Trauma Registry (Nwomeh *et al.* 2006).

It is particularly noted that the WCDoH (2009) draft document "Emergency Centres in the Western Cape, Draft V10 1 25th August 2009" does not address data management. It is strongly recommended that this topic should be added to their document as internationally regarded a high priority and an essential building block for management planning and resource allocation purposes as has been extensively commented on in this report.

8.2.3 Caseload Severity

In the absence of other measures, GSH management previously used increased numbers of gunshot victims treated at the GSH TC (789 during 2003 / 4 to 916 during the 2005 / 6 financial years) as indicative of increased severity and complexity of injuries (Groote Schuur Hospital 2006). Since January 2007, patient severity scoring in the GSH TC is managed by way of the Cape Triage Score, but internationally recognized injury severity scoring is not routinely done.

It is noted in the WCDoH (2009) draft document "Emergency Centres in the Western Cape" that no formal severity scoring has been included and that the only proxy is the South African Triage Scale (WCDoH 2009).

Previous researchers of the GSH TC have commented on the need to measure the "severity of trauma" (Frankish 2004: 17) and the "intensity of the workload" (Cummins 2004:45). Frankish (2004) used admission rates as a proxy measure of patient acuity and established changing admission rates at the GSH TC in June and December of 2000 (33.4%); 2001 (29.3%) and 2002 (30.3%). Cummins (2004) reported the admission rate at GSH TC for June 2002 as 37%. The admission rate during this study period is calculated as 33.3% (GSH admissions only) or 37.8% (GSH admission and transfers to other hospital) and as such, only provides a very crude measure of patient severity

Cummins (2004) suggested that there is no simple way of assessing the intensity of the workload and recommended the use of the Revised Trauma Score (RTS) as well as the incidence of particular conditions using ICD10 coding. Pohlman *et al.* (2007) agree that injury severity is difficult to quantify and that outcome predictions will never be perfect. They advocate use of objective injury severity calculation towards improvement of the survival of injured persons, to predict trauma outcome, end-of-life decision making and to steer resource allocation (Pohlman *et al.* 2007).

Nathens (2004) supports analyses of preventable death rates to assess the effectiveness of trauma systems and facilitate outcome comparisons between different trauma centres (Nathens 2004).

The GSH TC is an internationally recognised Level 1 major trauma centre, serving a city that carries the highest injury mortality rate of all the major cities in South Africa (Trauma Society of South Africa 2009) and suffers fatalities due to homicide and road traffic injuries considered as amongst the highest in the world (Bourne *et al.* 2007). It would be remiss not to recommend the urgent implementation and routine use of at least one practical injury severity scoring system.

It is thus strongly recommended that agreement is reached on a suitable injury severity scoring system to be implemented as routine, at least for the three major Trauma Centres in Cape Town, including GSH; Tygerberg Hospital and the Red Cross War Memorial Childrens' Hospital.

It would be an exciting development if the designers of the Cape Triage Score and the South African Triage Scale were to embark on an initiative to design an injury severity score suited to South Africa circumstances.

8.2.4 Operational issues at the GSH TC.

8.2.4.1 The epidemiology of trauma:

Patterns of injury presentation at the GSH TC are evident. It is recommended that the epidemiology of trauma should inform resource distribution.

8.2.4.2 Use patient flow information:

Donson and Peden (2000) and Cummins (2004) concluded that most injuries presenting at the GSH TC, occurred after-hours and on weekends, together with

other patterns of predictable patient attendance. They recommend that peak attendance times should be routinely traced and that staff scheduling should correspond with the prominent predictable peaks. Similar results were demonstrated by this study and these recommendations are supported. The suggestions should at least be piloted.

8.2.4.3 Monitoring of "Top 10" ICD-10 admission codes:

Routine monitoring at least of the "Top 10" ICD-10 trauma admission codes is recommended. It is a sensible way of establishing the required range and volume of specialties and support services. As recommended by Cummins (2004), it is noted that ICD-10 coding on the HIS (Clinicom) system is user friendly when completed in real-time by doctors, and should not be limited to two digits, as this limits the usefulness of the information (Cummins 2004)

8.2.4.4 Acknowledge the need for observation beds:

The WCDoH (2009) draft document "Emergency Centres in the Western Cape", acknowledges the requirement for observation beds in emergency units. It is recommended that the present "trolley beds" in the GSH TC be renamed "observation beds" and staffed accordingly. Observation beds carry the same clinical workload as conventional beds. This should be recognized by immediate classification of patient status as "admissions" as soon as patients are allocated to these euphemistically named "trolley beds".

8.3 RECOMMENDATIONS FOR FURTHER STUDY

It is evident from this research report that some of the objectives were much too ambitious for the scope of the project and that there are numerous subjects that justify further study. These topics range from umbrella resource allocation issues to day-to-day operational matters, with some topics relating to both, as listed here-under:

8.3.1 Prospective assessment of patient severity

The most urgent topic for further study a the GSH TC concerns objective assessment of patient workload with injury severity based on internationally acceptable scores. This should be conducted with a view to rational planning for trauma care based on observed needs. This should ensure allocation of correct levels of care accompanied by the correct resources for the correct patients.

8.3.2 A study of nurse workload indicators

According to W. Bryant (personal communication, December 10, 2009) GSH nurses do score patients according to an activity of daily living (ADL) scoring system, represented in the GSH formal data set. This system represents a formally accepted measure of nursing workload. It is highly recommended that further studies should be conducted in order to investigate and match required nursing resources with the formally measured nursing workload in the GSH TC.

8.3.3 Quality indicators: patient outcomes

A prospective study should be conducted to establish patient outcomes, throughout the patient journey, if not to the end of rehabilitation, then at least throughout the stay in the Groote Schuur Hospital.

8.3.4 Real costs of trauma care

The real costs of trauma as experienced in the GSH TC should be studied by actuarial professionals. This should include *all* aspects of the treatment of trauma victims, including human resource requirements and ideally followed through to rehabilitation.

8.3.5 Theatre cases originating from GSH trauma centre.

Theatre cases are known cost drivers. A study of theatre cases originating from the GSH TC should include all aspects of injuries and surgical treatment e.g. mechanisms of injury; injuries sustained; operation types and frequency; multiple surgery on single patients; time of operations; time-to-table; consumable usage; real costs per patient and details of patient disposals.

8.3.6 Trends related to patient age

Data for the GSH TC is not separated per mechanism of injury and thus relates to injury in general. It reveals a major peak in the 16 to 25 year group, steadily tapering off through all older age groups Clearly in order to make meaningful comparisons, standardised age groupings must be used, with a caution against too large age ranges. There is much scope for further study of multiple trends related to the age of patients reporting to the GSH TC, especially associated with different mechanisms of injury and the design of upstream preventative interventions.

8.4 CONCLUSIONS

At the outset of this study the aim was to explore the numbers, demographic characteristics, injury classification and severity of patients reporting to the GSH TC, in order to be able to assess resources required to manage these trauma patients and finally, to assess the outcome of their treatment.

High expectations of ready access to comprehensive, accurate and user-friendly data in two separate electronic databases were not realized. This expectation was especially applicable to the TraumaBank Trauma Registry. The researcher thus reverted to manual transcription of source data from nurse manufactured trauma registers into Microsoft Excel electronic format. It was a revelation to discover that, in the present electronic age, the most accessible, accurate, comprehensive and user-friendly source of rich data at this L1 Trauma Centre was the voluntary nurse-held trauma register. Indeed, the greatest limitation to realisation of initial study objectives (e.g. injury classification and severity; patient outcomes and disposal together with resource requirements) are grounded in over-optimist expectations related to data accessibility. For this reason, an entire chapter has been dedicated to data collection, and discussions on data management permeate most aspects of this study.

A comprehensive literature review demonstrated the critical importance of trauma systems, trauma centers and trauma registries; triage and injury severity scores as foundations of well-functioning trauma care and key to improved patient survival and outcome. These topics could thus not be omitted from this study.

Examination and analysis of demographic data illuminated elements of descriptive epidemiology, the so-called "who, what, where and when" of injury, whilst reviewed literature clarified analytical epidemiological aspects, the "how and why". Together, this translated into the importance of Burden of Disease concepts as impacting on the profile of pathology presenting at the GSH TC. Burden of Disease concepts thus became interwoven into the body of the text.

Considering the destruction of lives and livelihoods created by the overwhelming burden of injury, the concept of trauma and injury as a "malignant epidemic" springs to mind. The injuries that present at the GSH TC are but manifestations of the greater public health problem. In this way, trauma and injury translate into much more than happens in the GSH TC. It is a most alarming public health problem, requiring urgent collaborative multi-sectoral intervention.

Finally, Gwinnutt *et al.* (2001) conclude that success in trauma management is not only about reducing mortality in patients with life-threatening injuries. Unless these patients can return to a useful existence, then trauma systems are creating an enormous economical and emotional burden for society. The goal should not only be to increase the number of survivors, but to increase the number of persons returning to functional lives (Gwinnutt *et al.* 2001).

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Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011) 717-2745

Reference: Ms Tania Van Leeve
E-mail: tania.vanleeve@wits.ac.za
23 July 2008
Person No: 297184
PAG

Dr R Kirsten
3 Ann Close
Constatia
7806
Cape Town, South Africa

Dear Dr Kirsten

Master of Public Health (Hospital Management): Approval of Title

We have pleasure in advising that your proposal entitled "*Groote Schuur Hospital: event and outcome study*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Enquiries : Dr S Kariem
Telephone : (021) 404-3178/9
Fax : (021) 404-3121
E-mail : skariem@pgwc.gov.za
Reference : Dr Ria Kirsten
Date : 4 March 2009

Departement van Gesondheid
Department of Health
ISebe lezeMpilo

Ms Anisa Keshav
Secretary: Human Research Ethics Committee
University of the Witwatersrand
Johannesburg

Tel 011- 717 1234 Fax 011- 7171265

REF: R14/49
M808552
Groote Schuur Hospital Trauma Centre - Event and Outcome Study

Authorisation is hereby given for Dr R. Kirsten to conduct the above study in the Groote Schuur Hospital Trauma Centre, provided that all relevant Ethics permissions are obtained.

Yours sincerely

DR S KARIEM
CHIEF EXECUTIVE OFFICER
GROOTE SCHUUR HOSPITAL

RK/dt

Groote Schuur Hospital
Private Bag,
Observatory, 7935
Telephone: 404-9111

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Kirsten

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M080552
PROJECT	GrootSchuur Hospital Trauma Centre Event and Outcome Study
INVESTIGATORS	Dr R Kirsten
DEPARTMENT	School of Public Health
DATE CONSIDERED	08.05.30
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.03.06 CHAIRPERSON .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof E Kramer

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • **Facsimile** [021] 406 6411
e-mail: sumayah.ariefdien@uct.ac.za

08 May 2009

REC REF: 222/2009

Dr R Kirsten
GSH Management

Dear Dr Kirsten

PROJECT TITLE: GROOTE SCHUUR HOSPITAL TRAUMA CENTRE: EVENT AND OUTCOME STUDY

Thank you for submitting your study to the Research Ethics Committee for review.

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

Approval is granted for one year till the 12th May 2010.

