INJURY SURVEY AT CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL, SOWETO, SOUTH AFRICA

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DECLARATION

I, Dr Nazia Khan (student number 348939), hereby declare that the work on which this research report is based, is my own original work.

It is being submitted for the degree of Master of Science in dentistry at the University of the Witwatersrand, Johannesburg.

Neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other University.

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ABSTRACT

Introduction

In 2007, South Africa was listed as one of the most violent countries in the world, with more than 30 000 trauma-related deaths recorded annually. The aim of the study was to determine the profile and nature of injuries sustained by patients attending the trauma unit at the Chris Hani Baragwanath Hospital (CHBAH) over a three-month period 1st September -31th October 2017.

Methods

A cross-sectional study using record review was performed.

Results

A total of 5371 patients were admitted to the trauma unit. Male to female ratio of 2:1 was recorded. Only 22.69% reported that they were employed. The median age was 28 years (interquartile range 14-40 years). The predominant mechanism of injury was due to falls (32.37%), followed by assault (27.44%). The males were more likely to suffer any form of injury compared to females ($p<0.05$). The incidence of injuries due to falls showed the least difference between sexes with 58% in male compared to 42% in females. Assault injuries were 4.23 times more likely to result in head and neck injuries compared to any other mechanism of injury (OR:4.23, CI 3.52-5.08, $p <0.00$). Upon initial admission to the unit, 43.04% of patients were discharged home after initial treatment, while 41.54% were transferred to the orthopedic unit and nearly none (0. 15%) were referred to the maxillofacial unit.

Conclusion

Sex, employment status, age and area of residence influence the pattern of traumatic injuries. Falls injuries and assault were the predominant mechanisms of injury. Males were more likely to suffer from any form of injury than females. Assault injuries were more than four times more likely to result in head and neck injuries than any other mechanism of injury. Therefore, ongoing surveillance and education campaigns are recommended.

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LIST OF ABBREVIATIONS

ATLS:	Advanced Trauma and Life Support
BoD:	Burden of Disease
CDC:	Centre for Disease Control
CHBAH:	Chris Hani Baragwanath Academic Hospital
CHC:	Community Health Centre
CMJAH:	Charlotte Maxeke Johannesburg Academic Hospital
COHSASA:	Council of Health Service Accreditation of South Africa
DTR:	Denmark Trauma Registry
EMS:	Emergency Medical Services
HEMR:	Hybrid Electronic Medical Registry
HREC:	Human Research Ethics Committee
IPV:	Inter Personal Violence
ISS:	Injury Severity Score
MOI:	Mechanism of Injury
NEISS:	National Electronic Injury Surveillance System
RHT:	Refusal of Hospital Treatment
RTI:	Road Traffic Incidents
RTS:	Revised Trauma Score
SA:	South Africa

SANTR:	South African National Trauma Registry
SATS:	South African Triage Score
TRISS:	Trauma Revised Injury Severity Score
TSSA:	Trauma Society of South Africa
USA:	United States of America
WHO:	World Health 0rganisation
WITS:	University of the Witwatersrand

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DEFINITION OF TERMS

Injury is defined as a wound or trauma; harm or hurt; usually applied to damage inflicted on the body by an external force (1).

Surveillance refers to 'on-going systematic collection analysis interpretation and dissemination' according to the World Health Organisation (WHO), whilst *survey* is defined as a once-off event (2).

Trauma injury is defined by the University of Florida Health Encyclopedia as physical injuries of a sudden onset and severity requiring immediate attention (3).

The *Trauma Revised Injury Surveillance Score* (TRISS) is used to assess the severity of injuries as it gives a physiologic and anatomical index of injury severity based on the following:

1) Injury Severity Score (ISS), 2) the Revised Trauma Score (RTS), 3) patient age, and 4) nature of injury i.e. blunt or penetrating.

Combining these four parameters, the TRISS method is useful in quantifying the probability of survival and to evaluate the outcomes of trauma care (4).

In South Africa, the terms township and location usually refer to the often underdeveloped racially segregated urban areas that, from the late 19th century until the end of apartheid, were reserved for non-whites, namely Indians, Africans and Coloureds (5).

CHAPTER 1: INTRODUCTION

OVERVIEW OF INJURIES

Injuries constitute a major public health problem and are a leading cause of years of potential life loss in both developed and developing countries (6). According to the World Health Organisation (WHO), individuals die every five seconds due to injuries. Daily the lives of more than 154 000 people are lost as a result of injuries. Traumatic injuries may be intentional such as those resulting from blunt, penetrating objects used in interpersonal conflicts or even acts of self-harm. Alternatively they may be unintentional, such as those sustained in motor vehicle accidents (2). Among the causes of injury are acts of violence (either against others or oneself), road traffic accidents, burns, drowning, falls and poisonings. More than 5 million people of all ages and economic groups die every year from unintentional injuries and violence (7). Globally, motor vehicle accidents (MVA) alone account for more than 1 million deaths annually and are estimated to contribute to 20-50 million significant injuries. MVA constitute the leading cause of death due to injury worldwide and account for more than 90% of accidents in the developing world (7). Injury is a disease; it has a host (the patient) and a vector of transmission (e.g. motor vehicle, firearm etc.), and the environment where it occurs (7).

Interpersonal violence (IPV) is the most common cause of traumatic injuries in South Africa (8). In 2007, South Africa (SA) was listed as one of the most violent countries in the world. The homicide rate was nine times more than the global rate in males aged 15-29. The trauma burden in SA is significant as the country experiences over 30 000 trauma-related deaths annually (9). This figure is almost two-thirds of the 46 000 annual trauma fatalities recorded for the whole of Europe (10). The South African surveillance studies revealed that males were more likely to sustain trauma-related injuries than females, and that assault and other acts of violence such as stab wounds were the highest mechanism of injury in the country, followed by road traffic related injuries. Injuries resulting from burns, gunshot wounds and falls also played a major role in patients attending trauma care centers around the country (4, 8, 11, 12).

In South Africa, a homicide rate seven times the global rate was recorded among females aged 30-44. Homicide rates for children under five were equally high for girls and boys – more than double the global average (13). The extremities (i.e. upper and lower limbs) were most commonly affected, followed by the head and neck (4, 8, 12).

MANAGEMENT OF TRAUMATIC INJURIES

Most traumatic injuries are referred to trauma units or hospitals where resuscitation and other forms of surgical and non-surgical emergency treatment are provided (13). A trauma system includes optimal multidisciplinary management during all phases of the injury. While treatment is being rendered, the ultimate objective of which unit members are cognisant is to reduce injury-related morbidity, mortality and years of life lost (8). More severe and multiple traumatic injuries should be immediately transported to regional level-one trauma centers as they provide the requisite comprehensive multi-disciplinary care with optimal resources and capabilities (3). Unless properly managed, a traumatic injury may result in systemic shock called “shock trauma” that may require immediate resuscitation and urgent and immediate inventions to save a life or limb (3).

The first 60 minutes after the occurrence of a major multi-system trauma, commonly known as the “Golden Hour”, are critical (2). Many changes regarding training and Advanced Trauma and Life Support (ATLS) have improved care and outcomes for injured patients. Improvements in traumatic injury control efforts are still necessary in most developed countries where traumatic injury remains the leading cause of death in persons from 1 to 44 years of age (13).

SURVEILLANCE SYSTEMS

According to the WHO, surveillance systems are important for on-going monitoring (2). Surveillance systems are monitoring tools that provide policy makers and public health practitioners with the necessary information for injury control.

Internationally, ongoing established electronic injury surveillance systems include the National Electronic Injury Surveillance System (NEISS) and the Denmark Trauma Registry (DTR) (14, 15). According to Mackenzie and Pless, surveillance is held as a key element in developing effective injury surveillance programs (16). Conducting such research in emergency rooms provides better estimates of the magnitude of the injury problem than mortality data alone. Furthermore, surveillance provides early warning of new hazards useful for program evaluation (16).

