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Epidemiology of traumatic orthopaedic injuries at Princess Marina Hospital, Botswana

Manwana ME¹, Mokone GG², Kebaetse M³, Young T⁴

¹ Division of Community Health, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa; Medical doctor, Princess Marina Hospital, Ministry of Health, Botswana

² Senior Lecturer and Exercise Physiologist, Faculty of Medicine, University of Botswana

³ Senior Lecturer and Rehabilitation Scientist, Faculty of Medicine, University of Botswana

⁴ Director, Centre for Evidence-based Health Care, Stellenbosch University, Cape Town, South Africa

Corresponding author: Dr Manwana M Esperance, Division of Community Health, Faculty of Medicine and Health Sciences, Stellenbosch University, PO Box 241, Cape Town 8000, South Africa; tel: (+27) 21 938 9498; fax: (+27) 21 938 9138; email: esperancemanwana@yahoo.com

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Abstract

Background: Traumatic injuries pose a significant and increasing challenge to healthcare systems worldwide. One major type of traumatic injury is the traumatic orthopaedic injury, whose epidemiology is unknown in Botswana. The aim of the study, therefore, was to evaluate the age, sex, type, and determinants of traumatic orthopaedic injuries for inpatients at Princess Marina Hospital from August 2014 to January 2015.

Methods: We performed a descriptive study by retrospectively collecting data on age, sex, date of admission, date of injury, date of discharge, radiological investigation, and injury types and determinants from medical records of patients admitted to orthopaedic wards.

Results: The median age of patients with traumatic orthopaedic injuries was 33.5 years (n=372). Males were more frequently injured than females, with a sex ratio of 7:3. Fractures were the most common type of traumatic orthopaedic injury (413 injuries, 75.5%). The most common injury determinants were falls (145 patients/39.0%), road traffic accidents (95 patients/25.5%), and assaults (57 patients/15.3%).

Conclusions: Young adult males were the group most affected by traumatic orthopaedic injuries. Fractures were the most common type of traumatic orthopaedic injuries, with falls being the most common injury determinant. These findings may guide efforts to improve healthcare delivery and public health policy.

Level of evidence: Level 4

Key words: traumatic orthopaedic injuries, descriptive study

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Introduction

Traumatic injuries pose a significant and increasing challenge to healthcare systems worldwide.¹ According to the World Health Organisation (WHO), traumatic injuries are one of the main causes of mortality in the world, with 90% of the injuries estimated to occur in low-and middle- income countries.²

A large number of traumatic injuries are orthopaedic in nature. Orthopaedic injuries are injuries that cause damage to the musculoskeletal system, which includes bones, ligaments, joints, tendons, muscles, and nerves.³ Orthopaedic injuries can be divided into traumatic and non-traumatic injuries. Orthopaedic injuries are common. For example, a survey covering an eight-year period reported that 25% of Americans had impairments secondary to musculoskeletal conditions,⁴ while in Kenya one study showed that 221 of 362 (61%) victims of non-fatal road traffic crashes were admitted to the orthopaedic wards.⁵ Furthermore, studies generally show that orthopaedic injuries predominantly affect younger male adults, with fractures being the most common injury.^{6,7}

A limited number of studies have been conducted on the epidemiology of traumatic orthopaedic injuries, especially in low- and middle-income countries. In Botswana, a sub-Saharan African upper middle-income country,⁸ with an estimated 2014 population of 2.04 million,⁹ the epidemiology of traumatic orthopaedic injuries is unknown. Although there is lack of data on the epidemiology of traumatic orthopaedic injuries in Botswana, the country has high rates of road traffic accidents (RTAs) and related fatalities.^{10,11} Furthermore, RTAs cause traumatic injuries, which could greatly contribute to the number of traumatic orthopaedic injuries in Botswana.

