

Acute Fracture Care at a Tertiary Referral Hospital in Northern Tanzania: Systems Limitations to the Provision of Definitive Treatment in the Developing World

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Introduction

- The burden of musculoskeletal disease in low/middle income countries (LMIC) continues to increase mainly due to **road traffic crashes (RTC)**
- Globally, RTCs constitute over 1.35 million deaths annually**
 - more than HIV/AIDS, TB and diarrheal diseases combined
 - third leading cause of disability for people aged 15-44 [1,2]
- Traumatic MSK injuries often necessitate orthopaedic surgical treatment
 - in LMICs, definitive care is not readily accessible for most patients
- Countries in Sub-Saharan East-Africa are no exception to this scenario
 - Tanzania experienced 17,840 deaths due to RTCs
 - 9th highest mortality rate from RTCs worldwide [2]
- For a population of **50 million people: 45 orthopaedic surgeons**
 - only **one** orthopaedic surgeon for every **1.1 million Tanzanians** [3]
- Current workforce unable to address the demand for orthopaedic services
- Our group previously characterized the orthopaedic burden at **Kilimanjaro Christian Medical Center (KCMC)** in northern Tanzania
- At this tertiary referral center, the orthopaedic volume is comparable to that of a level one trauma center in the United States of America (USA)
 - **only 10% of population have access to orthopaedic surgical care**
- As RTCs continue to rise in the developing world, the current growth rate and true burden of orthopaedic injuries is still unknown [1]

In this study, we:

- calculated the % of orthopaedic patients that received definitive fixation for their orthopaedic injury when surgery was indicated
- re-evaluated KCMC's orthopaedic burden and documented the growth-rate since 2015 in the absence of any system level changes



We hypothesized that:

- the number of patients that received definitive treatment of their musculoskeletal injury would be less than previously reported, and
- the burden of disease at KCMC would grow considerably over a three-year period [4]

Methods

Setting

- KCMC** is a 700-bed facility in northern Tanzania
- One of the country's four large tertiary referral centers
- Catchment area covers 12.5 million people
- KCMC treats 110,000 outpatients and admits 25,000 patients annually
- Limited material and intellectual resources
 - Four full-time equivalent orthopaedic surgeons
 - 17 orthopaedic residents
 - 16 trained nurses (three nurses per shift)
 - Orthopaedic ward: 66 total beds
 - Five operating theaters: **only 1 dedicated to orthopaedic surgery**
 - Second theater is shared with general surgery and ob/gyn
 - One full-time anesthesiologist and 11 nurse anesthetists
- No established pre-hospital emergency response system

Study Design

Retrospective Data

All available ED, outpatient clinic and orthopaedic ward records were reviewed by two authors (WH and MJ). Review of ED records established the total number of orthopaedic consultations. Outpatient analysis determined the total number of evaluated clinic patients and the percentage of patients presenting with health insurance. Retrospective review of orthopaedic ward data determined the number of ward admissions, diagnoses and discharge status (including deaths).

Prospective Data

All patients, except those with isolated spine injuries, admitted to the orthopaedic ward during the study period were included for prospective data collection. When available, admission and post-operative radiographs were collected and reviewed by two senior orthopaedic surgery resident authors (AP and CP). The authors classified each admission radiograph according to the 2018 AO/OTA Fracture and Dislocation Guidelines and determined if surgical fixation was indicated.[5] Post-operative radiographs were evaluated for the presence of definitive surgical fixation. Patients who received open reduction and internal fixation (ORIF) or intramedullary nailing were categorized as having undergone definitive surgical fracture treatment; isolated external fixation was categorized separately. Hardware removal procedures were also categorized as definitive treatment.