CHAPTER 2: LITERATURE REVIEW

Epidemiological studies in developed countries have reported on the causes and strategies for prevention of traumatic injuries. Road traffic accidents are a relevant growing concern to public health authorities world-wide; they contribute significantly to the global burden of disease (BoD) (17). South Africa is experiencing a quadruple BoD comprising the HIV/Aids epidemic, infectious diseases, emerging chronic conditions and injuries resulting from violence, road traffic accidents and other trauma (18). It is essential for South Africa to conduct surveillance so that appropriate interventions to reduce BoD are identified (17). Surveillance systems are necessary to enable the control and prevention of the BoD, instead of reactive responses to problems within the health systems (19).

SURVEILLANCE SYSTEMS

Several countries have well-established ongoing electronic injury surveillance systems as part of monitoring and evaluation processes such as the NEISS and the DTR (14, 15). There is an increase in the importance of health information systems and the role of mortality statistics in the monitoring of public health. Monitoring and evaluation contribute to developing public health policies and resource allocation (20). More than three decades ago, Eastman et al reported the importance of establishing and maintaining trauma registries presented as data bases that contain information on patients' trauma (8). Data bases allow for *continuous* monitoring of trauma care.

In the USA, NEISS maintains the traumatic injury registry in hospital emergency departments. A study conducted by Jackson et al to analyze non-fatal occupational injuries, emphasized that surveillance allows for intervention strategies to be developed and helps to assess the success of prevention efforts (14).

Another study by Inchikawa and Nakahara conducted on a survey of 224 Japanese university hospitals, reported that of the 84 university hospitals, 47 reported the use of computerized trauma registers. However, 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 (20).

Injury surveillance programs in the developing world are less common (21). Concerted effort and regular follow up is required as seen in the South African studies (4,8,11,12). From the existing surveillance programs in developing countries, trauma registries are generally not well established; they are mostly basic and incomplete. However, developing countries worldwide are making attempts to improve their data collection, allowing for the evaluation of patient outcomes and inter-hospital comparisons (8).

During an injury surveillance program conducted by Jayram and colleagues at health institutions in a rural district in India, of 2146 injuries analysed, road traffic injuries constituted more than 50% of all traumatic injuries. The second biggest cause of injury was assault at 20%, followed by poisoning at 12 % (21).

Zargar et al. investigated the characteristics and outcomes of urban injuries. Three different emergency departments were analysed over a one-year period, revealing that employed patients were the most vulnerable group and that special preventative measures should be targeted at them. Unsatisfactory trauma care resulted from inadequate usage of ambulance services, increased time of transport from injury to hospital, frequent referrals between centers, and delayed or inadequate resuscitation by emergency medical services. The study suggested that an integrated trauma system be established in order to improve the quality of trauma care (22).

In 2007, a multi- national injury surveillance project was conducted across five African countries over a six-month period. Results showed that the recording of the proposed monthly evaluation of the electronic surveillance system had difficulties due to difficulties in internet access as well as the distance between the coordinating centers and participating hospitals. Furthermore, administrative delays prevented the uniform start of the project. Ultimately the results of the study demonstrated how limited epidemiological information routinely written in medical records were compared to the injury surveillance system. (23)

In South Africa, the South African National Trauma Registry (SANTR) has developed a medium to collect and store data related to trauma patients (8). The SANTR is used to calculate trauma scores. This registry was created using guidelines from the WHO and other internationally recognized and standardized systems.

Datasets collected included patient demographics, 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 (8).

The private sector has augmented the SANTR as MediBank and it is successfully implemented as is the case at Milpark Hospital in Johannesburg (24). The public sector, however, as evident at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and Chris Hani Baragwanath Academic Hospital (CHBAH), continue to manually enter data in record books. Thus, the implementation of the SANTR is still lacking at public sector hospitals in Johannesburg.

In Cape Town, South Africa, a study done by Nicol et al. attempted to implement and use an electronic data base. Over a one year period at Groote Schuur Hospital Traum Unit, 9 236 patients were recorded. Results revealed that the trauma unit was presented with mostly males (71.3%) and inter personal violence was shown to be the most common mechanism of injury (71.6%) (11).

In a study by Donovan et al. Grey's Hospital in the Kwa- Zulu Natal Province, South Africa, used a Hybrid Electronic Medical Registry (HEMR) that allowed benchmarking of quality of trauma care. Over the 5 year study period 8 722 patients were admitted to their trauma unit and their records were easily accessed from the system. In order for the HEMR to run effectively, staff attended monthly workshops consisting of extemsive quality control programmes (25).

TRIAGE

Triage is defined as the process of sorting patients according to the urgency of their need for care (26). It was practiced by the Roman military and the chief surgeon of Napoleon Bonaparte for the speedy treatment of battlefield trauma victims. The French surgeon Baron Jean Larrey prioritized medical care on Napoleon's battlefields by sorting patients according to their possibility of survival to return to the battlefield, rather than by rank (27). Hoyt and Coimbra 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 (28).

It is postulated 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. A triage system is needed in order to classify casualties by the number and severity of injuries, ideally within a maximum of 5 minutes (11). Thus, the South African Triage Scale (SATS) (Appendix 1), has been in use since 2007 (29). The SATS has been shown to reduce mortality and morbidity. The triage scale is practical, user friendly, reliable and accurate (30). The SATS assigns a colour according to the level of priority of the traumatic injury as follows: (i) Red – immediate priority (resuscitation cases), (ii) Orange – very urgent priority (potentially life- or limb-threatening cases), (iii) Yellow – urgent priority (significant pathology), (iv) Green – delayed priority (minor injuries or illness), and (v) Blue – deceased (8).

PATTERN AND THE CAUSES OF TRAUMATIC INJURIES

A year-long study at a single pediatric centre in India by Sharma et al. showed a male to female trauma ratio of 9:1. Falls represented the highest mode of injury (39.4%) followed by road traffic injury and then burns. Home was the place where most unintentional traumatic injuries occurred. The authors concluded that knowledge of the epidemiology of pediatric trauma would render the majority of the injuries preventable and that trends for children differ from those in adults. The difference in trends was postulated to be due to delayed presentation at the tertiary institute (either by referral or direct admission), or, probably, lack of knowledge and low literacy levels among the parents of these children. Thus, prevention strategies should be made on the basis of epidemiologic trends (31).

Burns remain common in the pediatric population, particularly in the lower socio-economic groups, with major burns proving fatal. Pediatric burns represent a unique form of trauma requiring an experienced, multi-disciplined team for optimal outcomes. First aid is critical for the burns patient; however, it appears to be frequently under-used despite laboratory and clinical evidence of its efficiency (32). When taking into account burn-related injuries, the upper extremities were the most frequently burnt body region, followed by the lower extremities. Most burns reportedly occurred during the late morning and evening, around supper time when food is being prepared, cooked and served (33).

Studies conducted in developing countries have demonstrated that more than 50% of burns occur in the 0-4 years age group. The high prevalence of burns in infants and toddlers was attributed largely to their total dependence on caregivers and parents (34). The majority (>50%) of burns were reported as unintentional. A few cases of self-inflicted burns and burns caused by assault and maltreatment were also reported (34).

In their study carried out at the Nelson Mandela Academic Hospital in Mthatha, South Africa, Dhaffala et al reported a 5:1 male to female ratio among injured patients. The leading cause of injury in 60% of cases was interpersonal violence (IPV). Motor vehicle accidents accounted for 19%, of which 38% were caused by poor visibility, speeding and fatigue (12). Bruce et al also showed assault or IPV to be the major cause of injury in 70% of cases attending the trauma unit at CMJAH, formerly known as Johannesburg General Hospital (4). This figure was similar to the Nicol et al. study in Cape town, South Africa, where IPV accounted for 71.6% of admissions (11).

Road traffic injuries (RTI) are increasing at a fast rate in developing countries due to rapid motorization and other factors (35). High proportions of passenger injuries and fatalities are associated with the use of public transport, types and conditions of such vehicles, and the driving skill of their operators (36).

ANATOMICAL AREA OF TRAUMATIC INJURIES

Galano and colleagues reported that orthopaedic injuries were the most frequently reported injuries amongst the paediatric population in the USA. (37).The study emphasized that paediatric trauma remains the leading cause of morbidity and mortality among children and entails exorbitant costs. Among the 0-18 year age range, lower limb fractures were the most commonly reported hospitalized traumatic injury at 43.20%. The next most common traumatic injury humerus bone fracture at 17.0% (37).