Studies have shown that RTAs are the most common determinant of traumatic orthopaedic injuries, with a prevalence of 39.1%¹² and 63.6%.⁷ Some researchers report that RTAs are the most common determinant of fractures, with a fracture prevalence of 29.4%,¹³ 49.3%¹⁴ and 68.4%.¹⁵ Similarly, falls have been shown to be a serious public health problem worldwide.¹⁶⁻¹⁸ Studies have shown that falls are the second most common determinant of traumatic orthopaedic injuries, with a prevalence of 21.8%⁷ and 35.1%.¹² However, the contribution and prevalence of falls to traumatic orthopaedic injuries in Botswana are unknown. The present study, therefore, aims to evaluate the epidemiology of traumatic orthopaedic injuries for inpatients at Princess Marina Hospital, Botswana. This study was conducted with the specific objective to determine the demographic profile, prevalence, and determinants of traumatic orthopaedic injuries.

Materials and methods

Study design

We performed a retrospective descriptive cross-sectional study at Princess Marina Hospital, one of two tertiary government referral hospitals in Botswana, located in Gaborone.

Study period

We chose the period August 2014 to January 2015 to include non-festive and festive seasons in Botswana. It was hypothesised that more traumatic orthopaedic injuries would be recorded during the festive season.¹⁹

Participants and data collection

Our study population consisted solely of patients with orthopaedic injuries and who had been admitted to male and female orthopaedic wards from 1 August 2014 to 31 January 2015. From those patients, we identified those with traumatic orthopaedic injuries as our sample of convenience. A sample of convenience

is very easy to carry out and the cost and time required to perform it are small in comparison to probability sampling techniques.²⁰ All arthroplasty patients (such as patients admitted for total knee and hip replacements) were excluded from the study, as most arthroplasty patients' injuries were due to non-traumatic causes. In addition, joint replacement data could obscure findings because Princess Marina Hospital relies on surgeons from South Africa to perform arthroplasty only three or four times a year.

Admission and discharge registers from male and female orthopaedic wards were used to obtain the patient's name, age, sex, diagnosis, and medical record number. In the case of patients with no medical record numbers in the registers, their names were used to obtain their medical record numbers through the Integrated Patient Management System (IPMS). The IPMS is a comprehensive, state-of-the-art healthcare information technology system used for capturing healthcare data on a computer.²¹ The information collected from the registers in the male and female orthopaedic wards helped us to look for patients' files in the Medical Record Unit at the Princess Marina Hospital. Once the files were obtained, a data collection form was used to record age, sex, date of admission, date of injury, date of discharge, radiological investigations performed, and the type and determinants of orthopaedic injuries from the patients' files. When a patient had more than one injury, each injury was counted separately.

The principal investigator and one of the co-investigators independently reviewed the first 20 patients' files to assess the reliability of the data collection methodology. Each study participant was given a unique identification number. A register of the unique identification numbers and patients' names was kept locked separately from the data collected. Missing data were coded as missing after two unsuccessful searches for files. Data were backed up on an external hard drive after each capturing session and kept separately by the principal investigator.

Statistical analysis

Kappa statistics were used to determine the reliability of radiological investigations, and types and determinants of orthopaedic injuries data obtained from the first 20 patients' files between the principal investigator and one of the co-investigators. The data obtained were entered into Microsoft Excel 2010. Stata 13 software was used to perform statistical analysis. For the age of patients enrolled in our study, median and interquartile ranges were calculated and illustrated with histograms. Categorical variables (types of traumatic orthopaedic injuries, their determinants, sex and radiological investigation) were described using frequencies, percentages and bar charts.

Ethics

Before the commencement of the study, ethics approval was obtained from Stellenbosch University (Ethics ref no S15/09/211), the Health Ministry of Botswana (ref no HPD ME 13/18/1X [193]), and the Princess Marina Hospital research committee (ref no PMH 5/79 [224]). Informed consent was waived by the ethics committees since we performed a retrospective chart review and there was no direct contact with the patients.

Results

A total of 693 orthopaedic patients had been admitted to male and female orthopaedic wards at the Princess Marina Hospital during the study period. Files were found for only 506 (73.0%) of patients. The remaining 187 patients (27.0%) were thus excluded as their medical records were still missing after two unsuccessful searches. Of the 506 patients, 372 (73.5%) had been admitted with traumatic orthopaedic injuries and 134 (26.5%) with non-traumatic orthopaedic injuries.