Results

Retrospective Cohort

Clinical Setting	2015	2018	Percentage Change
EMD Consultations	3,358	2,179	-35.1%
Orthopaedic Clinic Patients	6,379	11,266	+76.6%
Orthopaedic Ward Admissions	1,430	1,672	+16.9%
Total Patients	11,172	15,117	+35.3%

- KCMC treats an average of 15,117 orthopaedic patients each year
 - 74.5% are seen as outpatients in clinic
 - 14.4% are encountered in the emergency department and
 - 11.1% are inpatients in the orthopaedic ward

Prospective Cohort

- June 18 – July 31, 2018 (6-weeks)*
 - **190 patients** admitted
 - 41 isolated spine patients omitted from analysis

Variable	n	%	Mechanism of Injury	n	%
Age, years			RTC	89	46.8
0-14	23	12.1	Motorcycle	47	52.8
15-44	104	54.7	Pedestrian	25	28.1
45-64	37	19.5	Car	11	12.4
More than 64	26	13.7	Truck	3	3.4
Age, years, mean (SD)	39.2 (22.1)		Bicycle	2	2.2
Sex, male	147	77.4	Bus	1	1.1
Occupation			Falls	60	31.6
Farmer	38	20.0	Infection	14	7.4
Business	31	16.3	Tumor/Mass	10	5.3
Student	31	16.3	Assault	7	3.7
Field worker	26	13.7	Crush Injury	6	3.2
Driver	15	7.9	Other	4	2.1
Tradesman	12	6.3			
Unemployed	10	5.3			
Other	27	14.2			

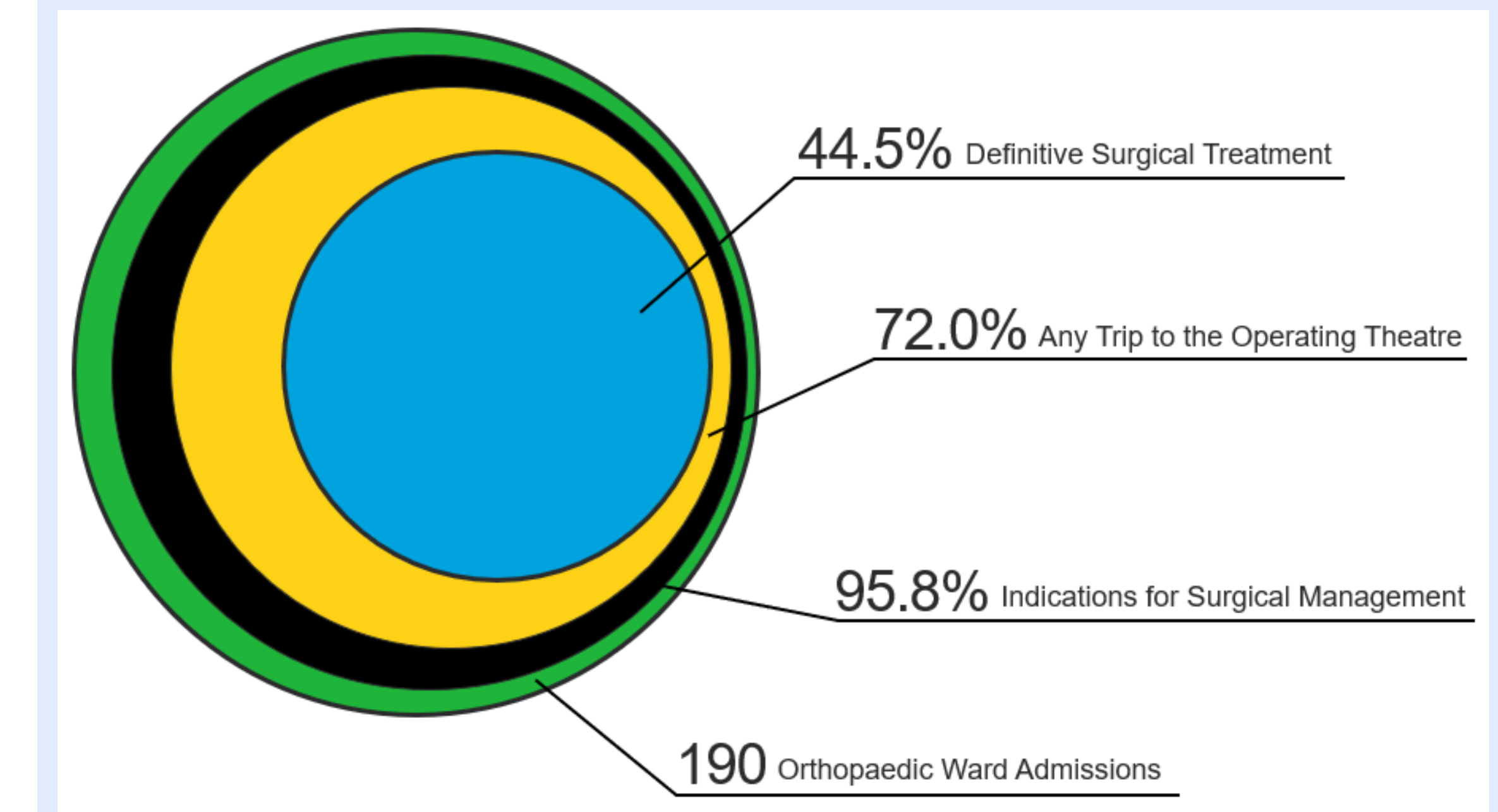
- The majority of admitted patients were male and under 45 years old
- RTC (46.8%)** was the most common etiology of injury
 - followed by falls (31.6%), and infections (7.4%)
- The majority of RTCs (68.5%) were motorcycle-related (inc pedestrians)
- 77.9% of patients were admitted for **fracture** treatment
 - **Femur fractures (31%)** were most common
 - 34.5% had at least one **open** fracture
 - 83.8% had a **lower extremity** fracture
- Average time to surgery was 4.2 days, average LOS was 13.1 days

