

# Spectrum of intentional injuries in the adolescent population treated at a South African level one trauma centre

Vrouwgelien M Tadema-Meijering<sup>1</sup>, Pradeep H Navsaria<sup>1</sup>, Andrew Nicol<sup>1</sup>, Sorin Edu<sup>1</sup>, Stella R Smith<sup>1</sup>, Hameed Morad<sup>2</sup> and Sanju Sobnach<sup>1\*</sup>

<sup>1</sup>Trauma Center, Groote Schuur Hospital & University of Cape Town, Republic of South Africa

<sup>2</sup>Division of General Surgery, Vancouver General Hospital & University of British Columbia, Canada

## Abstract

**Background:** South Africa has one of the most violent societies worldwide. The national homicide rate is 34 per 100,000; young males form the majority of this cohort. Comprehensive injury surveillance in low and middle-income countries is limited. There is paucity of data describing the epidemiology and outcomes of intentional injuries in the adolescent population.

**Methods:** Ethics approval was obtained. Data of patients aged 12 to 19 years admitted to the Groote Schuur Hospital Trauma Centre over a 33-month period (April 2014 to December 2016) were retrieved from a prospectively established electronic Trauma Health Record (eTHR) and analysed.

**Results:** Over the study period, 2889 adolescents were admitted to the trauma centre. Intentional injuries (n = 1380, 48%) accounted for nearly half of the study cohort. Within this cohort, 229 (17%) patients were victims of gang related violence. Penetrating injuries were seen in 946 (69%) patients, of whom 428 (45%) sustained knife injuries and 358 (38%) sustained gunshot wounds. The most affected body region was the head (n = 429, 31%), followed by the thorax (n = 335, 24%). Permanent disability resulting directly from injury was seen in 6% (n = 87) of survivors (n = 1347). The overall mortality was 2% (n = 33).

**Conclusion:** Intentional injuries are common within the adolescent population group in Cape Town. Penetrating injuries and gang-related activities account for a large subset of these patients. The permanent disability rate is 6% and is likely to have significant public health and economic ramifications for the South African health care system in the future.

**Abbreviations:** ISS: Injury Severity Score, RTS: Revised Trauma Score.

## Introduction

Trauma occurring in adolescents aged ten to 19 years is a major public health concern in low and middle-income countries (LMICs). Homicide and non-fatal assaults involving young people contribute significantly to the burden of premature death, disability and injury worldwide [1-3]. There currently exists an epidemic of youth violence in South Africa; the homicide rate amongst males in the 15 to 29-year age group is 69 per 100,000 [4]. This is eight times the global average. In the United States, seven to eight percent of all murders involve a juvenile perpetrator. Furthermore, young patients admitted for non-accidental injuries are at very high risk for early violent death upon hospital discharge [5,6]. Adolescent trauma incurs large costs to the health system, decreases productivity and disrupts essential services. The risk factors for juvenile violence are male gender, low socio-economic status and household family members with a history of mental illness, self-mutilation and high levels of aggressiveness [7,8]. There is a paucity of data describing the epidemiology and surgical outcomes of adolescent trauma in South Africa. The Trauma Centre at Groote Schuur Hospital is an urban high-volume level one unit that treats an estimated 12000 patients annually. Penetrating trauma accounts for 25% of all admissions, and adolescent individuals constitute 12% of all hospital visits [9]. Gaining further insight into these patients can assist in the

planning of community-based interventions, boost injury surveillance and improve access to long-term physical and social rehabilitation. Thus, the aim of this study is to describe and detail the presentation, management and outcomes of trauma in the adolescent population presenting to a high-volume urban Trauma Centre in the developing world.