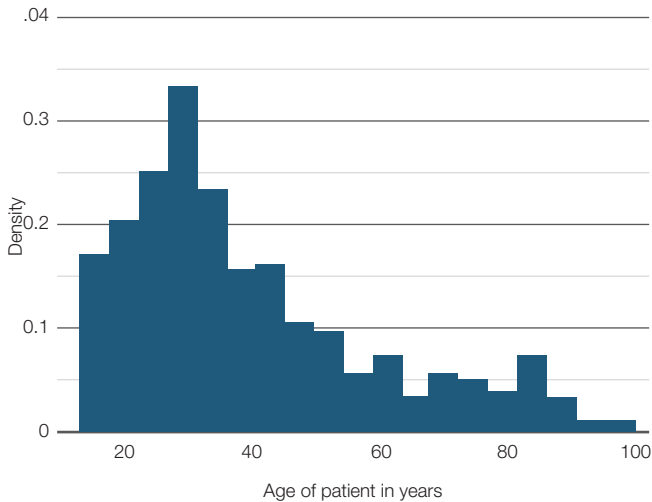


Figure 1. Histogram of patients' age

The Kappa statistics for radiological investigations, and types and determinants of orthopaedic injuries data, revealed a statistically significant agreement ($p < 0.0001$) between the two observers. The median age of the 372 patients with traumatic orthopaedic injuries enrolled in the study was 33.5 years (IQR= 25–50) (Figure 1).

The admission rates were the highest for adults up to the age of 49 years ($n=277$, 74.5%). The proportion of males admitted was higher than the proportion of females admitted with a sex ratio of 7:3. Younger males were more likely to be admitted than younger females. From 60 years and older, females were more affected than males (Table I). Most patients were admitted in the months of August (84 patients) and September (80 patients). Otherwise, a lower but relatively even number of patients was admitted monthly from October 2014 through January 2015 (Figure 2).

Of the 372 patients admitted with traumatic orthopaedic injuries, 258 patients (69.4%) had fractures only and 38 (10.2%) patients had fractures which were combined with dislocation or subluxation (Figure 3). In total there were 547 cases of injury, with the most common injury being fractures (413 cases, 75.5%) and the most common fracture site being the lower limbs (250 cases, 45.7%), followed by the upper limbs (118 cases, 21.6%) and the spine (26 cases, 4.8%) and pelvis (19 cases, 3.5%). There were 55 cases (10.1%) of various dislocations and subluxations.

Table I: Age of patients admitted with traumatic orthopaedic injuries

Age in years	Sex		Number of patients (%)
	Male (%)	Female (%)	
13 to 19	30 (11.5)	8 (7.2)	38 (10.2)
20 to 29	74 (28.4)	26 (23.4)	100 (26.9)
30 to 39	66 (25.3)	23 (20.7)	89 (23.9)
40 to 49	40 (15.3)	10 (9.0)	50 (13.4)
50 to 59	22 (8.4)	8 (7.2)	30 (8.1)
60 to 69	12 (4.6)	11 (9.9)	23 (6.2)
70 to 79	6 (2.3)	9 (8.1)	15 (4.0)
80 to 89	11 (4.2)	10 (9.0)	21 (5.6)
90 to 99	0 (0.0)	4 (3.6)	4 (1.1)
≥100	0 (0.0)	2 (1.8)	2 (0.5)
Total	261(70.2)	111(29.8)	372 (100)