Please submit an annual progress report if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

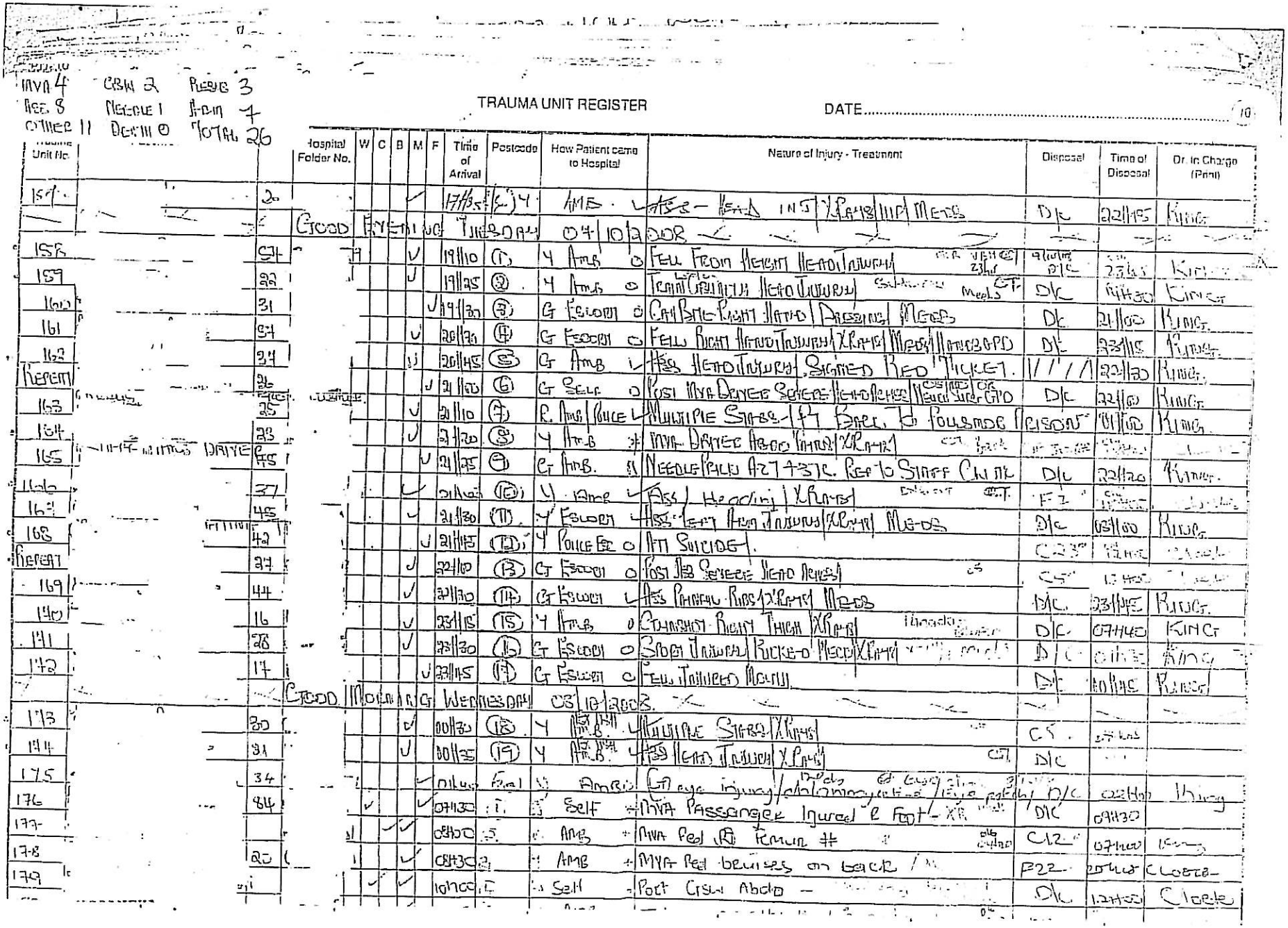
Yours sincerely

Lesley Henley

pp **PROFESSOR M BLOCKMAN**
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

ariefdien

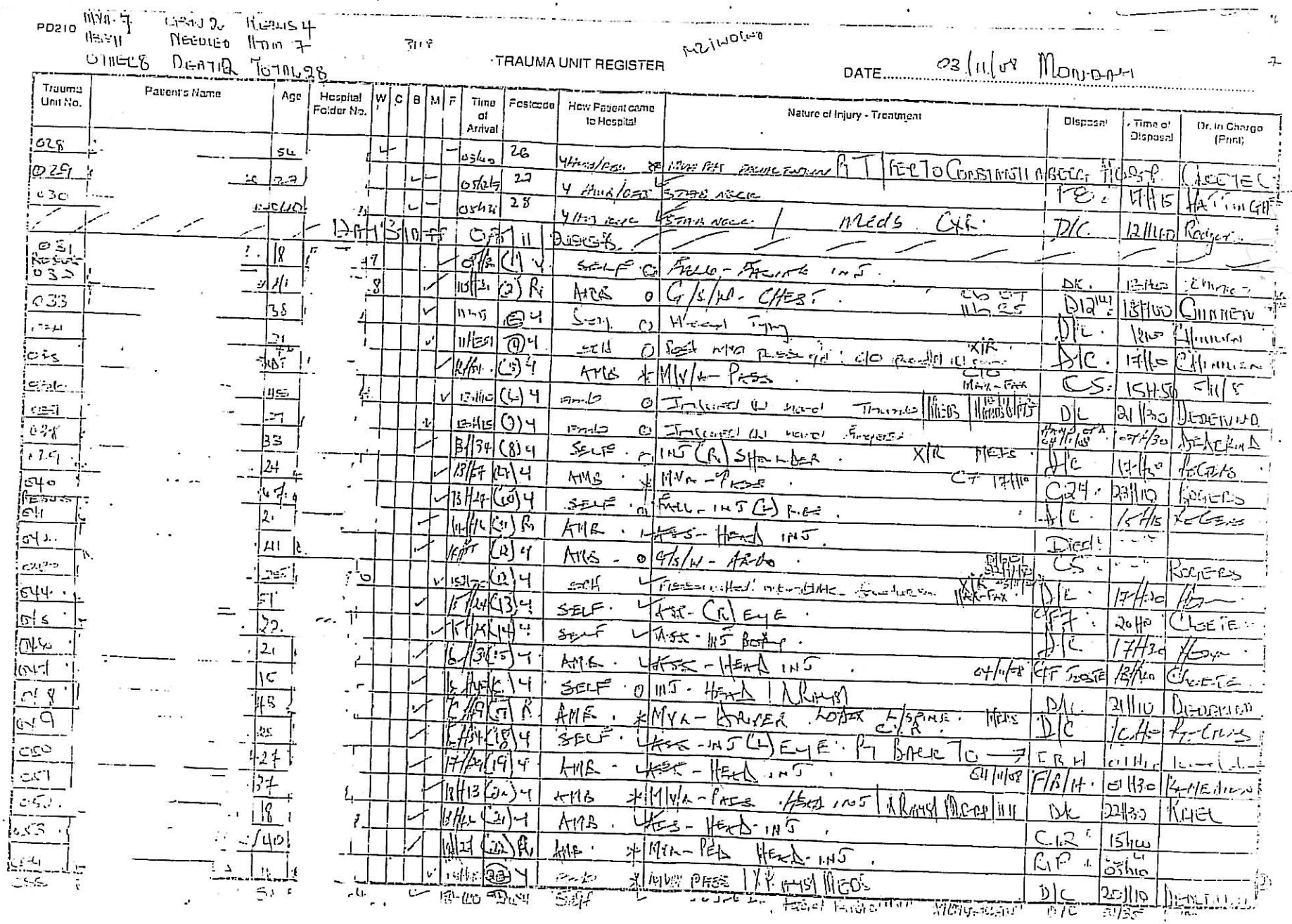


INVA 4 CSW 2 RESUS 3
RES 8 NEEDLE 1 ARM 4
OTHER 11 DEATH 0 TOTAL 26

TRAUMA UNIT REGISTER

DATE.....

Trauma Unit No	Hospital Folder No.	W	C	B	M	F	Time of Arrival	Postcode	How Patient came to Hospital	Nature of Injury - Treatment	Disposal	Time of Disposal	Dr. in Charge (Print)
157	20				✓		17/8	[illegible]4	AMB	LACS - HEAD INJ XRAYS IIP MEDS	D/C	22/145	King
	GOOD FRIDAY MORNING						TUESDAY	04/10/2	008				
158	24				✓		19/10	(1)	4 AMB	0 FELL FROM HEIGHT HEAD INJURY	D/C	23/45	King
159	22				✓		19/45	(2)	4 AMB	0 TEMP CEREBRAL HEAD INJURY	D/C	23/45	King
160	31				✓		19/30	(3)	G ESCORT	0 CAR BIKE RIGHT HAND DRESSING MEDS	D/C	21/00	King
161	34				✓		20/30	(4)	G ESCORT	0 FELL RIGHT HAND INJURY XRAYS MEDS TETANUS GPO	D/C	23/15	King
162	24				✓		20/45	(5)	G AMB	1 HEAD INJURY SIGNED RED TICKET.	D/C	22/30	King
Repeat	26					✓	21/00	(6)	G SELF	0 POST MVA DRIVER SCREEN HEAD FACE NECK SIDE GPO	D/C	22/00	King
163	25				✓		21/10	(7)	P. AMB POLICE	4 MULTIPLE STABS - LT BACK, LT FOUSMDS	PRISON	01/00	King
164	23				✓		21/30	(8)	4 AMB	1 MVA DRIVER HEAD INJURY XRAYS			
165	45				✓		21/45	(9)	G AMB.	0 NEEDLE PALM A27+31C. REF TO STAFF CNIC	D/C	22/20	King
166	27				✓		21/45	(10)	4 AMB	4 ASS / HEADING / XRAYS	F2		
167	45				✓		21/30	(11)	4 ESCORT	4 HAS LEFT ARM INJURIES XRAYS MEDS	D/C	05/00	King
168	42				✓		21/45	(12)	4 POLICE	0 ATT SUICIDE	C23		
Repeat	37				✓		22/00	(13)	G ESCORT	0 POST JAB SEVERE HEAD INJURY	C5		
169	44				✓		22/30	(14)	G ESCORT	4 HAS PARIETAL RIBS XRAYS MEDS	D/C	23/45	King
170	16				✓		23/15	(15)	4 AMB	0 SHOTGUN RIGHT THIGH XRAYS	D/C	07/45	KING
171	28				✓		23/30	(16)	G ESCORT	0 SPORT INJURY KICKED MEDS XRAYS	D/C	01/45	KING
172	17				✓		23/45	(17)	G ESCORT	0 FELL INJURED KNEE	D/C	00/45	King
	GOOD MORNING						WEDNESDAY	05/10/2008.					
173	30				✓		00/30	(18)	4 AMB.	4 MULTIPLE STABS XRAYS	C5		
174	31				✓		00/45	(19)	4 AMB.	4 HAS HEAD INJURY XRAYS	C5	D/C	
175	34				✓		01/45	Final	AMB	17 eye injury / abdominal pain / eye patch	D/C	02/00	King
176	84		✓		✓		07/30	1.	SELF	MVA PASSENGER INJURED L FOOT - XR	D/C	09/30	
177		✓	✓		✓		08/00	5.	AMB	MVA PED R/T KNEE #	C12	07/00	
178	20				✓		08/30	3.	AMB	MVA PED BRUISES ON BACK /	F22	20/00	Closed
179		✓	✓				10/00	2.	SELF	POST CSW ABDO -	D/C	12/00	Closed