## Methods

The Human Research Ethics Committee of the Faculty of Health Sciences at the University of Cape Town granted ethics approval for this study (HREC REF: 031/2017, IRB00001938). Data of patients aged 12 to 19 years admitted to the Groote Schuur Hospital Trauma Centre over a 33-month period, from April 2014 to December 2016 were retrieved from a prospectively established electronic Trauma Health Record (eTHR) and analysed. Patients under the age of 12 do not present to this hospital, and are therefore not included in this study. Standard demographic information, injury mechanism and type, admission vital signs, relevant investigations, surgical management

\*Correspondence to: Sanju Sobnach, Trauma Centre, Groote Schuur Hospital & University of Cape Town, Anzio Road, Observatory 7925, Cape Town, Republic of South Africa, Tel: 27 72 585 3620, E-mail: sanjusobnach@yahoo.com

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and outcomes were all recorded. Injury severity was categorised by computing the Injury Severity Score (ISS) and Revised Trauma Score (RTS). The type of violence was documented and categorised into three subgroups, namely interpersonal, gang-related and community assault. The interpersonal group includes family and intimate partner violence, as well as random acts of violence between unrelated individuals. Community assault refers to a form of vigilantism, where communities seeking the establishment of law and order, implement justice by taking the law into their hands; punishments are administered through physical violence [10]. The referral patterns were also recorded and included the geographical location where the initial trauma was sustained. Permanent disability was defined as a physical impairment that significantly affects independency in daily life or prevents the individual from participating in the work force.

Data were stored on a spreadsheet registry (Microsoft Excel, Redmond, WA, USA) and statistical analyses were performed using the Microsoft Excel Data Toolpak. The Chi-squared and Fisher's exact test (for smaller numbers like mortality, substance use and previous admission) were used to determine associations between the various study parameters. A two-tailed *p*-value of less than 0.05 was considered statistically significant.

### Results

Two thousand eight hundred and eighty-nine (2889) adolescents presented to the Trauma Centre over the study period. Intentional trauma was seen in 1380 (48%) patients; this constituted the study cohort. There were 1225 (89%) males and the mean age was 17 ( $\pm 2$ ) years. The mean ISS was 10 (range 0-50). Interpersonal disputes and gang-related violence accounted for 64% and 17% of all injuries, respectively. Community assault occurred more frequently in men (12% vs. 5%, *p* = 0.004), compared to women (Figure 1). The ISS did not differ significantly between these types of violence. Recidivism, defined as two or more independent presentations for intentional injuries, was noted in 54 (4%) patients, and 117 (8%) admitted to using illicit substances. The patients were predominantly referred from within the Cape Flats Townships (Figure 2). A total of 445 (32%) patients were brought to the Trauma Centre directly from scene. Penetrating trauma was the most common mechanism of injury; knife wounds occurred in 428 (45%) patients and 358 (38%) sustained gunshot wounds. Penetrating injuries occurred most frequently to the thorax and abdomen, whilst blunt force trauma resulted mainly in head injuries. Haemodynamic instability (systolic blood pressure < 90mmHg) was documented in 37 (3%) patients, with a mean RTS of 8 ( $\pm 1$ ) (Table 1). Head, thoracic and abdominal injuries occurred in 429 (31%), 335 (24%) and 234 (17%) of patients, respectively (Table 2). More than half (728) of the patients

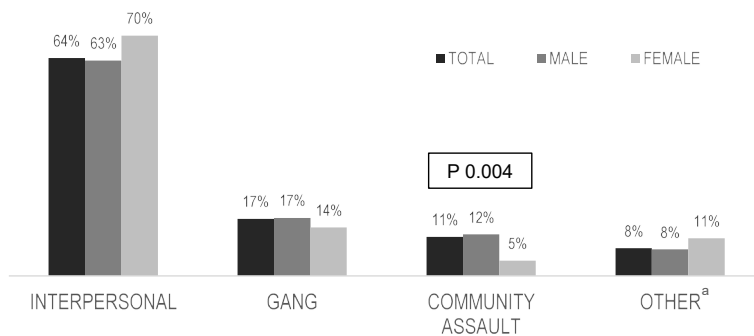


Figure 1. Types of violence documented in study cohort

<sup>a</sup> includes self-inflicted, rape and sexual assault, legal intervention