Chalya et al. found that in Tanzania, the fact that the economically productive age group was most likely involved in injuries demanded an urgent public policy. Their study showed that musculoskeletal injuries of the extremities were the most common body injuries recorded,

accounting for 60.5%, followed by head injuries at 52.1% (38). Of the musculoskeletal injuries, the lower limb was the most common area injured. This accords with previous studies (3, 35).

In South Africa, surveillance studies have been conducted in Eastern Cape, Kwa-Zulu Natal, Johannesburg and the Western Cape (4, 11, 8, 12, 25). Most of these studies were in the form of audits.

Chowdhury et al. assessed the trauma system in Cape Town over a four-month period from December 2011 to March 2012, reporting that delay in moving between injury and theatre was a significant factor in the development of complications. Furthermore, the male to female injury ratio was recorded as 12:1. The median for age was 26 years. On arrival at a trauma centre, patients were triaged according to the SATS. Results showed that almost half (49%) of the patients had an ISS>50, and the rest had an ISS<15. Most commonly injured anatomical areas were the abdomen at 36.58%, the chest at 32.92%, and the neck at 20.12% (8).

Dhaffala et al. conducted their study in the Eastern Cape and reported that head and neck injuries accounted for 32%, musculoskeletal injuries 21%, abdominal injuries 19% and thoracic injuries 14%. The study concluded that the Eastern Cape Province in South Africa experiences a high incidence of injury and death rates among the injured (12).

Bruce et al conducted a similar study at CMAH, in Johannesburg (4). Patients attending the trauma casualty unit were analysed over a one-year period. Profiles of injuries sustained by the victims in the central Johannesburg region were documented creating a baseline for further comparisons. The TRISS method was used to describe injury severity. The study concluded that more than two thirds of the patients were in the 16-35 year age group. A 3:1 male to female ratio was calculated, showing that males are in a higher trauma risk category, particularly during their nocturnal activities at weekends. Injury to the limbs and head and neck were most common at 45.2% and 30% respectively. More than 60% of a random sample of 163 patients sustained serious injuries with an ISS between 16 and 75; the majority, however, had a survival probability greater than 50%. Patient outcomes revealed that 61.2% of patients injured had sustained injuries which warranted discharge and 31.4% were admitted (4).

RISK FACTORS ASSOCIATED WITH TRAUMATIC INJURIES

A high burden of injuries in South Africa was due to Road Traffic Injuries (RTI), excessive alcohol intake, substance abuse and Inter Personal Violence (IPV). The latter problem is increasingly seen as a public health priority (12). Unfortunately, funding and research to deal with this burden is lacking in comparison to allocations for malaria, TB, and HIV/AIDS (12).

Wadman et al noted that women who were killed because of injuries related to interpersonal violence (IPV) were likely to have used trauma services before. The failure of health care professionals to notice such occurrences represented a missed opportunity for proper intervention in situations that otherwise could have been prevented (39).

In their study, Wu et al. provided health care practitioners with additional information to help identify IPV patients presenting with physical injuries. Most patients reviewed reported that injury was due to assault by a spouse or intimate sexual partner. However, a victim's feeling of dependency on her partner, for example, may deter her from disclosing her status of being in an abusive relationship. Thus, she may tolerate escalating severities of abuse. Results showed that among females presenting to emergency room departments, unwitnessed head and neck or facial injuries were significant markers for IPV. Conversely, extremity injuries were less likely to have been the consequence of IPV (40).

IPV is a major international health concern. If the cause of injury isn't verified and multiple injuries are present, this is an indication for one to be suspicious of in practice (40).

The proliferation of firearms in SA is another factor contributing to IPV resulting in traumatic injuries. In 2001, the South African Police's Central Firearms Registry revealed that 3.5 million South Africans legally possess some 4.2 million firearms and estimated that about the same number at the time were circulating illegally (41). Furthermore, porous borders allow smugglers to bring large quantities of firearms into the country (42).

Crime doesn't affect all people uniformly. The likelihood of the average person falling victim to crime has a strong association, among other factors, with age, income, place of residence and circle of friends and acquaintances (43).

Individuals living in wealthy households have an increased risk of property crime but are less likely to be effected by violent crime. The opposite holds true for victims living in poorest households (41).

Research has shown that perpetrators of violent crime and assault are highly likely to be known by their victims (11). Weekends, beginning Fridays and ending Sundays, as well as weekends following pay-day (mid–month and end of the month), have shown more of an increase in assaults than other days of the week. This could possibly be attributed to the fact that acquaintances, family and friends come together over the weekends and holiday periods in the context of increased alcohol intake (41).

Ozler et al. examined crime and local inequalities in South Africa. At that time, crime in South Africa was amongst the highest in the world. The threat of crime diverts resources to protection efforts, escalates health costs and generally creates an environment unconducive to productive activity. People who perceive their poverty as a permanent condition are driven by hostile impulses rather than rational pursuits. Crime further drives the widespread emigration of South African professionals to reside in a safer environment (44).

A comparison of crimes rates in the Institute for Security Studies' paper "Crime in South Africa" showed Johannesburg to be the most affected city, followed by Pretoria, Cape Town and Durban (41). Violence weakens social controls, producing marginalized groups reliant on crime for a livelihood. A strong relationship between the youthful population and crime is probably the single most important fact about crime as it is committed mainly by teenagers and young adults (41).

Daisy and colleagues showed that risk factors associated with burns include overcrowding, a child not being the first born (33). Another important risk is also lack of parental supervision (45). Lack of water supply and low income are additional risks. An increase in maternal education and the presence of a living room area were proven to be protective factors for childhood burns (46).

A study by Parbhoo et al. concluded that in South Africa, most hospitalised patients hailed from informal settlements where home safety was a low priority.

Burn injuries were shown to be prevented by improving the home environment and socio-economic living conditions. This can be achieved through the health, social welfare, education and housing departments (46).

Regarding the prevention of burns, suggestions included an increased improvement in socio-economic status, parental education, improved housing, provision of basic needs such as safe water, proper storage of flammable substances, and adequate child supervision, in particular of children with impairments (46). Community programs educating mothers on risk factors and prevention were proposed as strategies for burns prevention (47).

The American Medical Association states that health providers who are likely to have the opportunity to detect abuse in the course of their work have an obligation to familiarise themselves with protocols for diagnosing and treating abuse (48).

CONSEQUENCES OF INJURY

According to the WHO report, *Injury and Violence: the Facts,* the ripple effect of injury-related costs on the financial and overall well-being of victims and their families is well documented. The report showed that more than 40 % of families of injury victims reported a decline in income. About 20 % were forced to borrow money and incur debt to pay for medical treatment. A quarter of the families said there was a decrease in food consumption as a result of injury (7).

Daffala et al. emphasised that injury is a well established public health problem and will surely be a serious threat to future generations world-wide. The study concluded that violence is a major cause of morbidity and mortality resulting in not only physical but also psychological trauma. It reinforced that the absence of a valid injury surveillance system is a source of concern in SA (12).

The economic impact of trauma injury was and continues to be responsible for uncalculated costs to the government. This is due to long hospital stays, the large number of occupational injuries giving rise to losses in productivity due to the lengthy absenteeism of employed patients (12).

RATIONALE FOR THE STUDY

The above review displayed that traumatic injuries are a public health problem globally and also locally. In SA, there exists a national trauma registry and is well utilized by private sector but the public sector institution such as Chris Hani Baragwanath Academic Hospital (CHBAH), continue to manually enter data in record books. It is essential for South Africa to conduct surveillance and analyse the injuries so that appropriate interventions and planning to reduce quadruple burden of disease where traumatic injuries contribute are initiated. To date, there remain a dearth of literature regarding the analysis of injury surveillance studies in South Africa, and CHBAH being the biggest hospital in Southern Africa, such a study has not been conducted. Therefore this study will add value and provide evidence to recommending ongoing surveillance at the tertiary center of care.

AIM

To determine the profile and nature of injuries sustained by patients attending the trauma unit at CHBAH, over a three-month period from 1st September till 31st October 2017.