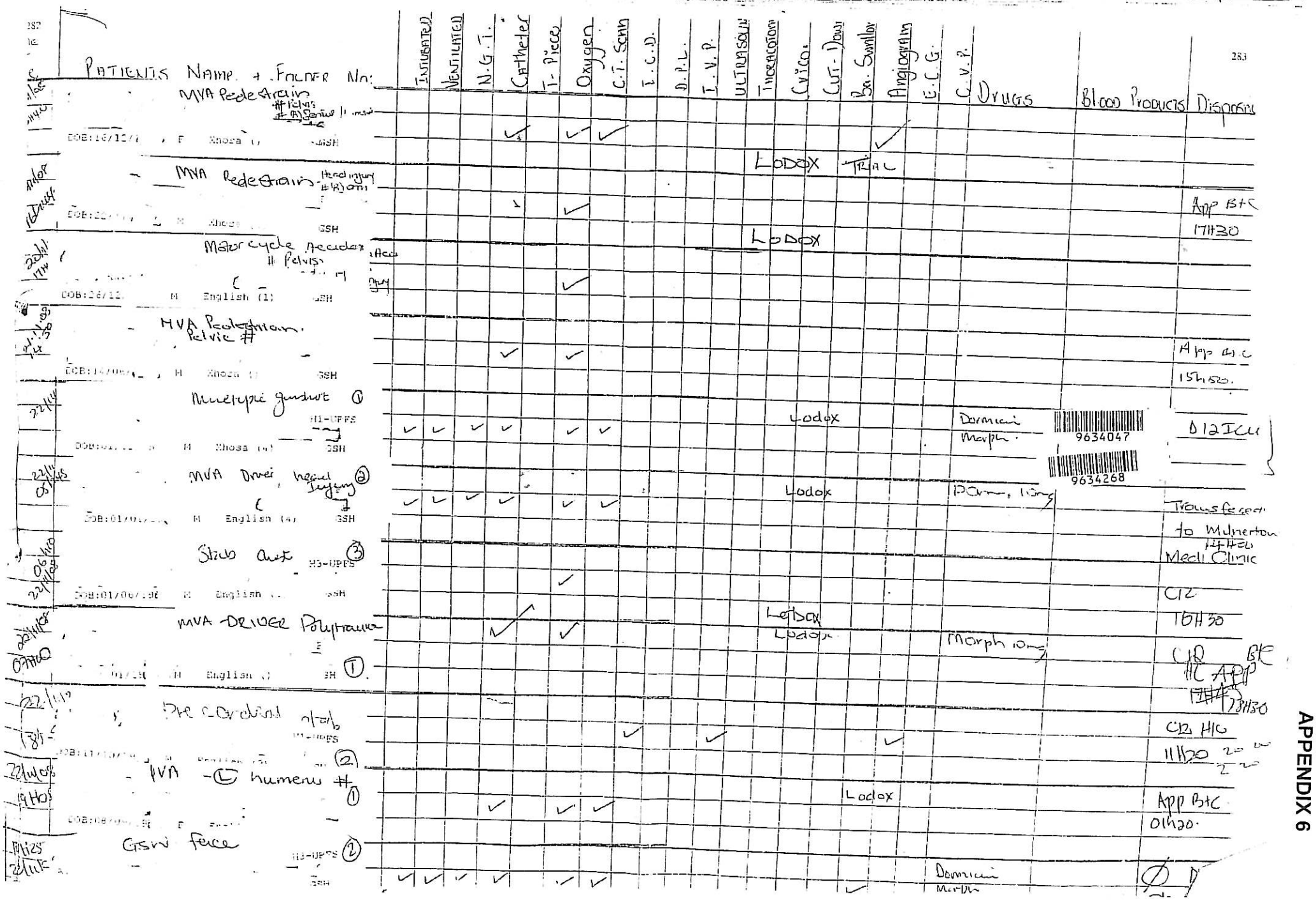


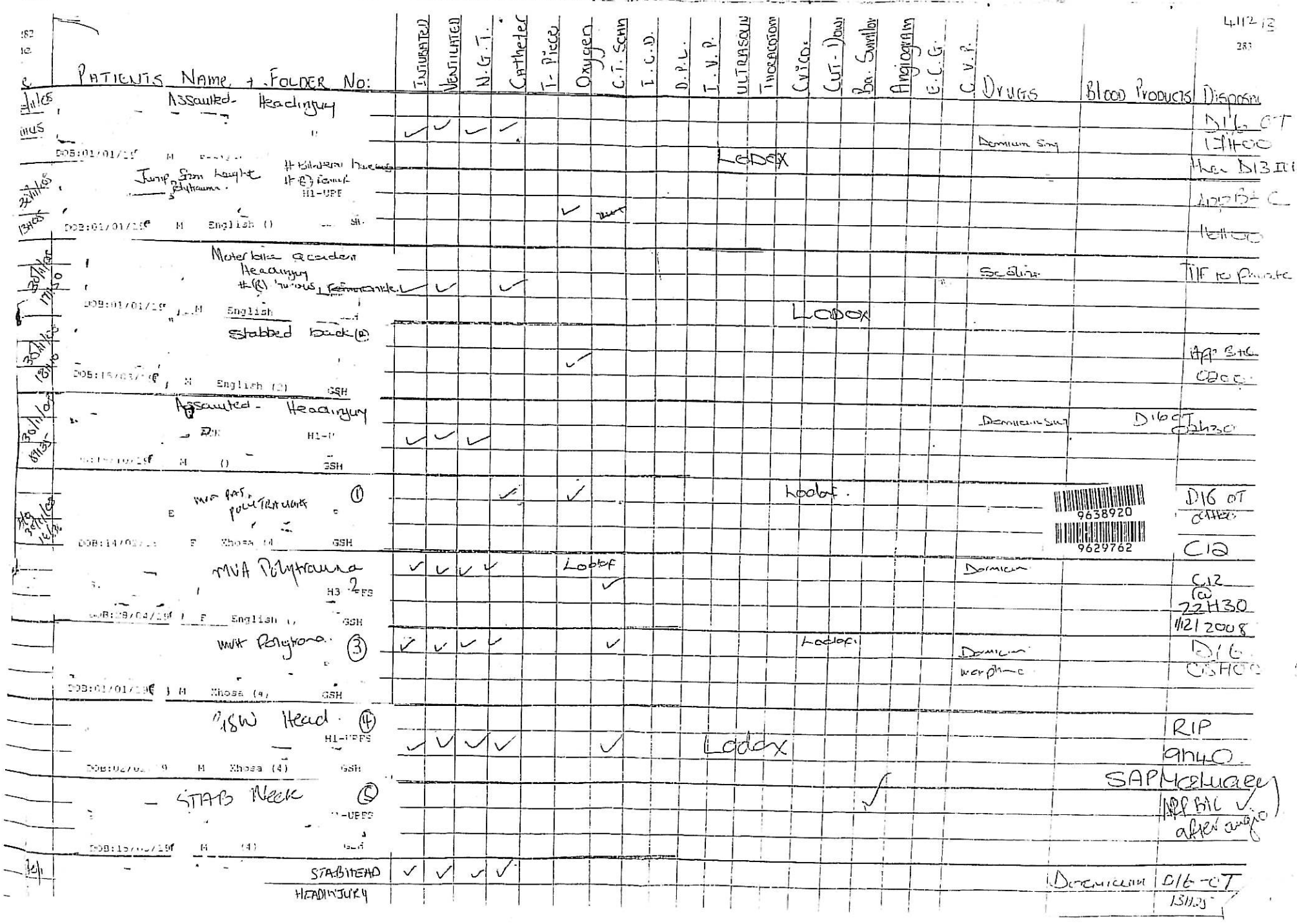
PD210 MVA-7 Cases 2 Heads 4
Bail Needles 1mm 7
Others Deaths Total 28

TRAUMA UNIT REGISTER

DATE 03/11/04 Monday

Trauma Unit No.	Patient's Name	Age	Hospital Folder No.	W	C	B	M	F	Time of Arrival	Postcode	How Patient came to Hospital	Nature of Injury - Treatment	Disposal	Time of Disposal	Dr. in Charge (Print)
028		54							0540	26	4 Amb/Fem	MVA RTA FRONTSEAT PASS RT TEL TO CORBETT HILL	BEC TRO	08:5?	CHEETE
029		23							0545	22	4 Amb/Self	STAB NECK	TE	17/11/15	HAYDEN GH
030		UNKNOWN							0548	28	4 Amb/Fem	STAB NECK / meds C&E	D/C	12/11/04	Rodger
031		18							0750	11	Police				
032		41							0818	(11) 4	Self	Fall - Facial inj.	DK	13/11/04	Emma
033		38							1015	(2) R	Amb	G/S/W - CHEST. CS CT 11/11 CS	D12	18/11/04	Gunnett
034		21							1115	(3) 4	Self	Head Inj	D/C	12/11/04	Hamilton
035		NBF							1145	(4) 4	Self	Stab MVA Pleural; c/o pain in Chest XR.	D/C	17/11/04	Hamilton
036		45							12/11/04	(5) 4	Amb	MVA - Pass. CT MAX-FAX	CS	15/11/04	Ellis
037		37							1240	(6) 4	Amb	Injured in Head Trauma	D/C	21/11/04	DEDERICHS
038		33							1245	(7) 4	Amb	Injured in Head Injuries	CT 12/11/04	07/11/04	BEACHAM
039		24							8/11/04	(8) 4	Self	INJ (R) Shoulder. XR Meds	D/C	17/11/04	McCABE
040		NBF							13/11/04	(9) 4	Amb	MVA - Pass. CT 17/11/04	C24	23/11/04	ROGERS
041		21							13/11/04	(10) 4	Self	Fall - INJ (L) Knee.	D/C	15/11/04	McGEE
042		41							14/11/04	(11) R	Amb	MVA - Head INJ.	Died		
043		25							15/11/04	(12) 4	Amb	G/S/W - Abdo. CT 15/11/04	CS		ROGERS
044		51							15/11/04	(13) 4	Self	Assaulted! Head Inj - Fracture XR - Face	D/C	17/11/04	
045		22							17/11/04	(14) 4	Self	Inj - (R) Eye.	CT 7	26/11/04	CHEETE
046		21							17/11/04	(15) 4	Self	Inj - Inj Body.	D/C	17/11/04	Hayden
047		15							16/11/04	(16) 4	Amb	MVA - Head Inj. CT 04/11/04	CT 12 DATE	18/11/04	CHEETE
048		NB							18/11/04	(17) R	Self	Inj - Head Injury	D/C	21/11/04	DEDERICHS
049		25							19/11/04	(18) 4	Amb	MVA - Driver Motor C/Spine. XR Meds	D/C	1/12/04	McCABE
050		42							19/11/04	(19) 4	Self	Inj (L) Eye. Pt Brake To →	ERH	01/11/04	[illegible]
051		37							17/11/04	(20) 4	Amb	MVA - Head Inj. CT 04/11/04	F/B/H	01/11/04	KAMEARA
052		18							18/11/04	(21) 4	Amb	MVA - Pass. Head Inj Arm Injury	DK	22/11/04	KHEL
053		40							19/11/04	(22) R	Amb	Inj - Head Inj.	C12	15/11/04	
054		11							19/11/04	(23) 4	Amb	MVA - Ped Head Inj.	C/P	03/11/04	
055		51							19/11/04	(24) 4	Self	MVA Pass XR Injs Meds	D/C	20/11/04	DEDERICHS


PATIENTS NAME + FOLDER No:
Intubated
Ventilated
N.G.T.
Catheter
T-Piece
Oxygen
C.T. Scan
I.C.D.
D.P.L.
T.V.P.
ULTRASOUND
Thoracotomy
Cvico.
Cut-Down
Sa. Sumilar
Angiogram
E.C.G.
C.V.P.
Drugs
Blood Products
Disposal
MVA Pedestrian
Motorcycle Accident
MVA Driver
MVA - Driver Polytrauma
MVA - L humerus #
GSW face
Lodox
Morphine
Dormicum
9634047
9634268
Transfer to Milnerton Medi Clinic
ICU
ICU BTC
CIR HIC
App B+C
17h30
12h30
15h30
01h20.
D12 ICU


PATIENTS NAME + FOLDER No:
Intubated
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N.G.T.
Catheter
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C.T. Scan
T.C.D.
D.P.L.
T.V.P.
ULTRASOUND
Thoracotomy
Cvico.
Cut-Down
Da. Swinton
Angiogram
E.C.G.
C.V.P.
DRUGS
BLOOD PRODUCTS
Disposal
Assaulted - Headinjury
Jump from height - Polytrauma
Motorbike accident - Headinjury
Stabbed back
Assaulted - Headinjury
MVA Polytrauma
MVA Polytrauma
GSW Head
STAB Neck
STAB HEAD
HEADINJURY
Lodox
Domicum 5mg
Scoline
Morphine
9638920
9629762
D16 CT
C12
RIP
SAP Measures
ABG
after surgery
D16-CT