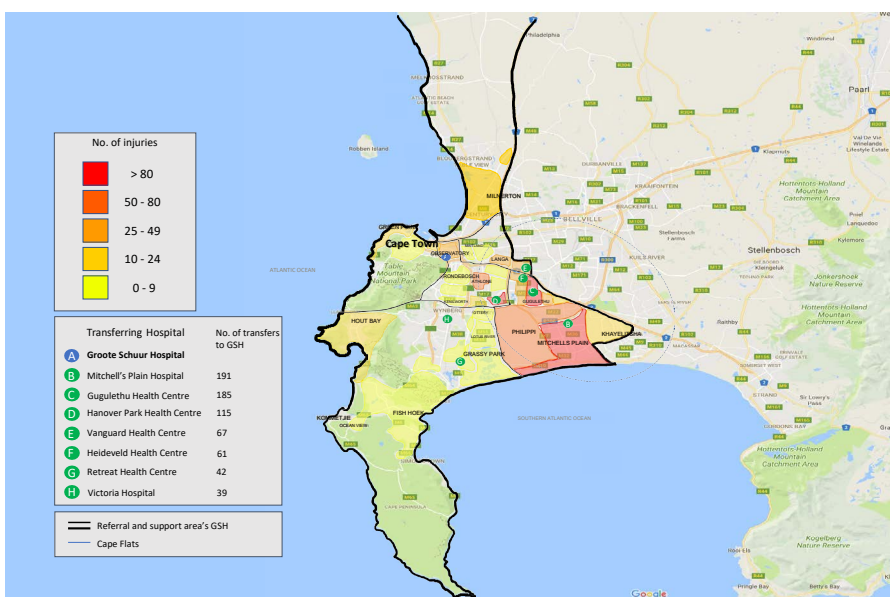


Figure 2. Cape Flats Townships

**Table 1.** Demographic and Clinical data of Study Cohort

Demographic Data	Total 1380	Males 1225 (89%)	Females 155 (11%)	P-value
Age (years) Mean (SD)	17 (± 2)	17 (± 2)	17 (± 2)	NS
SBP < 90	37 (3%)	33 (3%)	4 (3%)	NS
Mean RTS (SD)	8 (± 1)	7.7 (± 1)	8 (± 1)	NS
Previous admission for Intentional trauma	54 (4%)	52 (4%)	2 (1%)	NS
Substance use suspected	117 (8%)	104 (8%)	13 (8%)	NS
Directly from scene	445 (32%)	386 (32%)	59 (38%)	NS

NS: Not Significant

**Table 2.** Injuries seen in 1380 patients

Injury details	Study Cohort N = 1380	Head N = 429	Thorax N = 335	Abdomen N = 234	P-value
Penetrating	946 (69%)	152 (35%)	313 (93%)	217 (93%)	<0.0001
Knife	428 (45%)	62 (41%)	208 (67%)	72 (33%)	<0.0001
Firearm	358 (38%)	25 (16%)	73 (23%)	135 (62%)	<0.0001
Blunt	450 (33%)	299 (70%)	33 (10%)	19 (8%)	<0.0001
Mean ISS (SD)	10 (±9)	9 (±9)	18 (±11)	19(±11)	NS
Mortality	33 (2%)	12 (3%)	11 (3%)	8 (3%)	NS

NS: Not significant

needed hospital admission, whereof 16 patients were admitted for more than 30 days. Nearly all of these outliers sustained penetrating injury to head, thorax or spine and developed complications like meningitis, acute renal failure and sepsis. More than a third of all patients required surgical intervention, and 62 (4%) patients required admission to an intensive care unit. Permanent disability was seen in 87 (6%) patients. The mortality rate was 2% (33 patients), of whom 28 sustained penetrating trauma (Table 3).