Fracture	AO/OTA Classification	n	%
Femur		62	31.0%
Trochanteric Region	31A	13	21.0%
Femoral Neck	31B	12	19.4%
Femoral Head	31C	0	0.0%
Diaphyseal - Simple	32A	18	29.0%
Diaphyseal - Wedge	32B	10	16.1%
Diaphyseal - Multi-fragmentary	32C	3	4.8%
Distal Extraarticular	33A	2	3.2%
Partial Articular	33B	1	1.6%
Complete Articular	33C	2	3.2%
Tibia		27	13.5%
Proximal Articular	41	5	18.5%
Diaphyseal	42	20	74.1%
Distal Articular	43	2	7.4%
Fibula		23	11.5%
Proximal Articular	4F1	4	17.4%
Diaphyseal	4F2	18	78.3%
Distal Articular	4F3	1	4.3%
Foot		23	11.5%
Metatarsal	87	15	65.2%
Phalanx	88	6	26.1%
Talus	81	1	4.3%
Foot Crush Injury	89	1	4.3%
Radius		12	6.0%
Proximal Articular	2R1	0	0.0%
Diaphyseal	2R2	6	50.0%
Distal Articular	2R3	6	50.0%
Ankle		11	5.5%
Infra-syndesmotric Fibula Injury	44A	0	0.0%
Trans-syndesmotric Fibula Fracture	44B	3	27.3%
Supra-syndesmotric Fibula Fracture	44C	8	72.7%
Pelvis		9	4.5%
Acetabulum	62	4	44.4%
Pelvic Ring	61	5	55.6%
Humerus		9	4.5%
Proximal Articular	11	2	22.2%
Diaphyseal	12	2	22.2%
Distal Articular	13	5	55.6%
Hand		9	4.5%
Metacarpal	77	7	77.8%
Phalanx	78	1	11.1%
Scaphoid	72	1	11.1%
Ulna		7	3.5%
Proximal Articular	2U1	0	0.0%
Diaphyseal	2U2	4	57.1%
Distal Articular	2U3	3	42.9%
Other		8	4.0%
Patella	34	5	62.5%
Rib	16	2	25.0%
Clavicle	15	1	12.5%



Results - Continued

- Very few non-surgical patients were admitted to ward over the six-weeks
- 95.8% of admissions had indications for surgical fixation**
 - only 72.0% were taken to the operating theatre
- However, many patients taken to the operating theatre received only temporizing treatments such as surgical toilet or traction pin placement
 - **only 44.5% received definitive treatment** for their fracture



