

The Burden of Orthopaedic Gunshot Injuries on Healthcare Resources in South Africa

Sithombo Maqungo¹, Case Martin², Gerhard Thiar¹, Graham McCollum¹, Steve Roche¹

¹Department of Orthopaedic Surgery, Groote Schuur Hospital, University of Cape Town, South Africa

²University of Texas Southwestern Medical Center, Dallas, Texas



Introduction

Injuries inflicted by gunshot wounds (GSW) are an immense financial burden on the South African healthcare system.

In 2000, South Africa experienced 27,563 homicides, of which more than half (54%) were firearm-related.¹ Although annual homicides have decreased considerably since then, thanks in part to tighter gun laws, South Africa still faces a high rate homicides and firearm-related violence. In 2012, South Africa ranked the 11th most deadly country in the world according to the United Nations Office on Drugs and Crime (UNODC) with a homicide rate of 31.1 per 100,000.² According to UNODC, the proportion of all homicides committed by firearms in South Africa is about 45%.³ The South African Police Service (SAPS) recorded 16,259 homicides in their 2012-2013 annual report,⁴ meaning approximately 7,317 homicides were firearm-related. Consequently, South Africa had a gun-related mortality rate of 14.0 per 100,000. For comparison, the United States reported a firearm mortality rate of 10.4 per 100,000 in 2011.⁵

While the mortality rate attributable to firearms in South Africa is high, the burden of non-fatal firearm-related injuries is far worse. In 2005, Allard et al. postulated that South African state hospitals treat approximately 127,000 firearm victims each year. Based on the 21 patients in the study who required hospital admission and emergency abdominal surgery, the authors calculated treating abdominal gunshot wounds cost \$1,467 per patient – at the time, an amount 13 times greater than the annual per capita government health expenditure.⁶

Norberg, et al. followed in 2009 by assessing the average inpatient cost of all patients with firearm-related injuries who required admission for greater than 12 hours, thereby excluding minor injuries and injuries for which care was futile. From the 128 patients that met the criteria, the authors calculated the average cost per patient to be \$2,230.⁷

Objective

No estimates have been made to assess the financial burden of gunshot injuries in South Africa from an orthopaedic perspective. This study, therefore, sought to estimate the burden and average cost of treating gunshot wound victims requiring orthopaedic interventions in a South African tertiary level hospital.

Methods

This study was conducted in Cape Town, South Africa at Groote Schuur Hospital (GSH), a 893-bed hospital – one of the three largest university-affiliated state hospitals in South Africa.

The retrospective study surveyed over 1,500 orthopaedic admissions at Groote Schuur Hospital over a 12-month period in 2012. By looking at each orthopaedic inpatient's imaging and records, patients with injuries inflicted by gunshots were identified. Chart review subsequently yielded data on theatre time, number and type of implants, duration of admission, diagnostic-imaging studies performed, blood products used, laboratory studies ordered, and medications administered. Information provided by Groote Schuur Hospital's finance department then allowed for a cost analysis of each patient in South African Rand.

The South African Rand was converted to the US Dollar using the United States government Treasury Department's published end-of-year exchange rates of 8.485 Rand to \$1.00 from December 31, 2012.⁸

Results

A total of 111 patients were identified that had orthopaedic GSW-related injuries and for whom complete data was available.

- Patients included in the study consisted of 104 males and 7 females with an average age of 28 years (range 13-74 years).
- Each patient was hit by an average of 1.69 bullets (range 1-7 bullets).
- These patients sustained a total of 147 fractures.
- The majority of injuries occurred in the lower extremities with 38.8% of all fractures in femurs, 15.6% in tibias, and 11.6% in fibulas.
- Ninety-five patients received surgical treatment for a total of 135 procedures – 112 orthopaedic procedures, 13 orthopaedic procedures with concurrent general or vascular surgery procedures, and 10 separate trauma procedures - with a cumulative surgical time of 220 hours 3 minutes.
- Cumulative anesthesia time was 306 hours 25 minutes.

Theatre costs, excluding implants, were in excess of R800,000 (estimated \$94,284). Eighty of the patients received a total of 99 implants during surgery, which raised theatre costs an additional R452,935 (\$53,381) cumulatively, or R5,661.70 (\$667.26) per patient. Total costs were in excess of R1 million for ward admissions, R180,000 for imaging, R190,000 for blood products, R16,000 for laboratory investigations, and R16,000 for discharge medication. Individual patient costs range from R157,850.17 (\$18,603) to R2,584.70 (\$305) for an average of about R24,834.43 (\$2,927) per patient.