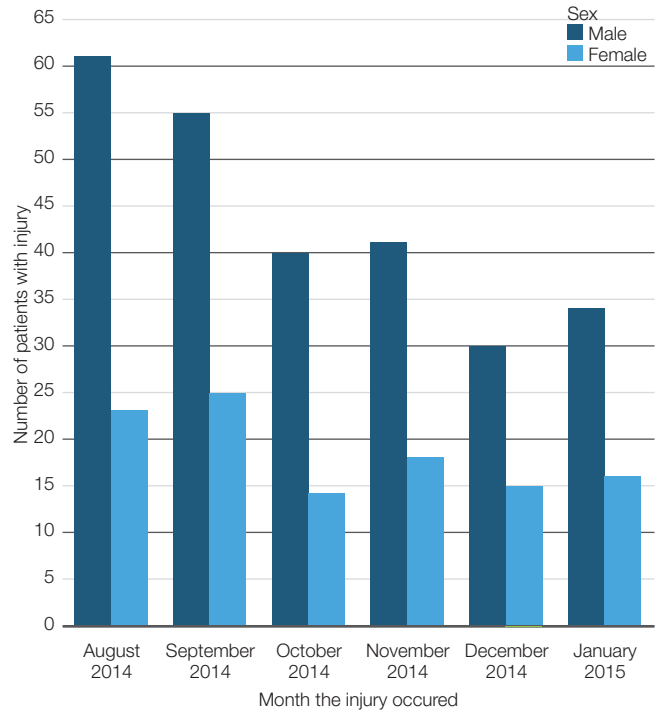


Figure 2. Patients with traumatic orthopaedic injuries admitted per month

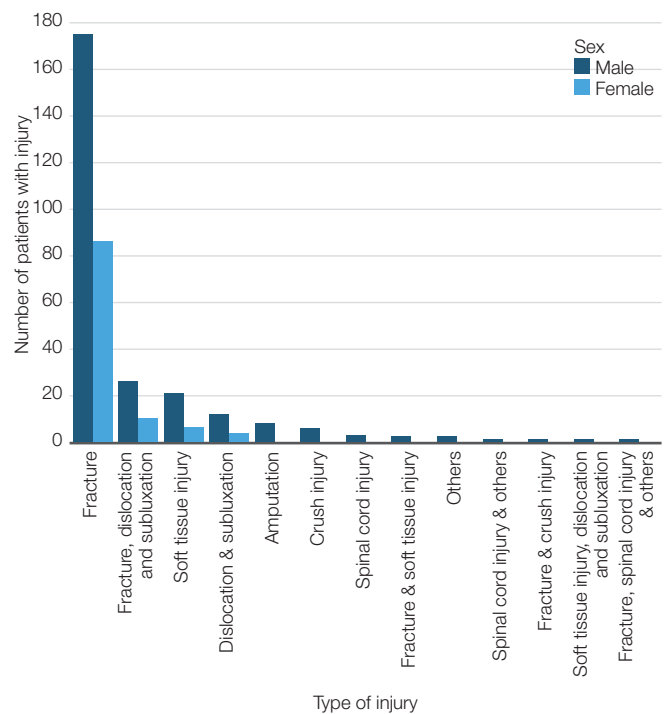


Figure 3. Types of traumatic orthopaedic injuries among 372 patients

Of the 41 (7.5%) cases of soft tissue injury, 22 (4.0%) were tendon injuries, five (0.9%) were nerve injuries, three (0.5%) were ligament injuries, while 11 (2.0%) were unspecified injuries. There were 18 (3.3%) cases of amputations, eight (1.5%) cases of crush injury, seven (1.3%) cases of spinal cord injury, and five (0.9%) cases with other types of injury (Table II). Our data show that of the 372 patients with traumatic orthopaedic injuries, 307 (82.5%) were aged between 13 and 59 years (Table III).

Table II: Types of traumatic orthopaedic injuries for admission

Type of injury	Number of injuries	Percentage
Fracture	413	75.5
Lower extremity	250	45.7
Upper extremity	118	21.6
Spine	26	4.8
Pelvic	19	3.5
Dislocation and subluxation	55	10.1
Soft tissue injury	41	7.5
Ligament	3	0.5
Nerve	5	0.9
Tendon	22	4.0
Unspecific	11	2.0
Amputation	18	3.3
Crush injury	8	1.5
Spinal cord injury	7	1.3
Others	5	0.9
Total	547	100

Generally, patients stayed in the hospital for less than a month (305 patients, 82.0%), with more than 50% staying for less than ten days. Two patients remained as inpatients more than 100 days, with one patient staying 107 days and the other 171 days (Figure 4).