## Discussion

Youth violence remains a significant contributor to mortality and Disability-Adjusted Life Years (DALYs) in South Africa [8–14]. The national homicide rate amongst the 10 to 19-year age group is 10%; young men are predominantly affected. This study was conducted in the Western Cape province of South Africa, where homicide accounts for 41% of all deaths [15].

This is the first paper detailing the spectrum of intentional trauma in adolescent patients at a high-volume urban Trauma Centre in the developing world.

Twelve percent of the patients presenting at our Trauma Centre are adolescents, with a mean age of 17 years according to our study population. This is concerning because these patients are of school-going age. Thus, for adolescents, and specifically the ones originating from lower socio-economic areas of Cape Town having difficulties participating in society as economically productive adults, intentional trauma presents itself as an important impediment.

Fifty one percent of all adolescent patients live in the Cape Flat townships. The latter refers to a conglomerate of suburbs in Cape Town (Figure 2), where communities face significant socio-economic challenges, such as high rates of unemployment, poor public infrastructure, domestic violence and gang-related violence [16]. Unfortunately, a vicious cycle of poverty drives the vulnerability of young individuals to crime and further violence. Gang-related violence accounted for 20% of all cases in this study. Gangsterism is present in numerous communities in Cape Town. There are about 137 documented gangs in the Cape Peninsula, and members are mostly aged

**Table 3.** Outcomes in 1380 patients

Outcomes	Number (%)
Admission	728 (53)
Surgical management	484 (35)
ICU management	62 (4)
ICU stay (days)	3 (0-103)
Total hospital stay (days)	1 (0-137)
Mortality	33 (2)
Penetrating Injuries	28 (85)
Stab chest	8
GSW head	6
GSW abdomen	6
Stab head	4
Permanently disability	87 (6)
Spinal cord injury	32 (2)
Functional loss extremity	32 (2)
Visual impairment	18 (1)

ICU: Intensive Care Unit, GSW: Gunshot Wound

between 11 and 40 years [12,17]. Marginalisation, unemployment and a sense of disillusion amongst the youth are well-described drivers of gang recruitment [12]. In the Western Cape, gangsterism remains associated with drug related activity which accounts for 4% of all crimes [18].

Community assault is widespread in the townships of Cape Town, and 11% of all adolescent patients seen in our Trauma Center sustained injuries due to vigilantism – a phenomenon where the community take the law into their own hands and use violence as punishment [19]. Our study shows that males are significantly more involved, confirming again their predominance in violence related injuries. A study conducted in the Khayelitsha township (Figure 2) showed that community assault victims sustained more severe injuries than their counterparts [10]. In this study, there was no significant difference between computed ISS values in these two groups.

The witnessing of violence by young individuals also has social, emotional and behavioural sequelae in early adulthood. The Well-Being of Adolescents in Vulnerable Environments (WAVE) study [20] confirmed that in disadvantaged communities throughout South Africa, juvenile violence predisposes to chronic mental health disease, substance abuse and precocious sexual behaviour with less protection.

The overall in-hospital mortality rate was 2%, and up to 6% of all patients sustained some form of permanent disability. This included functional loss of an extremity, visual impairment and severe spinal cord injuries, which require costly and lengthy rehabilitation. The limited number of rehabilitation centres nationally along with poor access thereof complicate the future management and outcomes of these patients [21].

Intentional injuries are common within the adolescent population in Cape Town. Penetrating injuries and gang-related activities account for a large subset of these patients. The permanent disability rate is 6% and is likely to have significant public health and economic ramifications for the South African health care system in the future. Injury surveillance, preferably using electronic health systems, is a national priority. Recording the spatial distribution and characteristics of injuries will provide valuable information to the relevant stakeholders and improve survival as well as life-expectancy within the adolescent age group in South Africa.

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