TRAUMABANK DATA COLLECTION FORM

www.verticalapps.co.za

DEMOGRAPHICS/ STICKER	Arrival date:	Hospital number:	Gender: Male / Female
	First Name:	Surname:	Age:
	Race: Black / White / Asian / Coloured	Residential Suburb:	

INCIDENT	
Incident Date:	Blunt / Penetrating / Burn / Medical / Other:
Incident Time:	How it happened: Stab / GSW - handgun, rifle, shotgun, AK47 / Hijacking / Assault / MVA / Taxi - driver, passenger, restrained, unrestrained / PVA / MBA / Bicycle / Train / Fall - from height, same level / Burn - fire, water, steam, petrol / Animal / Other:
Where it happened (suburb):	
Accidental / Self-harm / Assault: stranger / aquantance / family / intimate partner / child abuse / elder abuse / rape	
Site: road / home / work / recreation / tavern / prison / education / other:	

PRE-HOSPITAL	Doctor present on scene YES / NO	Crew: BLS / ILS / ALS	
Ambulance number:	EMS Service:	Helicopter used: YES / NO	Airlifted from:
Dispatch time:	Scene arrival time:	Scene departure time:	Hospital arrival time:
***Initial* scene vitals:**			**Sats:**
***Pulse*:**	Patient's own ***respiration*** rate:	Assisted ***ventilation*** rate:	**BP:**
GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor:1 2 3 4 5 6	*Initial* scene GCS:
Pre-hospital intervention:	***IV:*** 1 line / 2 lines ***Size:*** Ringers / Colloid I Other:	***Drugs:*** Nil / Tramal / Morphine / Dormicum / Scoline / Pavulon / Other:	***Other:*** Nil / Collar Board / Scoop / CPR / Defib / Trac 3 / Splint / Other:
Airway: Nil / O2 Mask / Oral Airway / Bag valve mask / Oral ETT / Nasal ETT / Cric / Other:			
Size:	Amount infused: ml	Dose:	

REFERRING HOSPITAL			
Transferred: YES / NO	Referring Hospital:		Arranged: YES / NO
Vitals on *arrival* at *Referring Hospital*:			
Pulse:	Patient's own ***respiration*** rate:	Assisted ***ventilation*** rate:	**BP:**
GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor:1 2 3 4 5 6	GCS at other hospital:
Referring Hospital Intervention:		Drugs:	Diagnostic Procedures:
Airway:	IV:		

EMERGENCY UNIT ADMISSION AND RESUS TEAM			
Emergency Unit arrival time:	Primary survey complete:	Arrived from: Scene / Referring Hospital / Home	Transport: Ambulance BLS / ILS / ALS / Helicopter / Police / Private Vehicle / Walk / Other:
Resus Team *activation* time:	Secondary survey complete:		
Consultant:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Registrar:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Doctor 1:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Doctor 2:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Sister 1:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Sister 2:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Neurosurgeon:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Orthopaedics:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Paeds:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Other:		Time present:	Telephonic / OT / Other Resus / Absent / Not called

EMERGENCY UNIT DATA

Initial **Emergency Unit vitals, Assessment and IV Fluids / Drugs Administered:**

Pulse:	Patient's own *respiration* rate:	Assisted *ventilation* rate:	BP:
Temperature:	GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor: 1 2 3 4 5 6
Comorbidity: Asthmatic / Diabetic / Epileptic / Pregnant / Anticoagulants / Hypothermic / Hypertensive / Contact lenses / Other:			
Allergies:	Meds:	PMS Hx:	Last Meal:
Airway: O2 Mask % / Oral Airway / Bag Valve Mask / Oral ETT, size / Nasal ETT, size / Cric / Nil			
IV Lines: 8.5Fr / 8.5FR / 14G / 14G / 16G / 16G / Other:			Subclavain/Femoral/Jugular
IV: Crystalliod: ml	Colloid: ml	Blood ordered:	FFP ordered:
		Blood given:	FFP given:
Drugs: Analgesia: Nil / Morphine / Other:	Sedation: Nil / Dormicum / Hypnomidate / Other:	Paralysis: Nil / Scoline / Pavulon / Other:	Antibiotics:
Cardiac: Nil / Adrenaline / Atropine / Anti-arrythmics / Other:			Tet tox

Emergency Unit Procedures:

Intubation: Yes / No	Cric / Trachy: Yes / No	ICD L : Yes / No; X 1 / X 2	ICD R: Yes / No; X 1 / X 2
Peripheral line: L X	Peripheral line: R X	Central line: L X	Central line: R X
Suturing: Yes / No	Fasciotomy: Yes / No	E R Thorocotomy: Yes / No	Bronchoscopy: Yes / No
Dressing: Yes / No	Urinary catheter: Yes / No	NG / OG tube: Yes / No	Eye care: Yes / No

Other: Nil / CPR / Defib / Trac 3 / Pelvic sheet / Bair Hugger / Other:

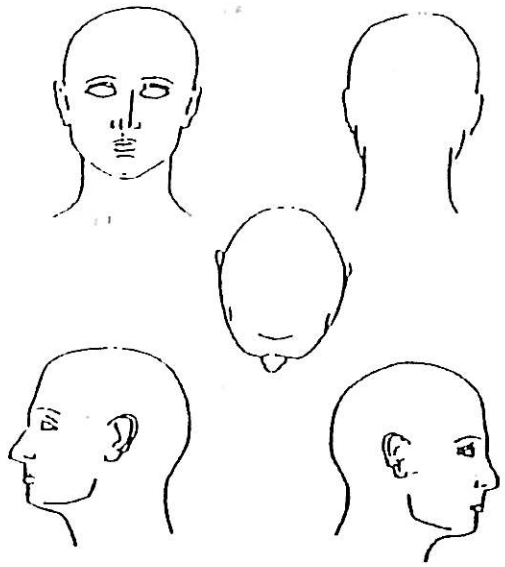
Diagnostic Procedures and Findings:

X-Ray C-Spine:		IVP: Yes / No	Positive / Negative
X-Ray Chest:		CT Abdo: Yes / No	Positive / Negative
X-Ray Pelvis:		CT Chest: Yes / No	Positive / Negative
X-Ray		CT Head: Yes / No	Positive / Negative
X-Ray		CT Spine: Yes / No	Positive / Negative
X-Ray		Dopplers: LEGS / ARMS	L = R =
Ultrasound Abdo: Yes / No	Positive / Negative	ECG: Yes / No	Abnormal / Normal
DPL Open/Closed: Yes / No	Positive / Negative	Trop T levels: Yes / No	Elevated / Normal
Angiogram: Yes / No	Positive / Negative	Other:	Positive / Negative

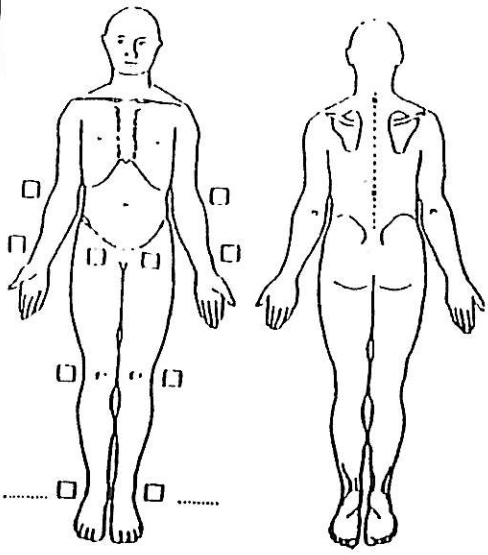
INJURY LIST / DIAGNOSIS:

HEAD:	FACE:
NECK: Carotid Pulses present: L Y / N; R Y / N Trachea central: YES / NO Neck Veins distended: YES / NO	THORAX: Flail: YES / NO Open chest: YES / NO Pneumothorax: YES / NO L / R Haemothorax: YES / NO L / R Haemo-pneumo: YES / NO L / R
ABDO & PELVIC CONTENTS: Rectal:	SPINE:
UPPER EXTREMITIES: Pulses present? Brachial: L YES / NO; R YES / NO Radial: L YES / NO; R YES / NO	LOWER EXTREMITIES: Pulses present? Femoral: L Y / N; R Y / N Popliteal: L Y / N; R Y / N Distal: L Y / N; R Y / N
EXTERNAL: Abrasions / Contusions / Lacerations / Burns	

HEAD AND NECK INJURIES:



SYSTEMIC INJURIES:



Contact lenses: YES / NO

Pulses present? Record Doppler pressures

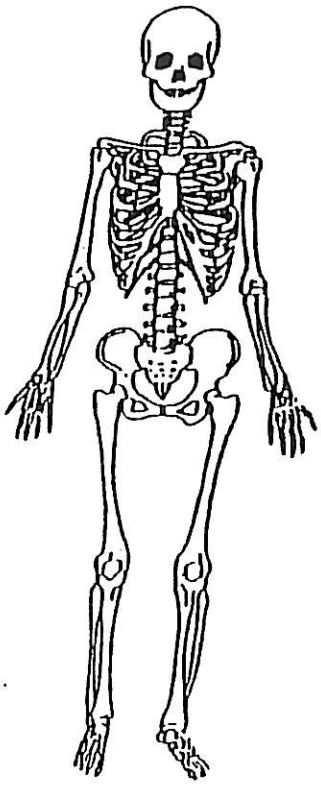
CENTRAL NERVOUS SYSTEM:

Pupils:			**Reflexes:**	L	R
Size	L:	R:	Biceps:		
React to light	L:	R:	Triceps:		
Consensual:			Patella:		
Fundi:			Ankle:		
Power:	L	R	Babinski:		
Arm flexion			OTHER:		
Arm extension			Blood sugar:		
Leg flexion			Urine dipstick:		
Leg extension			Clearview preg test:		
Sensation:			NG Aspirate:		
			CVP:		

Bloods sent: FBC / U&E / COMPAT
PI/PTT / GLUC / TOX / HCT / HIV / CE

	ABG:	ABG:	VBG:
TIME:			
Temp:			
PH:			
PO2:			
PCO2:			
Sats:			
SBE:			
HCO3:			
Hct:			
Hb:			
Na:			
K:			
LACTATE:			

SKELETAL INJURIES:



EMERGENCY UNIT DISCHARGE:

Emergency Unit discharge date:

Emergency Unit discharge time:

Emergency Unit disposition: Ward / ICU / Theatre / Theatre - Ward / Theatre - ICU / Home / DIC / DOT /
T/F to: Hospital

Admitting Discipline: Trauma / Neuro / Ortho / MaxFac / Other:

Ward:

Emergency Unit Doctor ATLS trained: YES / NO

Name: Signature:

Nurse team leader

Name:

Form checked by:

TraumaBank Theatre Form

Surgeon: _____
Assistant: _____
Anaesthetist: _____

PT DETAILS/STICKER
Hospital no: _____
First Name: _____
Surname: _____

Date:	
Start time:	**End time:**

SURGICAL COMMENT:

Incision:		
Findings:	Findings:	Procedure done:
Organ:	Grade of Injury:	

Decision for Damage Control:

Bleeding	Physiological	Contamination	Unknown

Closure:

Packed: YES/NO	Large Abdo Swabs: X	Vascular Swabs: X	Abdo: Open	Abdo: Closed

Drain:

Plan:

FLUIDS DURING SURGERY:

Coagulopathic: YES/NO/UNKNOWN	Crystalloid type: Amount: ml	Colloid type: Amount ml
Blood: units	FFP: units	Platelets: units
Cell saved: YES / NO	Amount:	

METABOLIC STATUS:

Temperature:	Lactate:	pH:
Hb:	HCO3:	Base Deficit:

Patient's Disposition (sent to):

TraumaBank ICU Data

Single ICU Patient Daily Follow-up Form:

Patient Sticker/ Name: Hospital Number:	Date: _____ Doctor: _____

Procedures:

Date: Time:	Theatre: YES/NO	Surgeon:	Units blood used:
What:			

Complications:

What:	Comments:

Sofa Scoring: Please note: all 6 fields are required to calculate a SOFA score

RESPIRATION (PaO2/Fio2): > = 400mmHg <400mmHg + - Resp Support <300mmHg + - Resp Support <200 and Resp Support <100 and Resp Support	COAGULATION (Platelets): >150 platelets <150 platelets <100 platelets <50 platelets <20 platelets	CARDIOVASCULAR (BP): MAP > 70mmHg MAP < 70mmHg Dopamine/Dobutrex < = 5mics Dopa > 5 or Adrenaline < = 0.1 Dopa > 15 or Adrenaline > 0.1
GCS:	LIVER (bilirubin mmol/l):	RENAL (creatinine mmol/l): <100mmol/l 100-170mmol/l 171-299mmol/l 300-400 or <500mls urine/day >400 or <200mls urine/day

Daily Info:

Ventilated: YES / NO	Mode of ventilation: Invasive (tube) / CPAP/ Non Invasive (mask)	Inotropes: YES / NO	Dialysis: YES / NO
Enteral Nutrition: Complete (no TPN) Supplemental Nil (only TPN) Nil (no TPN)	Bloods: HDL Cholesterol: mmol/l IL6: pictogram/ml Serum Magnesium: mmol/l	Comments:	

ICU Discharge:

Date:	Patient sent to:

Enquiries : Dr S Kariem
Telephone : (021) 404-3178/9
Fax : (021) 404-3121
E-mail : skariem@pgwc.gov.za
Reference : Dr Ria Kirsten
Date : 4 March 2009

Departement van Gesondheid
Department of Health
ISebe lezeMpilo

Ms Anisa Keshav
Secretary: Human Research Ethics Committee
University of the Witwatersrand
Johannesburg

Tel 011- 717 1234 Fax 011- 7171265

REF: R14/49
M808552
Groote Schuur Hospital Trauma Centre - Event and Outcome Study

Authorisation is hereby given for Dr R. Kirsten to conduct the above study in the Groote Schuur Hospital Trauma Centre, provided that all relevant Ethics permissions are obtained.

Yours sincerely

DR S KARIEM
CHIEF EXECUTIVE OFFICER
GROOTE SCHUUR HOSPITAL

RK/dt

Groote Schuur Hospital
Private Bag,
Observatory, 7935
Telephone: 404-9111

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Kirsten

CLEARANCE CERTIFICATE	PROTOCOL NUMBER M080552
PROJECT	GrootSchuur Hospital Trauma Centre Event and Outcome Study
INVESTIGATORS	Dr R Kirsten
DEPARTMENT	School of Public Health
DATE CONSIDERED	08.05.30
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 09.03.06 CHAIRPERSON .....
(Professor P E Cleaton Jones)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor : Prof E Kramer

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and ONE COPY returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

UNIVERSITY OF CAPE TOWN

Health Sciences Faculty
Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone [021] 406 6338 • Facsimile [021] 406 6411
e-mail: sumayah.ariefdien@uct.ac.za

08 May 2009

REC REF: 222/2009

Dr R Kirsten
GSH Management

Dear Dr Kirsten

PROJECT TITLE: GROOTE SCHUUR HOSPITAL TRAUMA CENTRE: EVENT AND OUTCOME STUDY

Thank you for submitting your study to the Research Ethics Committee for review.

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

Approval is granted for one year till the 12th May 2010.

Please submit an annual progress report if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the REC. REF in all your correspondence.

Yours sincerely

Lesley Bonley

pp **PROFESSOR M BLOCKMAN**
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

ariefdien

GSH Trauma Centre Attendance Register

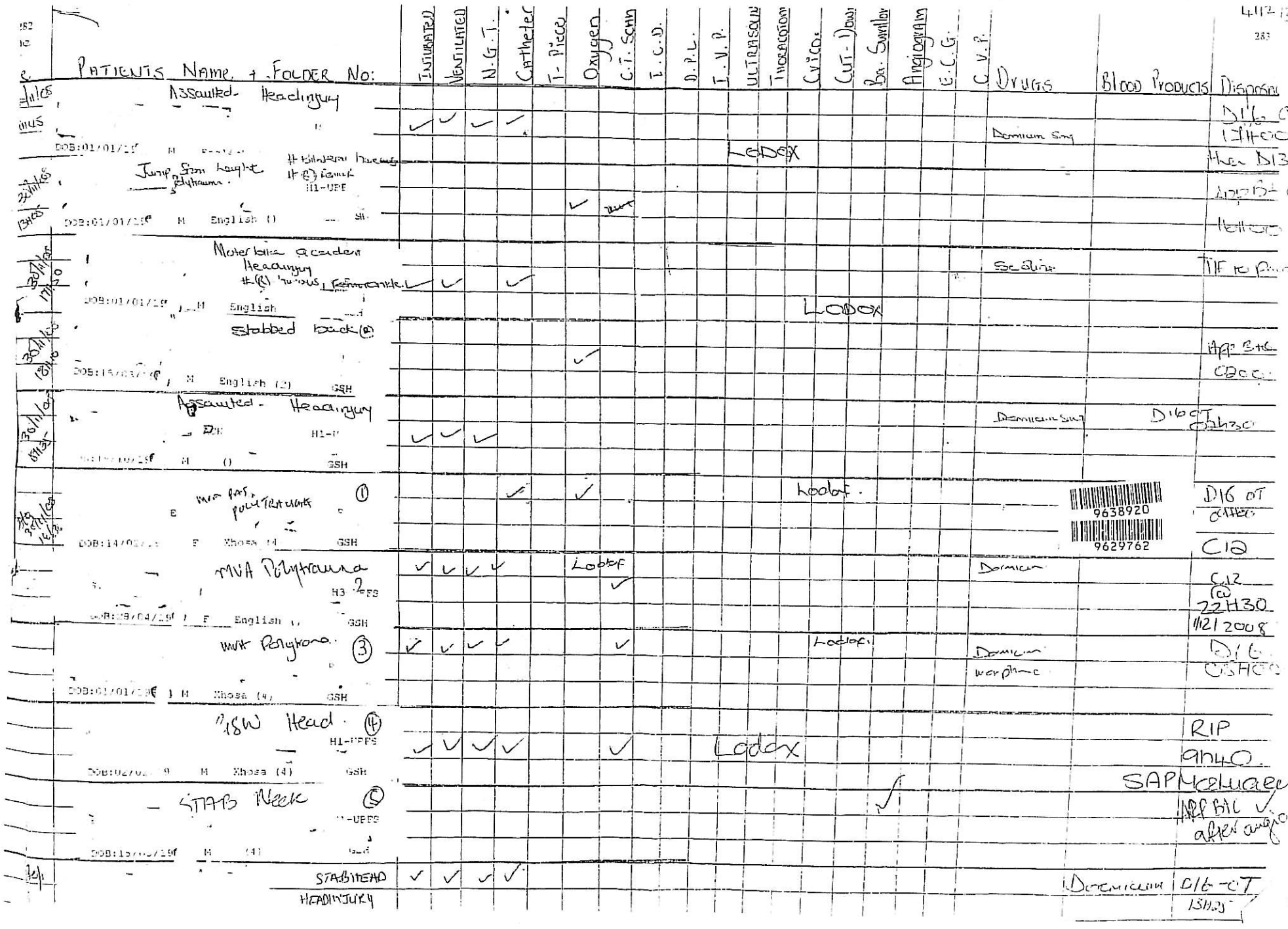
PD210 MVA: 7 Cards 2 Kebis 4
Assn Needles Hom 7
Others Deaths Total 28

TRAUMA UNIT REGISTER

DATE 03/11/09 Monday

Trauma Unit No.	Patient's Name	Age	Hospital Folder No.	W	C	B	M	F	Time of Arrival	Postcode	How Patient came to Hospital	Nature of Injury - Treatment	Disposal	Time of Disposal	Dr. in Charge (Print)
028		54							0514	26	Hand/foot	MVA PAT [illegible] RT FEET TO CONSULTING	BEDS	1105	[illegible]
029		23							0515	27	Hand/foot	STAB NECK	TC	17/11/15	[illegible]
030		[illegible]							0514	28	Hand/foot	STAB NECK / Meds CXR.	DIC	12/11/09	[illegible]
031		18							0516	1	SELF	FALL - STAIRS INJ.	DK	[illegible]	[illegible]
032		41							0518	(2)	AMB	G/S/W - CHEST. CXR CT	DIC	18/11/09	[illegible]
033		38							0519	(3)	SELF	Head Injury	DIC	18/11/09	[illegible]
034		21							0521	(4)	SELF	Foot MVA Passenger; C/O Pain in [illegible] XR	DIC	17/11/09	[illegible]
035		[illegible]							0522	(5)	AMB	MVA - PASS. CTC MAX-FAX	CS	15/11/09	[illegible]
036		155							0510	(6)	AMB	Injured in Head Trauma [illegible]	DIC	21/11/09	[illegible]
037		27							0515	(7)	AMB	Injured in Head Trauma	DIC	17/11/09	[illegible]
038		33							0534	(8)	SELF	INJ (R) SHOULDER. XR MEDS CT 17/11/09	DIC	17/11/09	[illegible]
039		24							0537	(9)	AMB	MVA - PASS.	CJA	23/11/09	[illegible]
040		47							0524	(10)	SELF	FALL - INJ (L) KNEE.	A/E	15/11/09	[illegible]
041		2							0514	(11)	AMB	MVA - HEAD INJ.	Died		
042		41							0517	(12)	AMB	G/S/W - ABDO.	CS		[illegible]
043		25							0521	(12)	SELF	[illegible] XR MAX-FAX	DIC	17/11/09	[illegible]
044		51							1521	(13)	SELF	ASS - (R) EYE.	CFT	20/11/09	[illegible]
045		22							1524	(14)	SELF	ASS - INJ BODY.	DIC	17/11/09	[illegible]
046		21							1530	(15)	AMB	ASS - HEAD INJ. 04/11/09	CFT [illegible]	18/11/09	[illegible]
047		15							1534	(16)	SELF	INJ - HEAD INJURY	DIC	21/11/09	[illegible]
048		43							1539	(17)	AMB	MVA - DRIVER. LOWER L/SPINE. C/R.	DIC	1/11/09	[illegible]
049		28							1534	(18)	SELF	ASS - INJ (L) EYE. PT BACK TO →	ERH	01/11/09	[illegible]
050		37							1547	(19)	AMB	ASS - HEAD INJ. 04/11/09	F/B/H	01/11/09	[illegible]
051		18							1613	(20)	AMB	MVA - PASS. HEAD INJ [illegible]	DK	22/11/09	[illegible]
052		40							1621	(21)	AMB	ASS - HEAD INJ.	C.12	15/11/09	
053		11							1621	(22)	AMB	MVA - PED HEAD INJ.	CJP	05/11/09	
054		51							1636	(23)	Self	MVA PASS [illegible]	DIC	20/11/09	[illegible]

PATIENTS Name + Surname No:
Intubated
Ventilated
M.G.T.
Chthelar
T- Piccs
Oxygen
C.T. Scan
T.C.D.
D.P.L.
T.V.P.
Ultrasound
Intercostal
Cyto.
Ctr. Tube
Sp. Swallow
Angiogram
E.C.G.
C.V.P.
Drugs
Blood Products
Diagnosis
MVA Pedestrian
Motor Cycle Accident
MVA Pedestrian
MVA Driver
MVA Driver
MVA Pedestrian
Lodox
Lodox
Lodox