Figure 1. Femoral fracture from a gunshot wound. Photo taken by author.

Interpretation

This study assesses the burden of orthopaedic firearm injuries in South Africa. It estimates that on average treating a patient with an orthopaedic gunshot wound costs R24,834.43 (\$2,927), utilizes about 3 hours of theatre time per operation, and necessitates a hospital bed for an average period of 10 days.

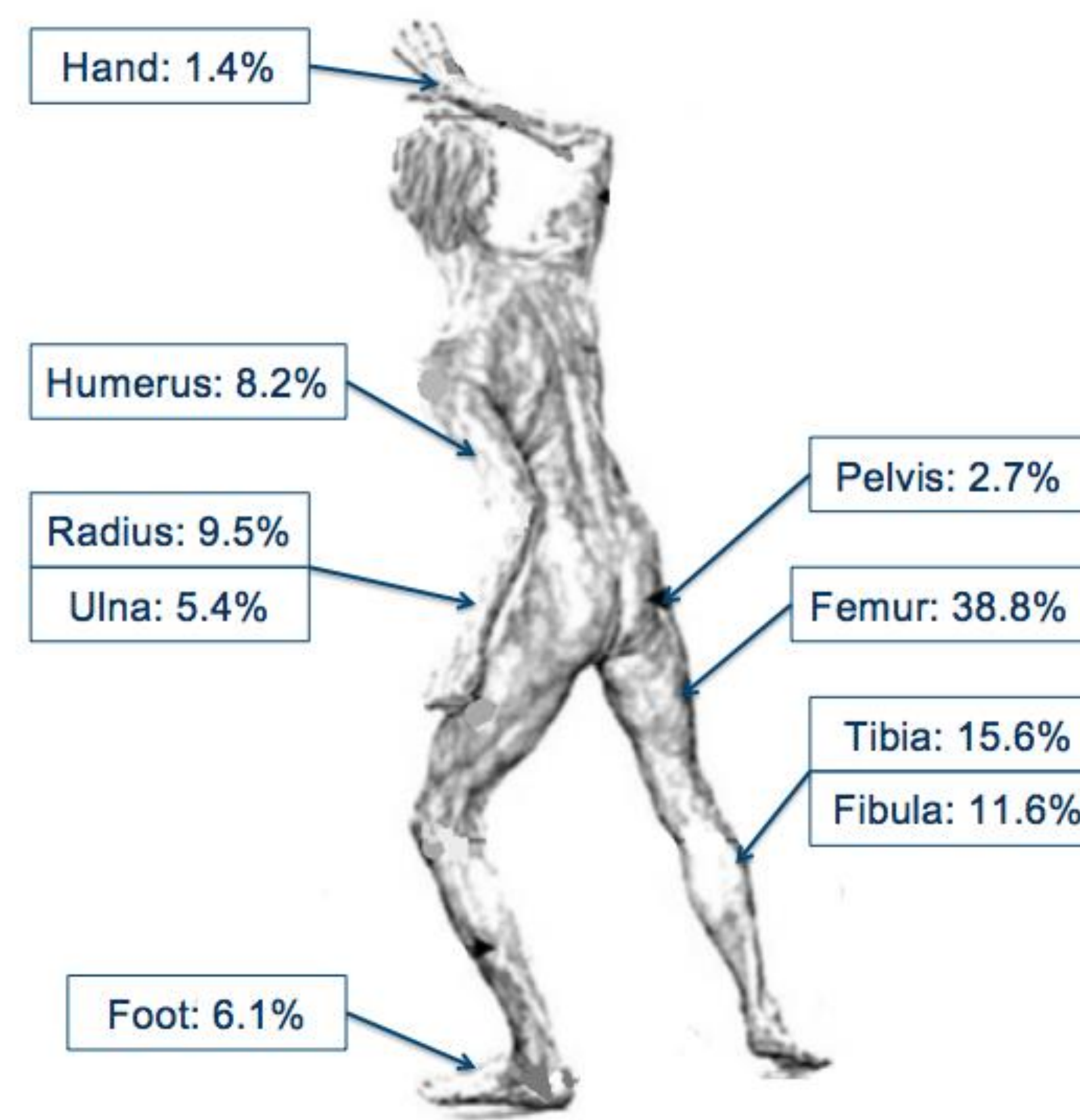


Figure 2. Fractures incurred by gunshot wounds, shown by location (n = 147 fractures).