The most common radiological investigation used was X-ray, which was used in 343 patients (92.2%), followed by a combination of X-ray and other investigations (19 patients, 5.1%), computed tomography (CT) scan (six patients, 1.6%), while magnetic resonance imaging (MRI) and a combination of CT-scan and MRI were the least used (two patients (0.5%)) (Table VI). Among the 19 patients who underwent a combination of X-ray and other investigations, there were 14 cases of X-ray and CT-scan, four cases of X-ray and MRI, and one case of X-ray and ultrasound.

Table III: Types of traumatic orthopaedic injuries by age

Age (year)	Fracture	Dislocation & subluxation	Spinal cord injury	Crush injury	Soft tissue injury	Amputation	Others	Number of patients
13 to 19	43 (10.4)	6 (10.9)	0 (0.0)	0 (0.0)	2 (4.9)	0 (0.0)	1 (20.0)	38 (10.2)
20 to 29	92 (22.3)	20 (36.4)	2 (28.6)	4 (50.0)	24 (58.5)	6 (33.3)	1 (20.0)	100 (26.9)
30 to 39	109 (26.4)	15 (27.3)	2 (28.6)	3 (37.5)	7 (17.1)	6 (33.3)	2 (40.0)	89 (23.9)
40 to 49	63 (15.3)	7 (12.7)	0 (0.0)	1 (12.5)	4 (9.8)	1 (5.6)	0 (0.0)	50 (13.4)
50 to 59	36 (8.7)	3 (5.5)	2 (28.6)	0 (0.0)	3 (7.3)	5 (27.8)	1 (20.0)	30 (8.1)
60 to 69	23 (5.6)	2 (3.6)	1 (14.3)	0 (0.0)	1 (2.4)	0 (0.0)	0 (0.0)	23 (6.2)
70 to 79	18 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	15 (4.0)
80 to 89	24 (5.8)	1 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	21 (5.6)
90 to 99	3 (0.7)	1 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.1)
≥100	2 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)
Total	413 (75.5)	55 (10.1)	7 (1.3)	8 (1.5)	41 (7.5)	18 (3.3)	5 (0.9)	372 (100)

Table IV: Determinants of traumatic orthopaedic injuries

Determinants	Number	Percentage
Fall	145	39.0
RTA	95	25.5
Assault	57	15.3
Sports-related	28	7.5
Machine	24	6.5
Gunshot	4	1.1
Others	19	5.1
Total	372	100

Falls were the most common determinant of traumatic orthopaedic injuries, being responsible for 145 (39.0%) of injuries, followed by RTAs in 95 cases (25.5%). Other determinants were assault in 57 cases (15.3%), sports injuries in 28 cases (7.5%), machine-related injuries in 24 cases (6.5%), gunshot injuries in four cases (1.1%) and others in 19 cases (5.1%) (Table IV). In general, our data showed that the determinants we studied predominantly affected adults aged 13 to 49 years. We note that patients most commonly affected by falls were aged 30 to 39 years (n=23;15.9%), followed by those aged 80 to 89 years (n=19; 13.1%) (Table V).

Discussion

The study aimed to evaluate the epidemiology of traumatic orthopaedic injuries for inpatients at Princess Marina Hospital. The results of our study revealed that the highest number of patients admitted with traumatic orthopaedic injuries were young male adults. Fractures were the most common type of traumatic orthopaedic injury, with falls being the most common determinant of those injuries.

Similar to findings from studies conducted elsewhere,^{6,7,22,23} our study showed that the majority of patients admitted were males, with a male-to-female ratio of 7:3. The sex difference may be due to the fact that males tend to exhibit more risky behaviour^{15,16} and are perhaps more involved in outdoor activities than females.