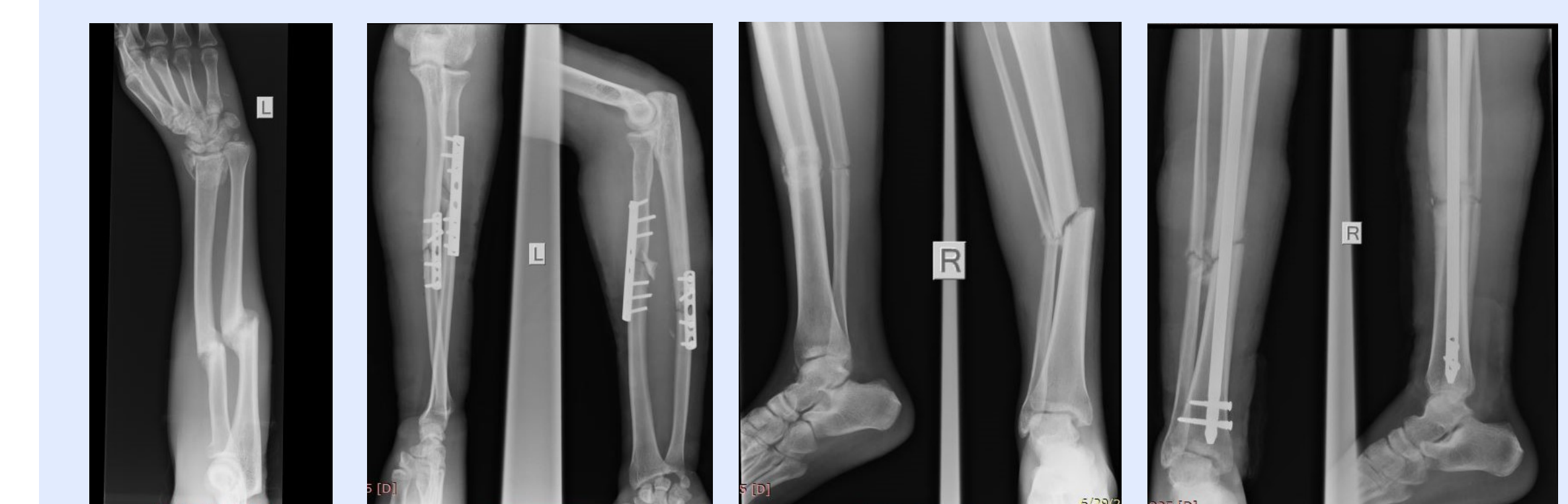
Discussion

Retrospective Data

- Our research team reported in 2015 that KCMC sees an average of 11,172 orthopaedic patients every year
- Three years later, that number has risen to 15,117 patients
 - an **increase of over 35% in total orthopaedic burden**
- The **musculoskeletal disease burden is persistent and growing**

Prospective Data

- The Global Burden of Disease 2017 study predicts a 26.0% increase in worldwide road traffic injuries by 2030
 - this study supports this projection [6]
- The burden of orthopaedic surgical disease seen at KCMC
 - is dominated by trauma
 - is increasing at a rate similar to or above that of global estimates [7]
- Significantly fewer available resources leaves a growing burden of neglected orthopaedic surgical disease



Conclusion

- Without new strategies to address this worsening situation, the discrepancy between supply and demand for musculoskeletal surgical care in the developing world will continue to worsen.
- Collaborative efforts are underway to develop an Orthopaedic Center of Excellence at KCMC [8,9]
- Volunteer surgeons at international academic institutions will provide:
 - year-round surgical services
 - specialty training
 - sustainable access to implants
 - a mechanism to address post-operative complications
- This venture's financial structure is devised to deliver democratized orthopaedic care
 - patients would have access to care regardless of their ability to pay
- The foundation of this long-term partnership is **education** at every level
 - a critical component of creating a **sustainable solution**

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