In 2012, the South African government allotted R117 billion (approximately \$13.8 billion) to the healthcare budget. The public healthcare system serves more than 80% of the population, yet public funding constitutes less than half of South Africa's total healthcare expenditures. Only 30% of doctors serve the public sector while 70% of doctors, including most specialists, work in the private sector. Patients exclusively funded by public healthcare cost the state an annual R1,900 per person (approximately \$224).⁹

With an average cost per patient of \$2,927, orthopaedic gunshot wound patients cost the South African state 13.1 times the national expense per person in the public health sector.

Conclusions

When compared to previous estimates of the costs associated with non-orthopaedic gunshot wound cases, treating orthopaedic gunshot wound patients is significantly more expensive.

The cost of the implants used in orthopaedic procedures accounts for much of this increased expense per patient. Implant prices would be even higher without the numerous cost saving measures – e.g. reusing parts of external fixators – Groote Schuur Hospital's orthopaedic department implements to minimize the implant price per patient. Additionally the South African government reduces the cost of implants for each of its hospitals by using a tender system among orthopaedic suppliers and buying implants in bulk. Despite these measures, implant costs remain high and represented 36% of total theatre expenses.

With a greater understanding of not only the high incidence of orthopaedic gunshot wounds treated in a South African tertiary care trauma center but also the costs incurred, the state healthcare system can better prioritize orthopaedic trauma funding and training opportunities while also supporting cost saving measures, including the redirection of financial resources to primary prevention initiatives.

Future Directions

While this study assesses the average cost of treating orthopaedic gunshot wound patients in Cape Town, little data is available to utilize this estimated figure in an attempt to determine the total number of orthopaedic gunshot wound patients throughout South Africa. Similarly, few studies have definitively determined what percentage of all gunshot wound victims in South Africa suffer orthopaedic injuries. Consequently, studies to determine these two figures would help to determine a more accurate national cost of the burden of orthopaedic gunshot wounds. Additionally, comparative studies of the costs in South Africa with those in other countries, including the United States, may help national health care systems better anticipate costs, advocate for primary prevention, and minimize trauma associated expenditures.

Acknowledgements

Funding for this project was made possible by grants from the UT Southwestern Medical Student Summer Research Program and the UT Southwestern Office of Global Health.

References

1. Norman, Rosana, Richard Matzopoulos, Pam Groenwald, Debbie Bradshaw. "The High Burden of Injuries in South Africa." *Bulletin of the World Health Organization*. Sep 2007; 85(9): 695-702.
2. UNODC. "Global Study on Homicide 2013: Trends, Context, Data." United Nations Office on Drugs and Crime. Vienna. http://www.unodc.org/documents/gsh/pdfs/2014_GLOBAL_HOMICIDE_BOOK_web.pdf.
3. UNODC. "Global Study on Homicide 2011: Trends, Context, Data." United Nations Office on Drugs and Crime. Vienna. http://www.unodc.org/documents/data-and-analysis/statistics/Homicide/Globa_study_on_homicide_2011_web.pdf.
4. South African Police Service. "Crime Statistics: April 2013-March 2014." http://www.saps.gov.za/resource_centre/publications/statistics/crimestats/2014/crime_stats.php.
5. Centers for Disease Control and Prevention. "All Injuries, Mortality." <http://www.cdc.gov/nchs/fastats/injury.htm>.
6. Allard, D and VC Burch. "The cost of treating serious abdominal firearm-related injuries in South Africa." *SAMJ* 95.8 (Aug 2005): 591-594.
7. Norberg, Johannes, Thomas Nilsson, Anders Eriksson, Timothy Hardcastle. "The costs of a bullet – inpatient costs of firearm injuries in South Africa." *SAMJ* 99.6 (Jun 2009): 442-444.
8. IRS. "Treasury Reporting Rates of Exchange as of December 31, 2012." <http://www.irs.gov/Businesses/Small-Businesses-&Self-Employed/Treasury-Department-End-of-Year-Exchange-Rates>.
9. WHO. "Bridging the Gap in South Africa." *Bulletin of the World Health Organization* 88.11 (Nov 2010): 803-804.

Table 1. Costs of orthopaedic gunshot wound injuries per patient (in US Dollars, n = 111 patients)

	Treatment Total	Surgical Procedure *95 patients	Implants *80 patients, 99 implants	Inpatient	Diagnostic Imaging	Discharge Medications	Blood Products	Laboratory Tests
Average	2,927	700	667	1,162	194	18	203	17
Median	2,389	576	589	777	174	3	45	18
Std Dev	2,595	449	357	943	118	62	742	39
Maximum	18,603	3,084	1,768	5,889	716	594	4,690	227
Minimum	305	164	28	111	46	0	0	0