The mean age of patients with traumatic orthopaedic injuries enrolled in our study was 33.5 years, similar to 34.5 years reported by Soleymanha *et al.*²³ The present study revealed that the admission rates were the highest for young adults between the ages of 13 and 49 years (n=277, 74.5%), similar to the findings from other studies,^{6,7,14} indicating that the majority of people involved in RTAs were in the productive age groups. Both the mean age and disproportionately higher admission rates for younger adults could lead to loss of productivity and negatively impact the economy.

Table V: Determinants by age group

Age in years	Determinants (%)							Number of patients
	RTA	Fall	Gunshot	Machine	Sports-related	Assault	Others	
13 to 19	13 (13.7)	15 (10.3)	0 (0.0)	1 (4.2)	5 (17.9)	1 (1.8)	3 (15.8)	38 (10.2)
20 to 29	31 (32.6)	18 (12.4)	1 (25.0)	9 (37.5)	15 (53.6)	23 (40.4)	3 (15.8)	100 (26.9)
30 to 39	26 (27.4)	23 (15.9)	3 (75.0)	9 (37.5)	5 (17.9)	18 (31.6)	5 (26.3)	89 (23.9)
40 to 49	16 (16.8)	16 (11.0)	0 (0.0)	2 (8.3)	2 (7.1)	10 (7.5)	4 (21.1)	50 (13.4)
50 to 59	6 (6.3)	18 (12.4)	0 (0.0)	1 (4.2)	1 (3.6)	3 (5.3)	1 (5.3)	30 (8.1)
60 to 69	2 (2.1)	17 (11.7)	0 (0.0)	1 (4.2)	0 (0.0)	1 (1.8)	2 (10.5)	23 (6.2)
70 to 79	1 (1.1)	13 (9.0)	0 (0.0)	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	15 (4.0)
80 to 89	0 (0.0)	19 (13.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.8)	1 (5.3)	21 (5.6)
90 to 99	0 (0.0)	4 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (1.1)
≥100	0 (0.0)	2 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)
Total	95 (25.5)	145 (39.0)	4 (1.1)	24 (6.5)	28 (7.5)	57(15.3)	19 (5.1)	372 (100)

Table VI: Radiological investigation used for traumatic orthopaedic injuries

Radiological investigation	Frequency	Percentage
X-ray	343	92.2
X-ray and others	19	5.1
CT scan	6	1.6
MRI	2	0.5
CT scan and MRI	2	0.5
Total	372	100

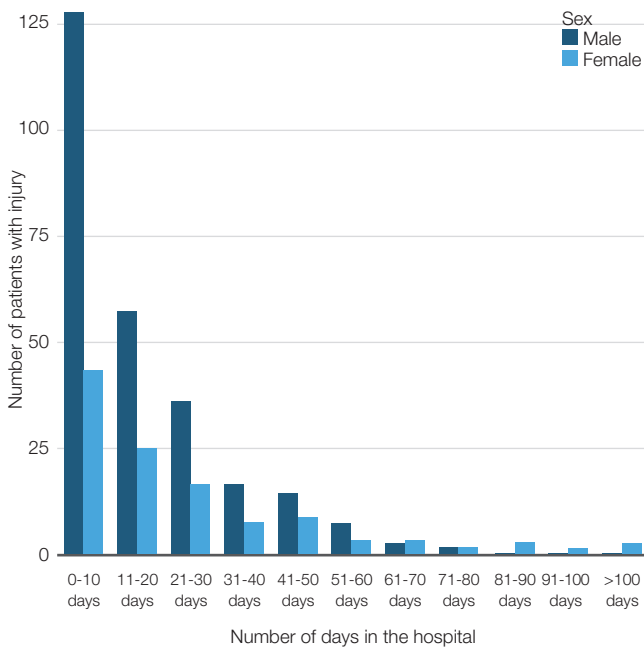


Figure 4. Length of stay of patients with traumatic orthopaedic injuries by sex

The present study also showed that females aged 60 years and older were more affected by traumatic orthopaedic injuries than males. This finding might be due to a higher rate of osteoporosis in older females when compared to men, as supported by Taylor and Young¹⁹ and Collinge *et al.*,²⁴ who reported increased incidence or prevalence of osteoporotic fractures in older females.