PATIENTS NAME + FOLDER No:
Intubated
Ventilated
N.G.T.
Catheter
T-Piece
Oxygen
C.T. Scan
T.C.D.
D.P.L.
T.V.P.
ULTRASOUND
Thoracotomy
Cyclos
Cut-Down
Ba. Swallow
Angiogram
E.C.G.
C.V.P.
DRUGS
BLOOD PRODUCTS
Disposal
Assaulted - Headinjury
Motorbike accident
Headinjury
Stabbed back
Assaulted - Headinjury
MVA Polytrauma
MVA Polytrauma
18W Head
STAB Neck
STABBED HEAD
HEADINJURY
Lodox
Domicum 5mg
Diclofenac
Morphine
Sedation
9638920
9629762
RIP
SAP Malware
AFB BAL
after amp

TRAUMABANK DATA COLLECTION FORM

www.verticalapps.co.za

DEMOGRAPHICS/ STICKER	Arrival date:	Hospital number:	Gender: Male / Female
	First Name:	Surname:	Age:
	Race: Black / White / Asian / Coloured	Residential Suburb:	

INCIDENT	
Incident Date:	Blunt / Penetrating / Burn / Medical / Other:
Incident Time:	How it happened: Stab / GSW - handgun, rifle, shotgun, AK47 / Hijacking / Assault / MVA / Taxi - driver, passenger, restrained, unrestrained / PVA / MBA / Bicycle / Train / Fall - from height, same level / Burn - fire, water, steam, petrol / Animal / Other:
Where it happened (suburb):	
Accidental / Self-harm / Assault: stranger / aquantance / family / intimate partner / child abuse / elder abuse / rape	
Site: road / home / work / recreation / tavern / prison / education / other:	

PRE-HOSPITAL	Doctor present on scene YES / NO	Crew: BLS / ILS / ALS	
Ambulance number:	EMS Service:	Helicopter used: YES / NO	Airlifted from:
Dispatch time:	Scene arrival time:	Scene departure time:	Hospital arrival time:
***Initial* scene vitals:**			**Sats:**
***Pulse*:**	Patient's own ***respiration*** rate:	Assisted ***ventilation*** rate:	**BP:**
GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor:1 2 3 4 5 6	*Initial* scene GCS:
Pre-hospital intervention:	***IV:*** 1 line / 2 lines	***Drugs:*** Nil / Tramal / Morphine / Dormicum / Scoline / Pavulon / Other:	***Other:*** Nil / Collar Board / Scoop / CPR / Defib / Trac 3 / Splint / Other:
Airway: Nil / O2 Mask / Oral Airway / Bag valve mask / Oral ETT / Nasal ETT / Cric / Other:	***Size:*** Ringers / Colloid I Other:		
Size:	Amount infused: ml	Dose:	

REFERRING HOSPITAL			
Transferred: YES / NO	Referring Hospital:		Arranged: YES / NO
Vitals on *arrival* at *Referring Hospital*:			
Pulse:	Patient's own ***respiration*** rate:	Assisted ***ventilation*** rate:	**BP:**
GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor:1 2 3 4 5 6	GCS at other hospital:
Referring Hospital Intervention:		Drugs:	Diagnostic Procedures:
Airway:	IV:		

EMERGENCY UNIT ADMISSION AND RESUS TEAM			
Emergency Unit arrival time:	Primary survey complete:	Arrived from: Scene / Referring Hospital / Home	Transport: Ambulance BLS / ILS / ALS / Helicopter / Police / Private Vehicle / Walk / Other:
Resus Team *activation* time:	Secondary survey complete:		
Consultant:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Registrar:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Doctor 1:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Doctor 2:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Sister 1:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Sister 2:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Neurosurgeon:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Orthopaedics:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Paeds:		Time present:	Telephonic / OT / Other Resus / Absent / Not called
Other:		Time present:	Telephonic / OT / Other Resus / Absent / Not called

EMERGENCY UNIT DATA

Initial Emergency Unit vitals, Assessment and IV Fluids / Drugs Administered:

Pulse:	Patient's own ***respiration*** rate:	Assisted ***ventilation*** rate:	BP:
Temperature:	GCS Eyes: 1 2 3 4	GCS Verbal: 1 2 3 4 5	GCS Motor: 1 2 3 4 5 6

Comorbidity: Asthmatic / Diabetic / Epileptic / Pregnant / Anticoagulants / Hypothermic / Hypertensive / Contact lenses / Other:

Allergies:	Meds:	PMS Hx:	Last Meal:

Airway: O2 Mask % / Oral Airway / Bag Valve Mask / Oral ETT, size / Nasal ETT, size / Cric / Nil

IV Lines: 8.5Fr / 8.5FR / 14G / 14G / 16G / 16G / Other: Subclavain/Femoral/Jugular

IV: Crystalliod: ml	Colloid: ml	Blood ordered:	FFP ordered:
		Blood given:	FFP given:
Drugs: Analgesia: Nil / Morphine / Other:	Sedation: Nil / Dormicum / Hypnomidate / Other:	Paralysis: Nil / Scoline / Pavulon / Other:	Antibiotics:

Cardiac: Nil / Adrenaline / Atropine / Anti-arrythmics / Other: Tet tox

Emergency Unit Procedures:

Intubation: Yes / No	Cric / Trachy: Yes / No	ICD L : Yes / No; X 1 / X 2	ICD R: Yes / No; X 1 / X 2
Peripheral line: L X	Peripheral line: R X	Central line: L X	Central line: R X
Suturing: Yes / No	Fasciotomy: Yes / No	E R Thorocotomy: Yes / No	Bronchoscopy: Yes / No
Dressing: Yes / No	Urinary catheter: Yes / No	NG / OG tube: Yes / No	Eye care: Yes / No

Other: Nil / CPR / Defib / Trac 3 / Pelvic sheet / Bair Hugger / Other:

Diagnostic Procedures and Findings:

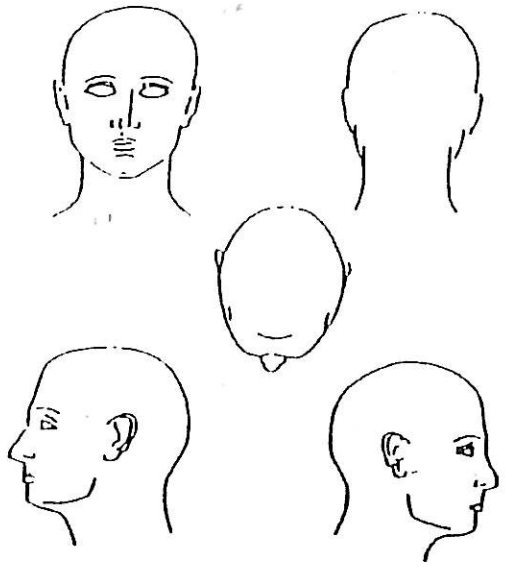
X-Ray C-Spine:		IVP: Yes / No	Positive / Negative
X-Ray Chest:		CT Abdo: Yes / No	Positive / Negative
X-Ray Pelvis:		CT Chest: Yes / No	Positive / Negative
X-Ray		CT Head: Yes / No	Positive / Negative
X-Ray		CT Spine: Yes / No	Positive / Negative
X-Ray		Dopplers: LEGS / ARMS	L = R =
Ultrasound Abdo: Yes / No	Positive / Negative	ECG: Yes / No	Abnormal / Normal
DPL Open/Closed: Yes / No	Positive / Negative	Trop T levels: Yes / No	Elevated / Normal
Angiogram: Yes / No	Positive / Negative	Other:	Positive / Negative

INJURY LIST / DIAGNOSIS:

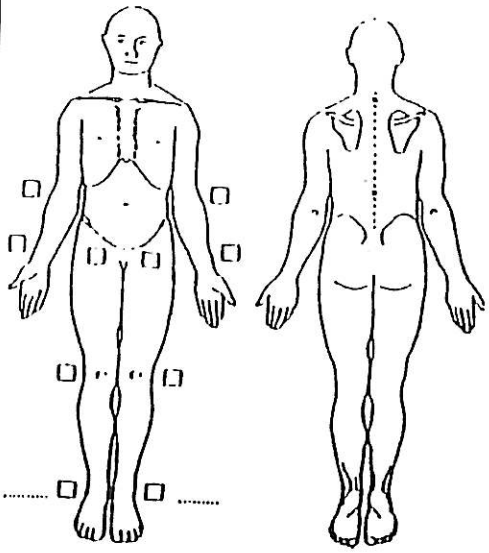
HEAD:	FACE:
NECK: Carotid Pulses present: L Y / N; R Y / N Trachea central: YES / NO Neck Veins distended: YES / NO	THORAX: Flail: YES / NO Open chest: YES / NO Pneumothorax: YES / NO L / R Haemothorax: YES / NO L / R Haemo-pneumo: YES / NO L / R
ABDO & PELVIC CONTENTS: Rectal:	SPINE:
UPPER EXTREMITIES: Pulses present? Brachial: L YES / NO; R YES / NO Radial: L YES / NO; R YES / NO	LOWER EXTREMITIES: Pulses present? Femoral: L Y / N; R Y / N Popliteal: L Y / N; R Y / N Distal: L Y / N; R Y / N

EXTERNAL: Abrasions / Contusions / Lacerations / Burns

HEAD AND NECK INJURIES:



SYSTEMIC INJURIES:



Contact lenses: YES / NO

Pulses present? Record Doppler pressures

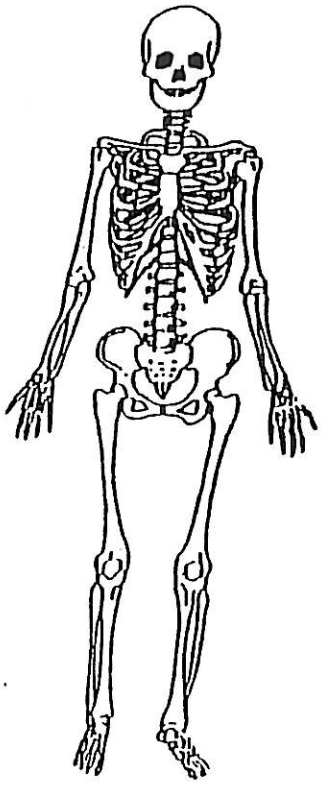
CENTRAL NERVOUS SYSTEM:

Pupils:			**Reflexes:**	L	R
Size	L:	R:	Biceps:		
React to light	L:	R:	Triceps:		
Consensual:			Patella:		
Fundi:			Ankle:		
Power:	L	R	Babinski:		
Arm flexion			OTHER:		
Arm extension			Blood sugar:		
Leg flexion			Urine dipstick:		
Leg extension			Clearview preg test:		
Sensation:			NG Aspirate:		
			CVP:		

Bloods sent: FBC / U&E / COMPAT
PI/PTT / GLUC / TOX / HCT / HIV / CE

	ABG:	ABG:	VBG:
TIME:			
Temp:			
PH:			
PO2:			
PCO2:			
Sats:			
SBE:			
HCO3:			
Hct:			
Hb:			
Na:			
K:			
LACTATE:			

SKELETAL INJURIES:



EMERGENCY UNIT DISCHARGE:

Emergency Unit discharge date:

Emergency Unit discharge time:

Emergency Unit disposition: Ward / ICU / Theatre / Theatre - Ward / Theatre - ICU / Home / DIC / DOT /
T/F to: Hospital

Admitting Discipline: Trauma / Neuro / Ortho / MaxFac / Other:

Ward:

Emergency Unit Doctor ATLS trained: YES / NO

Name: Signature:

Nurse team leader

Name:

Form checked by:

TraumaBank Theatre Form

Surgeon: _____
Assistant: _____
Anaesthetist: _____

PT DETAILS/STICKER
Hospital no: _____
First Name: _____
Surname: _____

Date:	
Start time:	**End time:**

SURGICAL COMMENT:

Incision:

Findings:	Findings:	Procedure done:
Organ:	Grade of Injury:	

Decision for Damage Control:

Bleeding	Physiological	Contamination	Unknown

Closure:

Packed: YES/NO	Large Abdo Swabs: X	Vascular Swabs: X	Abdo: Open	Abdo: Closed

Drain:

Plan:

FLUIDS DURING SURGERY:

Coagulopathic: YES/NO/UNKNOWN	Crystalloid type: Amount: ml	Colloid type: Amount ml
Blood: units	FFP: units	Platelets: units
Cell saved: YES / NO	Amount:	

METABOLIC STATUS:

Temperature:	Lactate:	pH:
Hb:	HCO3:	Base Deficit:

Patient's Disposition (sent to):

TraumaBank ICU Data

Single ICU Patient Daily Follow-up Form:

Patient Sticker/ **Name:** **Hospital Number:**	Date: _____ Doctor: _____

Procedures:

Date: Time:	Theatre: YES/NO	Surgeon:	Units blood used:
What:			

Complications:

What:	Comments:

Sofa Scoring: **Please note: all 6 fields are required to calculate a SOFA score**

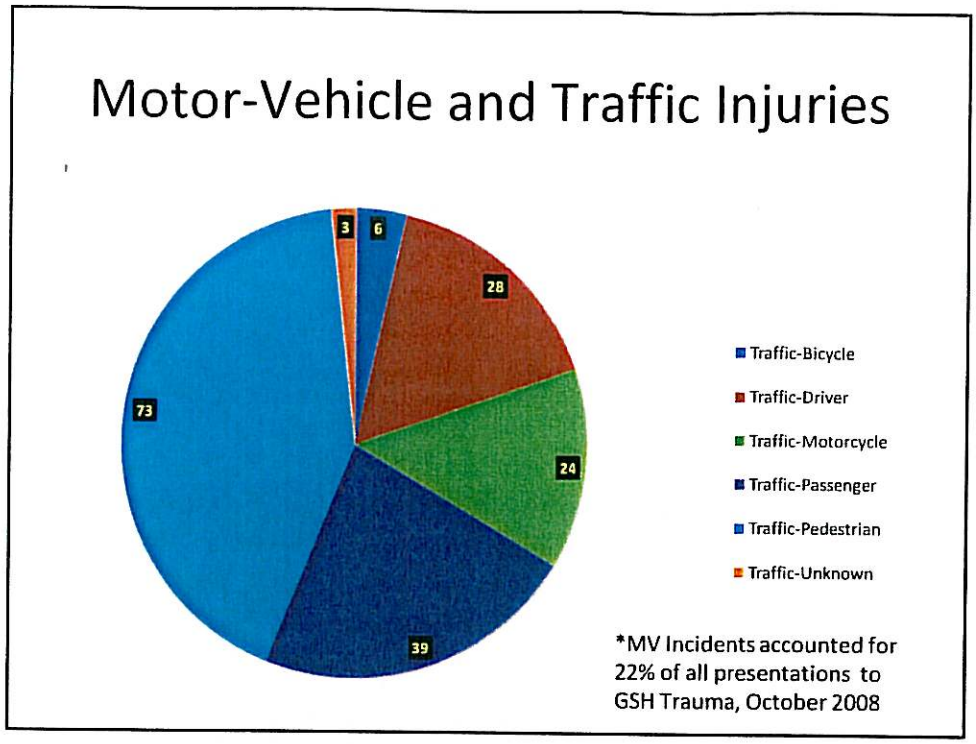
RESPIRATION (PaO2/Fio2): > = 400mmHg <400mmHg + - Resp Support <300mmHg + - Resp Support <200 and Resp Support <100 and Resp Support	**COAGULATION (Platelets):** >150 platelets <150 platelets <100 platelets <50 platelets <20 platelets	**CARDIOVASCULAR (BP):** MAP > 70mmHg MAP < 70mmHg Dopamine/Dobutrex < = 5mics Dopa > 5 or Adrenaline < = 0.1 Dopa > 15 or Adrenaline > 0.1
GCS:	**LIVER (bilirubin mmol/l):**	**RENAL (creatinine mmol/l):** <100mmol/l 100-170mmol/l 171-299mmol/l 300-400 or <500mls urine/day >400 or <200mls urine/day

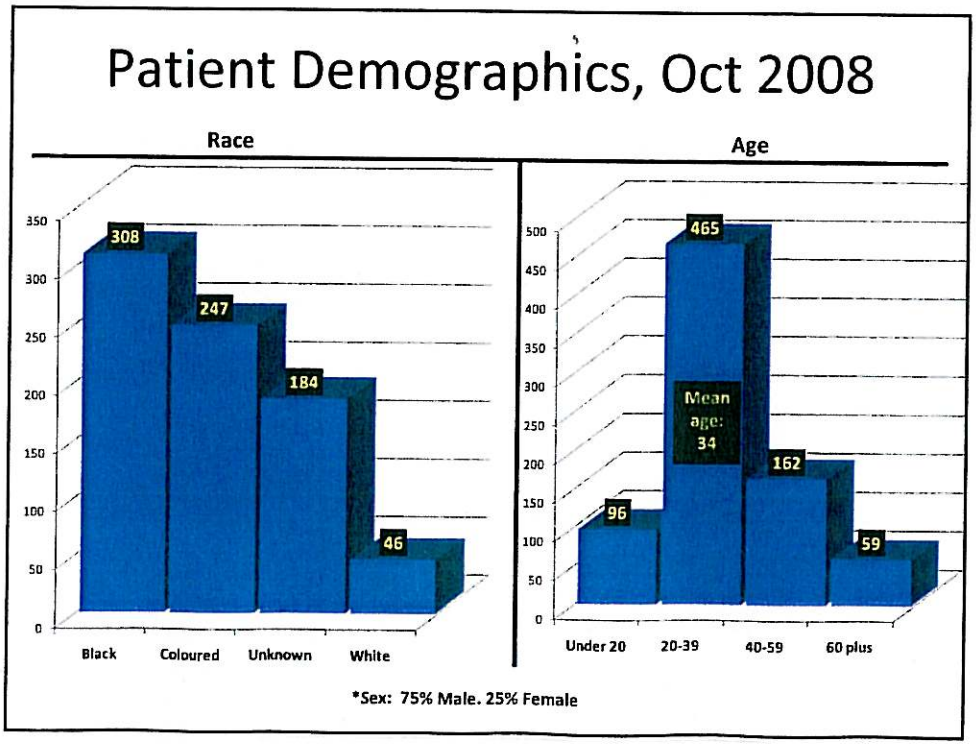
Daily Info:

Ventilated: YES / NO	**Mode of ventilation:** Invasive (tube) / CPAP/ Non Invasive (mask)	**Inotropes:** YES / NO	**Dialysis:** YES / NO
Enteral Nutrition: Complete (no TPN) Supplemental Nil (only TPN) Nil (no TPN)	**Bloods:** **HDL Cholesterol:** mmol/l **IL6:** pictogram/ml **Serum Magnesium:** mmol/l	**Comments:**	

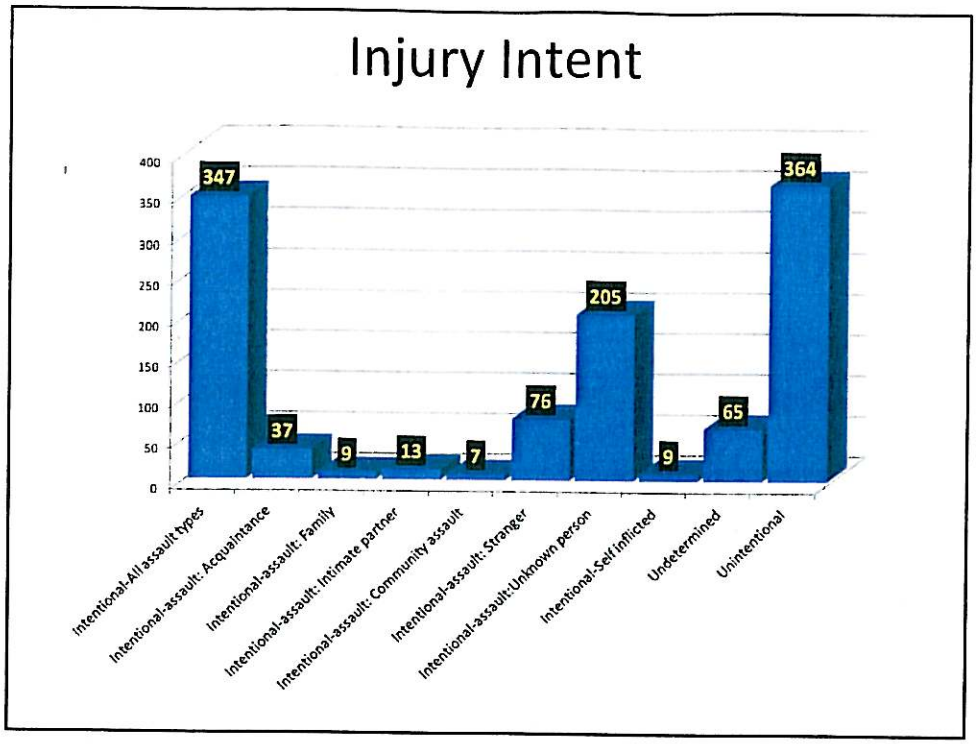
ICU Discharge:

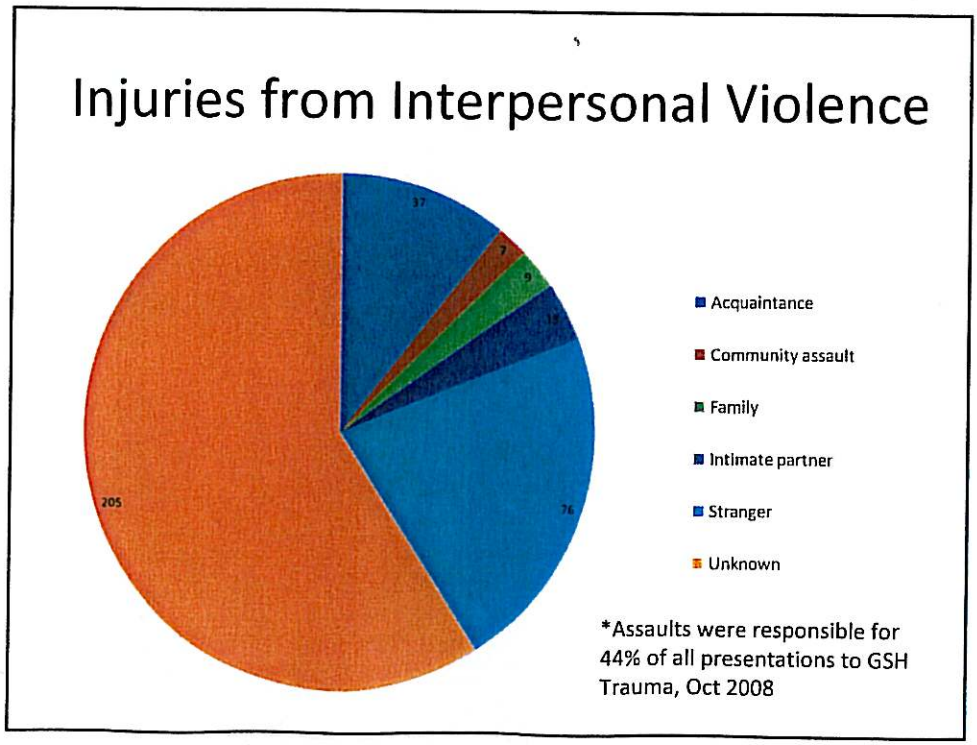
Date:	Patient sent to:



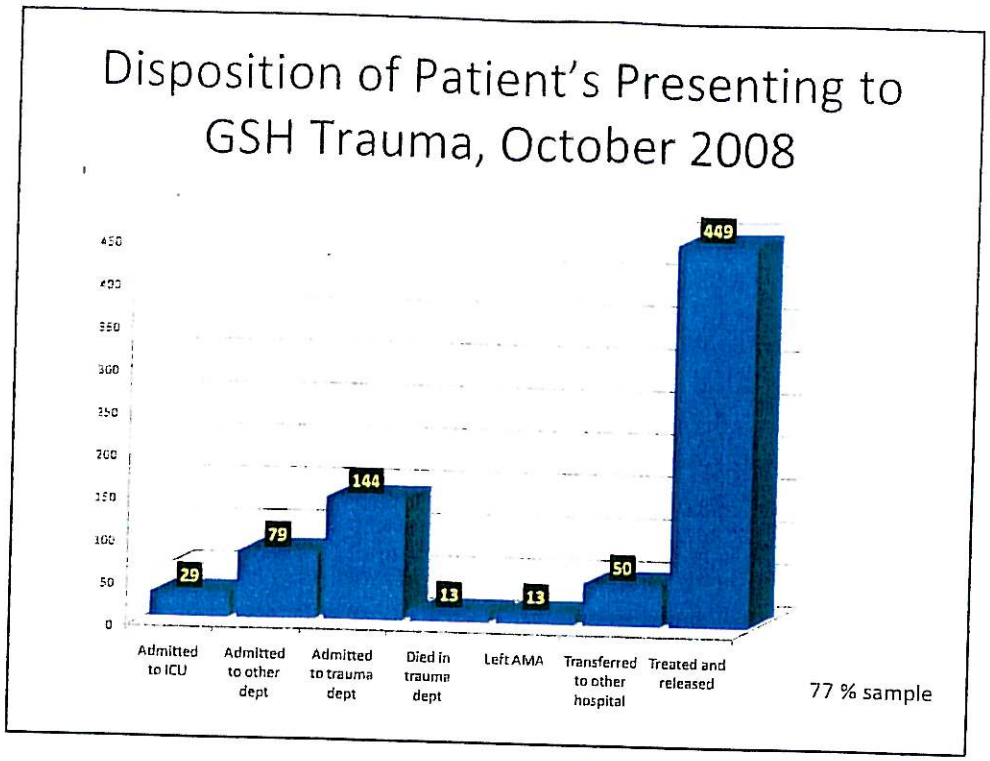


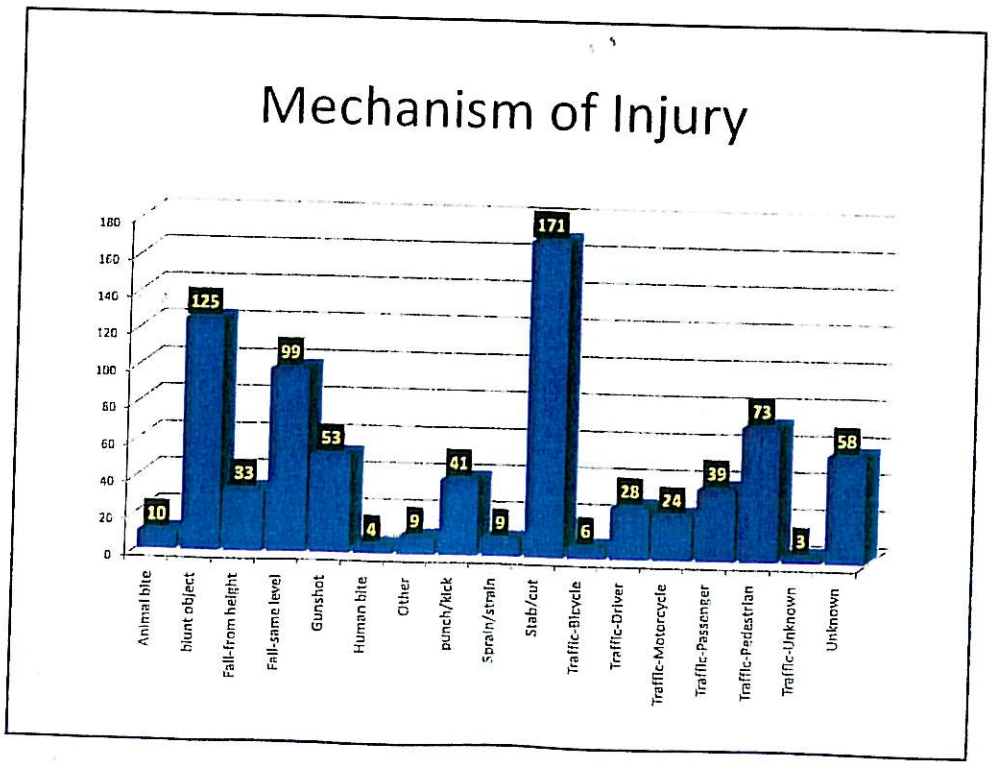
GSH TC October '08: Total patients, examples of graphs, TraumaBank (Cinnamon 2008)



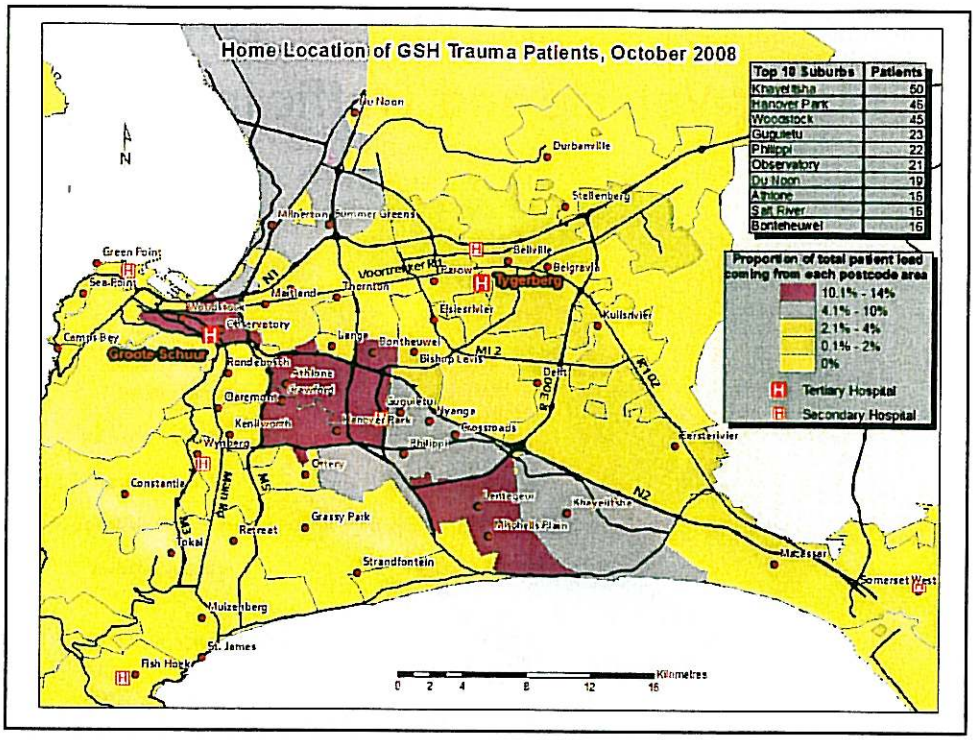


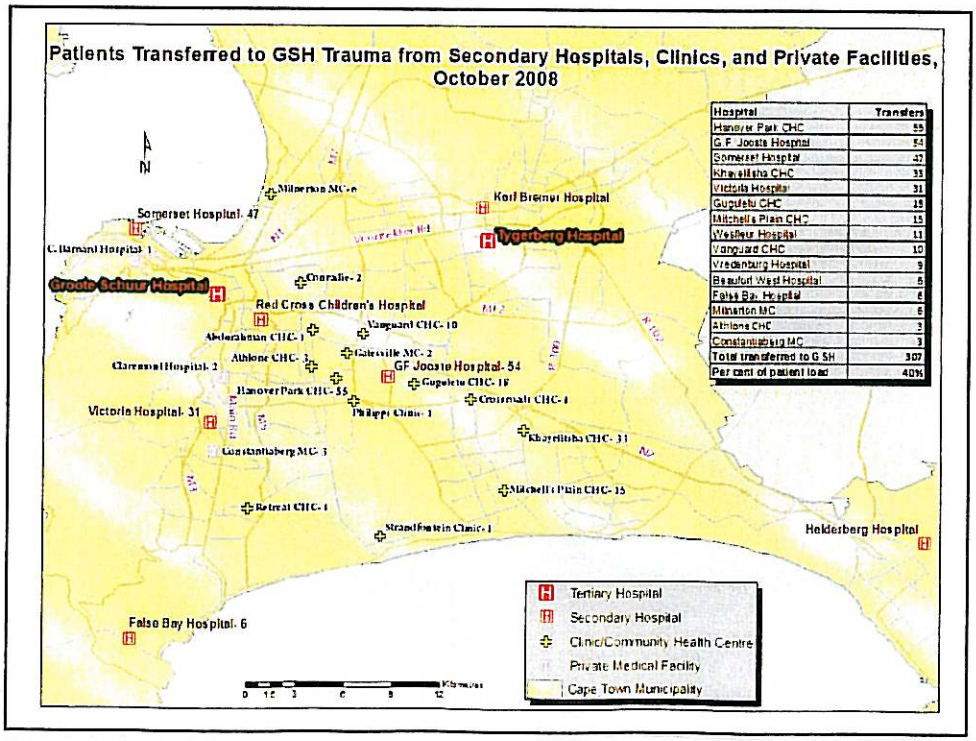
GSH TC October '08: Total patients, examples of graphs, TraumaBank (Cinnamon 2008)





GSH TC October '08: Total patients, examples of graphs, TraumaBank (Cinnamon 2008)





GSH TC October '08: Total patients, examples of graphs, TraumaBank (Cinnamon 2008)

ADULT TRIAGE SCORE							© South African Triage Group 2008
	3	2	1	0	1	2	3	
Mobility				Walking	With Help	Stretcher/ Immobile		Mobility
RR		less than 9		9-14	15-20	21-29	more than 29	RR
HR		less than 41	41-50	51-100	101-110	111-129	more than 129	HR
SBP	less than 71	71–80	81-100	101-199		more than 199		SBP
Temp		Cold OR Under 35		35-38.4		Hot OR Over 38.4		Temp
AVPU		Confused		Alert	Reacts to Voice	Reacts to Pain	Unresponsive	AVPU
Trauma				No	Yes			Trauma
over 12 years / taller than 150cm								

Colour	RED	ORANGE	YELLOW	GREEN	BLUE
TEWS	7 or more	5-6	3-4	0-2	DEAD
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins	DEAD
Mechanism of injury		High energy transfer			
Presentation		Shortness of breath - acute		ALL OTHER PATIENTS	
		Coughing blood			
		Chest pain			
		Haemorrhage - uncontrolled	Haemorrhage - controlled		
	Seizure - current	Seizure - post ictal			
		Focal neurology - acute			
		Level of consciousness reduced			
		Psychosis / Aggression			
		Threatened limb			
		Dislocation - other joint	Dislocation - finger or toe		
		Fracture - compound	Fracture - closed		
	Burn – face / inhalation	Burn over 20%	Burn - other		
		Burn - electrical			
		Burn - circumferential			
		Burn - chemical			
		Poisoning / Overdose	Abdominal pain		
	Hypoglycaemia - glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)		
		Vomiting - fresh blood	Vomiting - persistent		
		Pregnancy & abdominal trauma or pain	Pregnancy & trauma		
			Pregnancy & PV bleed		
Pain		Severe	Moderate	Mild	
	Senior Healthcare Professional's Discretion				

Adult Triage Score Calculator (South African Triage Group 2008)