OBJECTIVES

The objectives of determining the profile of injuries at the casualty department were:

1. To describe the socio-demographic profile of the patients seen at CHBAH trauma unit.
2. To assess the frequency, distribution and types of injuries.
3. To determine the severity of injuries on administration to the trauma unit, using Injury surveillance Score (ISS) and the Trauma Revised Injury Surveillance Score (TRISS).
4. To determine the patient outcomes after initial treatment/stabilization at the trauma unit.
5. To determine the factors associated with the traumatic injuries at the trauma unit.

CHAPTER 3: METHODOLOGY

STUDY DESIGN

A cross-sectional study was performed where patient records were reviewed prospectively and at the point of patient admission at the trauma unit.

STUDY SETTING

The study was conducted at the trauma unit of CHBAH. CHBAH is the largest hospital in Africa as well as a tertiary-level academic institution. The catchment population of the hospital is around 3 million people. It has more than 3200 beds and 6760 staff. Its facilities are housed in 429 buildings. Approximately 70% of all admissions are emergencies. Accident, emergency and ambulance are the busiest services, counting more than 350 patients daily (50).

The hospital serves not only townships in the South Johannesburg, the nearest districts but also serves as a referral for a large part of the country, including surrounding African states.

Furthermore, although the majority of patients seen at the hospital are not on any form of health insurance, a minority whose health insurance is unable to cover specialised costs are referred to CHBAH.

Upon arrival at CHBAH's trauma unit, patients were triaged according to the adult triage score (see Appendix 1). The majority of patients had been referred from the local satellite clinics or Community Health Centers for specialized tertiary treatment.

PROCESS OF ADMISSION TO CHBAH TRAUMA UNIT

Before patients are admitted to the trauma unit at CHBAH, they have to be triaged. The SATS is in use at CHBAH. However, when patients are brought by hospital ambulance or Emergency Medical Services (EMS), the vitals are recorded by the respective personnel; otherwise vitals are taken and recorded at the triage area just adjacent to the trauma unit. To prevent under-triage, a medical doctor is always on duty at the triage area, even though the nurses record the vitals, so that if an emergency occurs the doctor can intervene immediately.

Patients presenting to the trauma unit at CHBAH after referral by their local clinic classified as Priority 1 (P1) or Priority 2 (P2) category patients. Patient prioritisation is of utmost importance so that only patients with serious and life-threatening injuries are attended. Community health centers and local primary health care facilities should be well equipped to manage less seriously injured, Priority 3 (P3) category patients.

P1 corresponds with code Red, signifying "Emergency" and calling for immediate attention. P2 corresponds with code Yellow, signifying "Urgent" with a delay in care possible for a limited period of time without significant mortality. P3 corresponds with code Green, signifying, indicating "Non-Urgent". Red and Yellow patients are to be addressed first in that order (11).

The survival of injured patients can be further improved by means of the objective calculation of patients' injury severity (27). Categorization of injury severity is critical to the study of trauma. The Injury Severity Score (ISS) is the most used measure world-wide in trauma patients. It is a simple numeric method summarising multiple injuries by means of anatomical categorisation (28). Currently, it remains the gold standard of injury severity scoring (28). The scoring of ISS implies the following: 1-15 is minor injury; 16-24 is serious injury; 25-40 severe injury and 41-75 in critical injury. The Trauma Revised Injury Surveillance Score (TRISS) is used to assess the severity of injuries as it gives a physiological and anatomical index of injury severity based on the Injury Severity Score (ISS), the revised trauma score (RTS), patient age and nature of injury i.e. blunt or penetrating. Combining these four parameters, the TRISS method is useful in quantifying probability of survival and evaluating the outcomes of trauma care (4). Studies that have used the TRISS/ISS methods are discussed together with their findings further on in the literature review.

Quantifying injury severity is integral to the epidemiology of trauma and serves as a critical guide to appropriate resource allocation in trauma care (9).

STUDY POPULATION

The study population comprised the clinical records of patients seen at the CHBAH trauma unit from 31 July 2017 to 31 October 2017.

STUDY SAMPLE AND DATA COLLECTION

On average the trauma unit sees between 1 500 and 2000 patients per month, which translates to about 65 patients daily. The following records were excluded: patients who arrived as deceased; those patients seen to at the medical casualty department and those who were sent immediately to the resuscitation area. The total number of patient records accessed for the study was n=5371.

The data collection process occurred over a three-month period. During weekdays, all records of patients seen were included in the sample. Over weekends and public holidays, due to the large amount of patients attending, random patient reference numbers were selected. This was accomplished using a randomly generated numbers application from the internet found at www.random.org. The Random Integer Generator was used to sample the patients.

The randomly selected numbers were then recorded and only those entries were added to the study sample. A minimum of 50 computer-generated numbers was selected over each weekend and each public holiday. For example, any fifty numbers from 1 to 200 were generated. The corresponding numbers were then selected from the trauma register and recorded. Screenshots of these numbers were then taken and kept in a folder for record purposes.

Assuming a daily attendance of about 130 patients over the weekend, 60% incidence of traumatic injuries in the population, with power of 80% and 5% level of precision, 47 sample size for records were calculated. Thus a minimum of 50 computer-generated numbers were selected over each weekends.

A data capture sheet was created specifically for the study and used to collect socio-demographic data such as age, sex, residence, and employment status, and injury-related variables like injury diagnosis, type of injury, location of injury and cause of injury (see Appendix 2).

DATA ANALYSIS

All information from the data capture sheets was entered into Microsoft Excel and later exported to STATA version 13 for statistical analysis. Data was analyzed for measures of central

tendencies such as means, median and standard deviation where necessary. Association between independent exposure variables such as sex, and dependent outcome variables such as mechanism of injury, was calculated using chi-squared tests, and the level of statistical significance was set at 5%. Results for odds ratios were also calculated using logistic regression.

To determine the injury severity score/index (ISS), a random sample of n=116 triaged patients was selected. Further analysis using the TRISS calculator was later done with these patients. ISS assigns numerical scores to the body regions injured in order to determine the extent of multiple injuries and correlate these with mortality risk. The ISS range is from 1-75. When the ISS is 25, mortality is minimal, but thereafter the mortality risk increases almost linearly with the injury score; a score above 70 is close to mortality.

The second parameter, the Revised Trauma Score (RTS), combines coded values of respiratory rate, systolic blood pressure and Glascow coma scale to provide the extent of physiological derangement as a result of trauma. Once the patient's age is included in the TRISS calculator, the probability of survival is automatically calculated.

ETHICAL CONSIDERATIONS

Ethics approval to conduct this study was obtained from the WITS Human Research Ethics committee (HREC) prior to commencement. Clearance certificate number M170506 was issued (see Appendix 3).

Additional authorization to conduct research in the trauma unit as part of CHBAH was obtained from the head of the trauma unit, the acting CEO at the time (see Appendix 4), as well as from the Medical Advisory Committee of CHBAH (see Appendix 5).

Assigned reference numbers were used to protect patients' identity and confidentiality. Their hospital numbers were used only to search for socio-demographic data missing from the patient data on admission to hospital and to follow up on cases sent to the orthopaedic unit or to a ward.

All the data was reported anonymously. All source documents containing individual patient identification was kept in the strictest confidence by the primary researcher.

No harm was intended from the research. Furthermore, full care was taken that patients' personal information be held in confidentiality.

No financial gain was expected from patients or investigations carried out during the study.

CHAPTER 4: RESULTS

SOCIO-DEMOGRAPHIC PROFILE

SEX OF THE PATIENTS

A total of 5371 patient records were included in the study. Over the three-month study period, a predominance of males 3 569 (66.91%) compared to females 1 765 (33.09%) was recorded. Thus a 2:1 male to female ratio was noted.

EMPLOYMENT AND SCHOLAR STATUS

Most of the patients were unemployed 2 325 (45.59%). Employed patients accounted for 1 157 (22.69%) of the total. About one in five 963 (18.89%) of the total patients were in school and more than one in ten 655 (12.84%) were in pre-school.

GEOGRAPHICAL AREA OF RESIDENCE OF PATIENTS SEEN

The majority of patients admitted to the trauma unit 3 168 (67.39%) were from the Soweto residential area, specifically from Diepkloof township. Stretford Clinic in the Johannesburg South area accounted for 1 295 (27.55%) admissions, while the remainder came from other surrounding areas 238 (5.06%).