We identified 547 injuries, with the most common type being fractures (75.5%) and the most common site being the lower limbs, consistent with findings from other studies.^{6,7,14} The reason for the fractures being the most common traumatic injury is perhaps apparent and due to the forceful injury determinants involved (see below). Extremities are exposed and thus more susceptible to trauma, usually due to direct trauma in vehicle accidents¹⁴ or falls.

Although others found that falls were the second most common determinant of traumatic injuries after RTAs,⁸ our study revealed that falls were the most common determinant of traumatic orthopaedic injuries, with a prevalence of 39.0%. Similarly, Soleymanha *et al.* reported that the highest frequency of traumatic orthopaedic injuries related to falls (prevalence of 38.3%).²³ In the present study, we also found the second highest proportion of falls in the very old adults (80 to 89 years). The World Health Organisation (WHO) reported that the likelihood of falls increased with age-related biological change, with a high incidence over the age of 80 years.¹⁷ Older people usually fell due to factors related to their physical environment, which included excessively high or narrow steps, slippery surfaces, darkness or excessive lighting, and random objects on the surface.¹⁷

We showed that the second most common determinant (25.5%) of traumatic orthopaedic injuries was RTAs, with the vast majority of victims in the 13- to 49-year age group. Our findings are similar to those of Thomas *et al.*¹⁴ and Manna *et al.*,¹⁵ who showed that ~75% of RTA victims were younger than 45 years. A previous analysis of RTAs occurring in Gaborone, Botswana revealed that casualties were very high in the 20- to 39-year age group and that human factors, such as driver/rider negligence, unsafe following distances, failure to comply with signs, and being under the influence of alcohol or drugs were the main causes of traffic accidents, followed by unattended animals on the streets.²⁵

We found that the third determinant of traumatic orthopaedic injuries was assault (15.3%), and that the age group most affected (72%) was 20 to 39 years old. Similarly, Manoharan *et al.* showed that assault was more common in the same age group in patients with traumatic orthopaedic injuries.²⁶ We note that in general, the 20- to 39-year-old age group was most affected by all types of injury, not just for assault, both in our study and that by Manoharan *et al.*²⁶

We found that the highest admission numbers of patients with traumatic orthopaedic injuries were in August and September. Contrary to expectations, a smaller number of patients was admitted during the festive season (December and January). We think that the lower admission rate may be due to the fact that a large number of Gaborone residents typically travel out

of the city for holidays, mostly to their home villages and farms, during this period. In contrast, the highest number of patients with traumatic orthopaedic injuries were admitted in June in a district general hospital in England;¹⁹ the authors suggested that the high admission rate could be due to the summer activities. Our study showed that the vast majority of patients stayed in hospital for less than a month, with 56% staying for up to ten days. Similar to our findings, Taylor and Young showed that the average length of stay for patients was primarily related to the type of injury sustained, and that the majority of patients stayed in the hospital for a relatively short period of time.¹⁹

Study strengths

We used quick and relatively inexpensive study design and methods. Although we did not find all charts, we were able to locate and review 73.5% of charts for all patients of interest admitted during the study period.

Study weaknesses

Since we collected data retrospectively, we could not always be certain of data accuracy. Furthermore, we do not know how the missing charts may have modified the epidemiologic profile of traumatic orthopaedic injuries and study outcomes.

In addition, a significant number of RTA victims who die before reaching the hospital may have been missed. It is also possible that some patients were admitted under other services, such as general surgery and intensive care, and had orthopaedic injuries, but were discharged from the hospital without being admitted to orthopaedic wards and were thus missed. The collection of data using convenience sampling in a tertiary referral hospital would preclude us from extrapolating findings to a national level.

Conclusion

Young male adults sustained traumatic orthopaedic injuries more than any other group studied. Fractures were the most common type of the injuries, while falls, RTAs, and assaults were the three most common determinants of the injuries. Our results may help guide where efforts to improve healthcare delivery and public health policy should be focused.

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