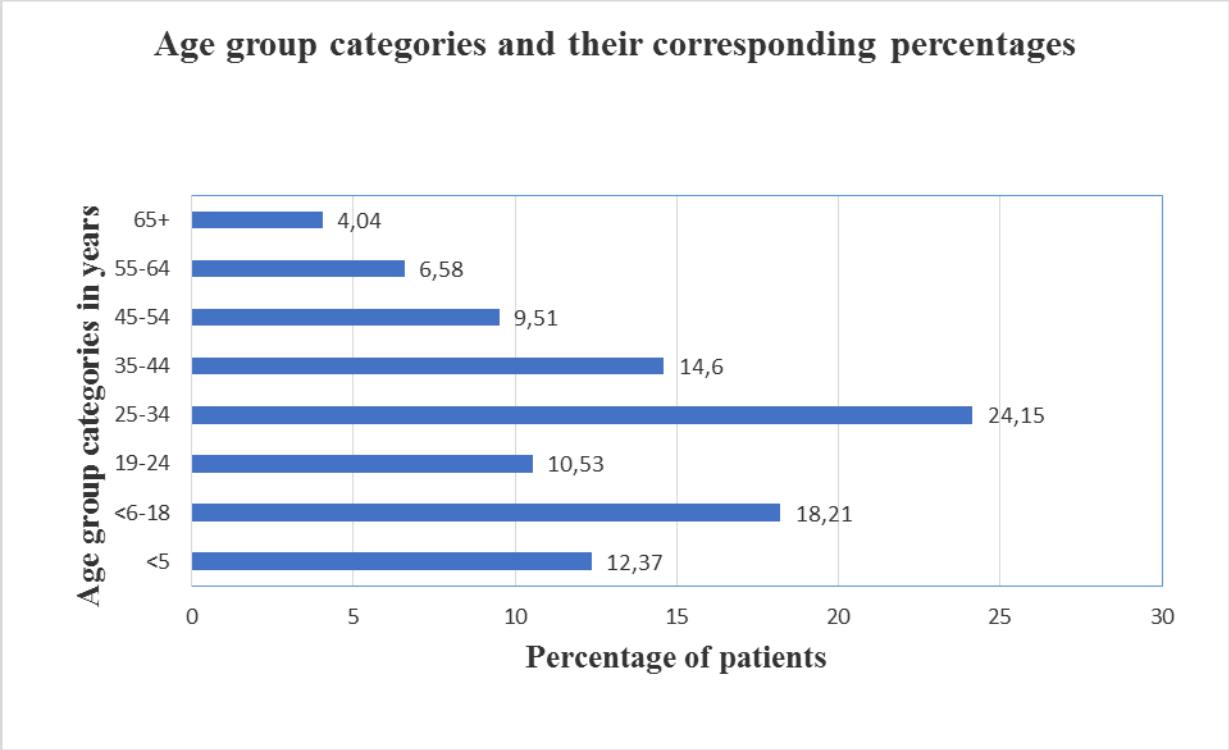


Figure 2: Bar graph representing age categories and their corresponding percentages

AGE

The age distribution was very wide, hence for ease of analysis it was categorized. The youngest patient being two weeks old and the oldest 102 years. Due to the skewness of the sample, the median age is reported as 28 years (Interquartile range 14-40 years). Approximately a quarter (24.15%) of the patients seen were in the 25-34 age group, followed by the 6-18 age group (see Figure 1).

FREQUENCY, DISTRIBUTION AND TYPES OF INJURY

LOCATION/ANATOMICAL AREA OF INJURY SUSTAINED

Table 1: Anatomical distribution of injury sites

Injury type	Frequency	Percentage (%)
Upper limb	1 652	41.06
Lower limb	1 182	29.38
Head and neck	786	19.54
Thorax	227	5.64
Abdomen	62	2.83
Generalised soft tissue injury	114	2.83
Total	4 023	100.00

Table 1 shows that most of the injuries that presented to the trauma unit were in a single anatomical area, with the highest being the upper limb 1 652 (41.06%). Generalised soft tissue injury accounted for fewer than 114 (3%) of injuries. Patients generally report this kind of injury when they are in shock after the trauma they have experienced.

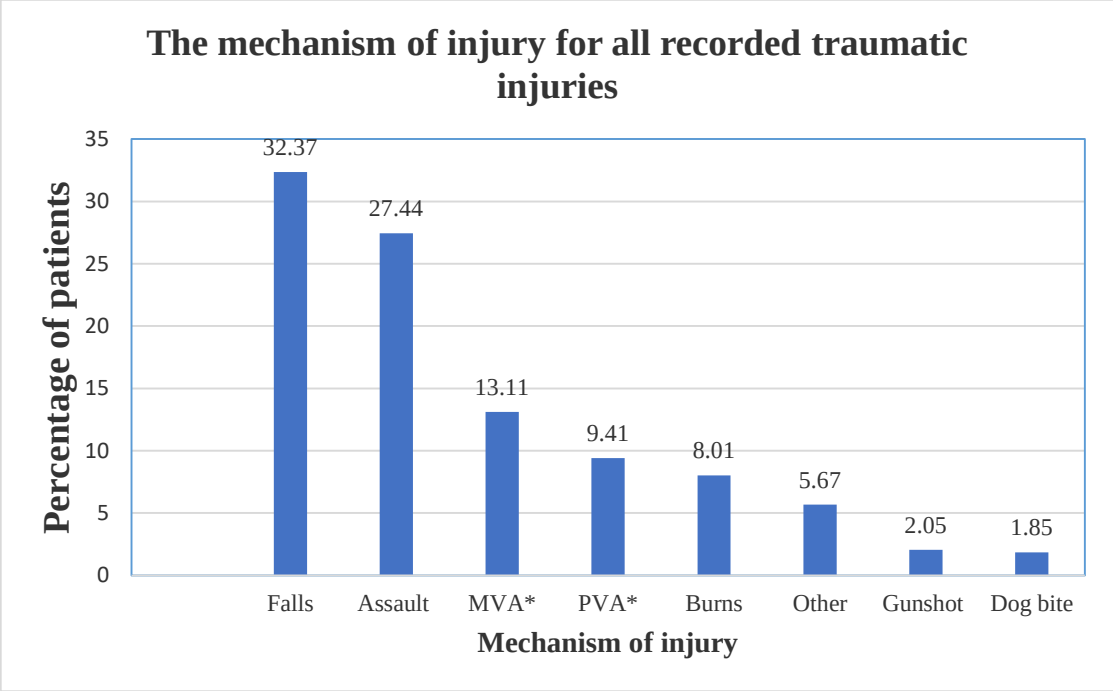
FREQUENCY OF ASSAULT INJURIES

Table2: The frequency of the traumatic assault injuries sustained amongst all participants

Employment or Scholar status	Frequency	Percentage (%)
Unemployed	698	62.26
Employed	303	27.03
Scholar	103	9.19
Pre-scholar	17	1.52
Total	1121	100

Table 2 represents depicts the frequencies of assault injuries by the employment/scholar status of the participants. It shows that the most 689 (62.26%) of the traumatic assault injuries occurred in patients who were unemployed whilst pre-scholars only contributed 17 (1.52%) of the total assault injuries presented.

MECHANISM OF INJURY (MOI)



*MVA-Motor Vehicle Accident; * PVA-Pedestrian Vehicle Accident

Figure 2: Bar graph depicting the mechanism of injury for all recorded traumatic injuries.

Figure 2 shows that the predominantly mechanism of injury (MOI) sustained by patients that presented to the trauma unit was from falls, (intentional or unintentional), at 32.37%, while gunshot wounds accounted for only 2.05% of admitted patients. Other injuries consisted of cuts by machinery or broken glass bottles, as well as rings stuck on fingers, and other less frequent miscellaneous causes of injury.

INJURY SEVERITY

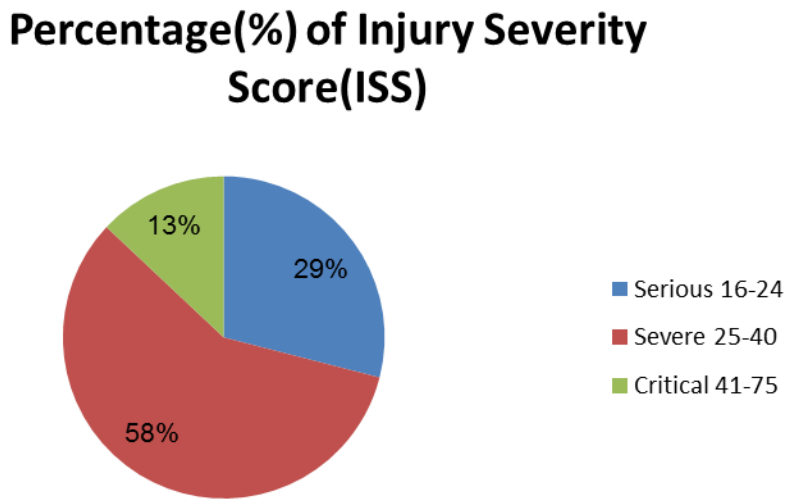


Figure 3: Pie chart depicting distribution of the Injury Severity score amongst traumatic injuries

The majority (58%) of patients sustained severe injuries with ISS between 25-40., whilst less than a third (13%) had critical injuries and were admitted (Figure 3). None of the patients in the study sample presented with a minor injury severity score of 0-16.

TRAUMA REVISED INJURY SEVERITY SCORE ANALYSIS

Table 3: The Trauma Revised Injury Severity Score (TRISS)

TRISS SCORE (percentage of survival)	BLUNT TRAUMA (n=73)		PENETRATING TRAUMA (n=43)	
	Frequency	**Percentage (%)**	**Frequency**	**Percentage (%)**
0-19	0	0	0	0
20-39	0	0	1	2.32
40-59	1	1.37	1	2.32
60-79	1	1.37	2	4.65
80-99	71	**97.26**	39	**90.70**
TOTAL	73	100	43	100

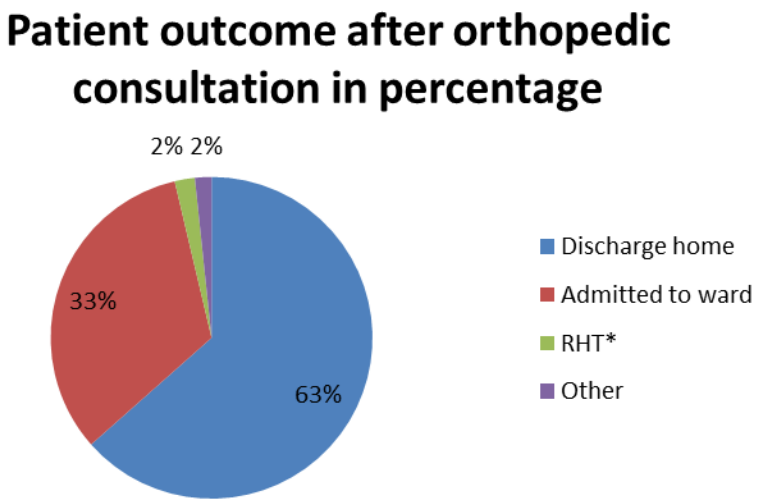
Table 3 depicts the survival probability between blunt and penetrating trauma using TRISS. The results indicate that nearly all patients who sustained blunt trauma had a higher survival rate score of 80-99%, accounting for n=71(97.26%), compared to n=39 (90.70 %) of patients who sustained penetrating traumatic injuries. Regardless of the type of trauma, a survival probability was good at the range of 80-99% score.

PATIENT OUTCOMES FOLLOWING ADMISSION TO THE TRAUMA UNIT

Table 4: Destination/ Referral of patients after initial treatment at the trauma unit

Destination after initial treatment	Frequency	Percentage (%)
Home	2 064	43.04
Orthopedic	1993	41.54
Ward(any)	390	8.14
Resuscitation	161	3.36
Other	67	1.40
Refusal of Hospital Treatment (RHT)	45	0.94
Surgical pit	27	0.56
St. Johns	23	0.48
Theatre	10	0.21
Medical emergency unit	9	0.19
Maxillo Facial	7	0.15
Total	4 795	100

Most of the of patients initially seen at the trauma unit were treated and then discharged (n = 2 064; 43.04%) to home or either sent to the orthopaedic pit for a consultation with an orthopedic surgeon regarding any fractures or dislocations that may require further treatment or follow up appointments (n=1 993; 41.54%) (Table 4).



*RHT-refusal of hospital treatment

Figure 4: Patients outcomes following orthopedic consultation

Figure 4 illustrates that more than half (63.46%) of the patients reviewed by the orthopedic surgeon were sent home. Fewer than 2% of patients refused further treatment or management and signed a Refusal of Hospital Treatment (RHT) form.

FACTORS INFLUENCING TRAUMA INJURIES

Table 5: The association of Mechanism of Injury (MOI) and sex of patients

Mechanism of injury	Sex		Total	p-value
	Male	Female		
Gunshot wounds	84.44	15.55	100	0.00
Injury due to cuts	80.71	19.28	100	0.00
Assault	70.03	20.96	100	0.00
Pedestrian vehicle accidents	66.66	32.60	100	0.00
Motor vehicle accidents	64.89	35.10	100	0.00
Burns	62.02	38.26	100	0.00
Dog bite	64.27	38.27	100	0.00
Falls	57.71	42.29	100	0.00
Other	66.10	33.90	100	0.00

Table 5 shows that males were more likely than females to suffer from any form of injury. There was a significant difference in all forms of injuries sustained between male and female patients ($p<0.00$). Specifically, 84% of gunshot wounds occurred in males compared to 16% in females ($p<0.00$). This is in contrast to falls, where the least difference between sexes was seen, with a male prevalence of 58% compared to 42% in females, still with statistical significant differences ($p<0.00$).

LOGISTIC REGRESSION MODELLING

Logistic regression modeling showed that injuries due to falls were more likely than other mechanisms of injuries to result in upper and lower limb injuries (OR: 1.91, CI 1.70-2.28, p<0.00) and (OR:2.10,CI 1.79-2.46,p<0.00) respectively. Likewise, the assault injuries were less likely to result in upper limb injuries (OR: 0.60; CI 0.51-0.71, p<0.00) and lower limb injuries (OR: 0.16, CI 0.12-0.21, p<0.00).

Assault injuries were 4.23 times more likely than any other mechanism of injury to result in head and neck injuries (OR: 4.23, CI 3.52-5.08, p <0.00). In contrast, fall injuries were less likely to result in head and neck injuries (OR: 0.03, CI 0.28-0.37, p<0.00)

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CHAPTER 5: DISCUSSION AND CONCLUSION

DISCUSSION

The socio-demographic profile results in the current study indicate that the male to female ratio of attendance at the trauma unit was 2:1; this is similar to the local Johannesburg study done at a different hospital by Bruce et al, which showed a 3:1 male predominance(4). A change from 3:1 to 2:1 is noted, taking into consideration that the studies are twenty years apart. The decrease in male to female ratio in our study may be attributable to the studies being carried out on different sites with different catchment populations. Another explanation may be the increased involvement of females in trauma. In the first instance, this can be brought about by female immigration and migration from rural to urban township areas (49). Urbanisation may in turn lead to a lack of adequate shelter and basic infrastructure, resulting in a high degree crime and violence (50). In the second instance, recent South African crime statistics note an increase in interpersonal gender violence where females are victims (51). Finally, higher rates of survival among females mean that the proportion of female patients suffering from any injury is likely to be higher (14).

The male to female trauma injury ratio results in the current study differ considerably from the study in Mthatha where a 5:1 male to female ratio was reported (12). Similarly, the current study results are very different from the surveillance study done in Cape Town, which illustrated a 12:1 ratio of male to female patients admitted to the trauma unit (8). The extreme difference between the ratios reported in these South African studies could possibly be attributed to the studies' different settings: Mthatha, in the Eastern Cape, is classified as a rural setting while Johannesburg and Cape Town are more urban/metropolitan (12). In the developing world, changes can be brought about by immigration and migration from rural to urban areas. Urbanisation in this manner leads to mass unemployment together with a lack of adequate shelter and basic infrastructure. Combined with weak social services and an obvious distinction between the "have" and "have-nots", this results in a high degree of social exclusion manifested in overall social dysfunction, crime and violence (49).

Research has shown that women from rural areas have less access to health care than urban women (52). Furthermore, the Cape Town study (8), reported a very high number of male trauma patients compared to female trauma patients, which could suggest that more males are involved in violent activities as a result of the high degree of gang-related violence in the Cape Town metropolitan area (53).

Internationally, in a Danish study using the Denmark Trauma Registry (DTR) (17), similar results have been reported to current study of a 2:1 male to female ratio. Male behavior is of a more aggressive nature than female behavior, further exposing males to injury (54). Males are also shown to be a high-risk category for trauma, over weekends in particular, during their nocturnal activities (4).

Regarding the employment status of the patients in the sample, the study showed that approximately half of the adults reported to have been unemployed (45.59%). This is similar to the Mthatha study, where more than 50% were unemployed. Further social dynamics supporting violence include unemployment (55). South Africa's unemployment rate was reported to be high for both youth and adults. This could be further attributed by young people having become discouraged with the labor market and furthermore not improving their skills base through education and training (56).

However this was contrary to studies conducted in Tanzania (28) and Tehran (22), which reported that employed patients were more likely to sustain job-related injuries. . With regard to different patterns of injuries sustained, the current study unemployment rate accounted for most of the assault related injuries (35.79%), whereas in the other studies, those employed were more likely to be injured due to work related mechanisms(57, 28) .

The second largest number of patients 1 295(27.55%) were referred from Johannesburg South, with most trauma cases being referred from Stretford Clinic in Orange Farm, situated about 45 kilometers away from CHBAH. It can take up to 45 minutes from Stretford to CHBAH by ambulance. Consequently, upgrading Stretford Clinic to a hospital equipped with a level-one trauma centre would be ideal and lifesaving and patients will be managed in the first 60 minutes or "golden hour" after the occurrence of injury (6).

The relatively low number of referrals from other areas can be attributed to the presence in central Johannesburg of another tertiary hospital (CMJAH) equipped with a level 1 trauma unit.

The median age of patients in our study was 28 years, with an Interquartile range (IQR) of 14-40 years, which compares closely with Chowdhury's study, where the median age reported was 26 years with an IQR of 21-32 years (8). Age group categories are important in deducing comparisons. In our study, less than half (38.24%) of the patients presenting were from the 25-44 age group. This also correlates with other studies, emphasizing that the young and active members of SA's societies are most frequently injured (4, 8, 11 , 12, 21,25). Evidence suggests that there are high levels of irresponsible use of alcohol in this age group (8). Globally and locally, the link between alcohol use/abuse and injury has been well documented (11,58). Of great concern is that almost a third (30.58%) of the patients in this study were minors, under the age of 18. With the increase of child-headed households in Soweto, adult supervision is not always apparent, thus making this age group more susceptible to injuries (58).

With regard to the type of injury, our study reported that the first injury was due to intentional or unintentional falls (32.37%). This was similar with two other international trauma studies done in Denmark and India (17, 31). The first study indicated that 34% of falls occur in the under 60years age group and 61% of falls in the over 60 population. The latter study had 39.40% of their sample of patients presenting due to a fall (31).

The second mechanism of injury reported was attributed to assaults or IPV (27.44%). in comparison with 70% recorded by the study done in Johannesburg (4) and 60% in the Mthatha study (8). Our study differs from the other SA studies (3, 11, 8, 12, 25) that showed IPV to be the predominant causes of admission, followed by road traffic accidents. Injuries resulting from assaults and accidents, could correlate with poverty levels in South Africa (59). Poverty levels and low socio-economic status are predominantly evident in the Black population as a consequence of apartheid-related segregation and discrimination (12) in terms of access to education, resources and employment. Our study context is an example of one of the townships/suburbs still recovering from decades of past inequality (55).

Crimes are most evident in these societies compared to more affluent contexts. Exposure to crime increases the risk of injury for the criminal as well as the victim. Victims who survive violent crime endure physical pain and suffering and may also experience mental distress and reduced quality of life (49).

After assault and IPV, MVA and PVA accounted for 13.11% and 9.41% of injuries respectively, closely resembling the combined Road Traffic Accidents (RTA) of 19% in the Mthatha study (12). Results from a study done in India showed more than 50% of all injuries were due to RTI. The vast difference in percentages can be attributed to the fact that in India, the motor vehicle population is growing at a faster rate than economic and population growth, resulting in an increase in road related injuries (60).

Burns were the fifth most common mechanism of injury. Parent/guardian education is imperative in decreasing this statistic as the zero to five years age group ideally should be under adult supervision at all times (34, 44). The main areas to target relating to trauma injury among children would be education at home or at school through the application of proactive measures by the Department of Housing and/or Department of Education, especially since an increase in maternal education and the presence of a living room area have been shown to be protective factors with regard to childhood burns (46). Further, burns can be prevented by improving the home environment and socio-economic living conditions. This can be achieved through the relevant government departments dealing with health, social welfare, education and housing (40). Community programs educating mothers on risk factors and prevention have also been proposed as strategies for burns prevention (47).

When analysing the anatomical area of the body that is most commonly involved in trauma, our study found that the upper and lower limbs accounted for 70.44% of the total injuries presented to the trauma unit. The result might explain the high number of falls-related injuries in our study. The second anatomical area reported was the head and neck region with 19.54% of injuries. This study results were in accordance with the other studies of this nature. The Johannesburg study revealed that 45.2% of its patients were admitted with upper and lower limb injuries and 30% with head and neck injuries (4).

International studies have also reported that the upper and lower limbs as the main areas affected by trauma. In the USA where they accounted for 60.20% of injuries (37) and a study conducted in Tanzania 60.5%, with head and neck injuries at 32% (32). Upper and lower-limb injuries frequently occur from trauma due to direct or indirect violence or as a result of patient involvement in road accidents (61).

With regard to the severity of injuries, our study found that 100% of injuries scored an ISS between16 – 75. Our study results were not different compared to the study done by Bruce and colleagues, wherein more than 60% of random sample of patients were reported to have sustained injuries with an ISS between16-75 (3). Furthermore 8% of patients in the Bruce study scored an ISS of 41-75 regarded as critical compared to 13% in the current study. A critical ISS is predictive of a 10% mortality rate and should ideally be addressed at a level one trauma facility (4). The above clarifies why no patients in the current study presented with an ISS of less than 15, which is classified as a minor injury case. All minor injuries should be addressed at the primary health care facility, be it a local clinic or community health centre, and not referred to CHBAH's trauma unit.

TRISS results of the current study are similar to other studies in South Africa and internationally. Collectively, the majority of patients triaged had a greater than 50% survival probability (4, 12, 62). In contrast another study done in India resulted in a larger unexpected death range, despite their calculated survival probability, which was attributed to a lack of resources in their trauma centre (63). Regardless of the slight differences reported, in both developing and developed countries, the TRISS methodology has proven to be an acceptable method for evaluating the difference between predicted and observed mortality (62).

Results from the patient outcome after initial treatment/stabilization at the trauma unit showed that the majority were discharged to home (43.04%). Our study results were lower compared to the study done at Johannesburg hospital, which reported that 61.2% of their patients were discharged from the trauma unit after initial treatment (4). The difference between the two studies could be due to that in the Johannesburg study, the orthopedic specialists were part of

their trauma unit, whilst at CHBAH they do not form part of the trauma unit. Of the patients who were seen by the orthopedic specialists, 63.46% were discharged home and 32.85% were admitted to ward to wait to undergo surgery. Combining the patients sent home after their orthopedic consultation with the ones sent home from the trauma unit, the total adds up to 58.31% of the study sample having been discharged home on the day that they presented with their relevant trauma related injury. This figure is comparable to the 61.2% that were discharged to home in the study done by Bruce and colleagues (4). This similarity could be attributed to the fact that both CMJAH and CHBAH both are tertiary learning institutes and have very specialized consultants at their disposal, who also train doctors internationally on traumatology.

Even though the results from the current study showed that a very small proportion (0.15%) of patients were referred to maxillofacial surgeons, the general rule is that conscious patients presenting with any facial trauma requiring a maxillofacial consult are discharged go home and then told to attend the Out Patient Department (OPD) on a Monday, Wednesday or Friday to be consulted to by the maxillofacial surgeons.

Statistical analysis using logistic regression to report odds ratios regarding factors associated with injury was conducted. Upon analyzing upper and lower limb injuries, results reveal falls as statistically significant (p-value <0.05). The odds of sustaining an upper or lower limb injury due to falling are twice as great. Assault also is shown to be statistically significant to upper and lower limb injury; however, the odds are less than 1. Contrary, the odds of sustaining a head and neck injury after being assaulted are 4 times higher than falling resulting in a head and neck injury.

The study illustrates that there is a definite need for surveillance at the CHBAH trauma unit as numerous patients are admitted to the unit on a daily basis.

STUDY LIMITATIONS

Generally, record review designs have a shortfall of missing data. This problem was experienced in the present study, although an effort was made to inform the trauma clerical staff of the study beforehand to highlight the importance of full data entry, as long as it did not interfere with their services.

Patients presenting to the trauma unit in an unconscious state or with severe penetrating wounds are immediately sent to the resuscitation area and if need be to theatre; thus they are not seen at triage first. These patients were not recorded. In addition, such patients may present with a compromised level of consciousness, which could have compromised our data if they were unable to recall what situation brought them to the hospital. In this instance information was accessed from personnel who accompanied them upon admission to the trauma unit.

CONCLUSIONS

The study revealed males to be the predominant sex affected by traumatic injuries. Employment status also plays a role in the study setting relating to injuries as majority of the patients seen were unemployed. One in four of the patients were in the younger age group and more than half hailed from surrounding townships. Fall injuries were shown to be the most common mechanism of injury and were mostly resulting in upper and lower limb injury. Even though assault was shown as the second most common mechanism of injury, it was significantly linked with head and neck injuries. According to the ISS, the majority of the injuries were severe. However, TRISS revealed a high survival probability score regarding the injuries that presented. Final outcomes after treatment at the trauma unit showed that a high percentage of patients were discharged to home after initial admission at the trauma unit or referred to the orthopedic unit. In addition, some were admitted for further observation or surgery and very few were referred to the maxillofacial unit. Males were more likely to suffer from any form of injury compared to females. Assault injuries were more than four times expected to result in head and neck injuries compared to any other mechanism of injury.

RECOMMENDATIONS

Our study has shown that males are more involved in injuries than females. Interventions, such as community based support groups are needed. Measures targeting reduction in male involvement in trauma are required in the study setting and the rest of region.

Due to unemployment having been recorded as significantly associated with the traumatic injuries reported, an increase in job opportunities would reduce the involvement of youth in injuries related to crime and assault.

Alarmingly, our study found that almost one in five patients reporting to the trauma unit are scholars. Thus, health promotion and injury prevention awareness programs should be targeted at schools. Children should be steered away from negative and risk-associated behaviors through social programs that will engage learners through character building as well as in terms of awareness on safety, health choices, crime and the consequences of crime.

With an increase in child-headed households in Soweto, the Department of Social Services needs to be more involved in order to support the children that are directly affected by this phenomenon.

Upgrading Stretford Clinic to a hospital equipped with a level-one trauma centre would be ideal and lifesaving.

As the saying goes, “Prevention is better than cure.” It is imperative for service delivery to be reoriented towards determining and implementing preventable strategies to assist in decreasing the number of trauma patients that require level one trauma care. The establishment of a properly installed and implemented surveillance system, preferably electronic, would greatly serve the country on various levels of decision making, making readily available information that will allow the health department as well as other policy makers in law and justice to monitor where there is a burden on the service and distribute health care service provisions accordingly.

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APPENDIX 1-CHBAH TRIAGE FORM ADOPTED FROM SOUTH AFRICAN TRIAGE GROUP

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				

APPENDIX 2-DATA COLLECTION SHEET

Injury surveillance at the trauma casualty department CHBAH by Dr N Khan

Patient reference number_____

Age of patient_____

Sex: Male _____ Female_____

Employment status _____ Area of residence _____

Time in and date _____ Time out and date _____

Mechanism of injury

_____

Diagnosis

_____

Transfer to ward Discharged home Life lost

_____ _____ _____

CHBAH Adult Triage Form

	3	2	1	0	1	2	3
Mobility				walking	assistance	stretcher	
RR		<9		9-14	15-20	21-29	<29
HR/pulse		<41	41-50	51-100	101-110	111-129	<129
SBP	<71	71-80	81-100	101-199		<199	
Temp	<35			35-38.4		>38.4	
AVPU		confused		alert	Reacts to voice	Reacts to pain	Unresponsive
Trauma				No	Yes		

Score_____

TRISS score_____

Extra notes_____

_____

APPENDIX-3 WITS HREC APPROVAL

R14/49 Dr Nazia Khan

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M170506

NAME: (Principal Investigator)	Dr Nazia Khan
DEPARTMENT:	Maxillo Facial and Oral Surgery Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	Injury Surveillance at Chris Hani Baragwanath Hospital, Soweto, South Africa
DATE CONSIDERED:	26/05/2017
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Mzubanzi Mabongo and Dr Yolanda Kolisa
APPROVED BY:	Prof P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	10/07/2017

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in May and will therefore be due in the month of May each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

11/7/2017
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 4 -LETTER OF APPLICATION TO CHBAH CEO

University of the Witwatersrand - Johannesburg
Faculty of Health Sciences, School of Oral Health Sciences, Department of Community Dentistry
Wits Medical School, 4th Floor, Room 4B12, Johannesburg

7 York Road, Parktown
2193, South Africa

Fax: +27 11 717 2247
e-mail: +2711 717 2625
Yolanda.Kolisa @wits.ac.za

26 Chris Hani Road
Johannesburg
1864
South Africa

Date: 05 May 2017

Dear Dr Maseko

Re: Permission to conduct a study at Chis Hani Baragwanath Academic Hospital Trauma Unit

I Dr Nazia Khan wish to conduct a study project titled: *"Injury Surveillance at the Chris Hani Baragwanath Hospital, Soweto, South Africa."*. Study will be supervised by Dept. of Community Dentistry: Dr Y Kolisa and the Department of Maxillo Facial and Oral Surgery Dr M Mabongo. Records of patients seen at the trauma unit will be used over a three month period. The study protocol will be submitted to the Human Research Ethics Committee (HREC) for approval. The project is also supported by by Prof Frank Plani Head of Trauma Directorate Department of Surgery University of the Witwatersrand.

We would greatly appreciate your approval in us going ahead with the research project.

Thanking you in anticipation

Yours sincerely
Student name: Dr N Khan, 348939

.....

Supported by

Supervisor: Dr Y Kolisa; BDS, MPH, MDENT Department of Community Dentistry

.....

Prof Frank Plani MD, FCS (SA) FRACS, Trauma Surgery (SA)
Head of Trauma Directorate Department of Surgery University of the Witwatersrand

.....

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APPENDIX 5-CHBAH MEDICAL ADVISORY COMMITTEE APPROVAL

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE
CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 15 May 2017

TITLE OF PROJECT: Injury surveillance at Chris Hani Baragwanath Hospital, Soweto, South Africa

UNIVERSITY: Witwatersrand

Principal Investigator: N Khan

Department: Maxillo-Facial and Oral Surgery

Supervisor (If relevant): M Mabongo

Permission Head Department (where research conducted): Yes

Date of start of proposed study: May 2017
Date of completion of data collection: Dec 2018

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Hospital. The CEO /management of Chris Hani Baragwanath Hospital is accordingly informed and the study is subject to:-

- Permission having been granted by the Human Research Ethics Committee of the University of the Witwatersrand.
- the Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- the MAC will be informed of any serious adverse events as soon as they occur
- permission is granted for the duration of the Ethics Committee approval.

.....
Recommended
(On behalf of the MAC)
Date: 15 May 2017

.....
Approved/Not Approved
Hospital Management
Date: 18/05/17