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Public versus private surgical treatment of common orthopedic injuries in Zambia: A retrospective review

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Abstract

Background: Trauma is a leading cause of disability and death in low- and middle-income countries, largely due to orthopedic injuries. In Zambia, public and private hospitals differ in medical resources, yet their orthopedic trauma care management and treatment outcomes have not been studied.
Purpose: This study aims to characterize and compare orthopedic injury patterns, treatment methods, and postoperative outcomes between a public and a private hospital in Zambia to identify disparities and inform improvements in trauma care.
Methods: This retrospective cohort study reviewed 512 orthopedic cases treated between 2021 and 2025 at Lusaka's public University Teaching Hospital (UTH) and private St. John Paul II Orthopedic Hospital (SJPII). Data included demographics, injury types, treatment methods, and postoperative outcomes.
Results: A total of 512 patients received orthopedic treatment in Zambia, with 258 managed at a public hospital (UTH) and 254 at a private hospital (SJPII). Femur, tibial shaft, and distal radius fractures were most common, with SJPII treating more complex fractures like bimalleolar ankle and acetabular fractures. Open reduction internal fixation (ORIF) was more common at UTH for femur (N=33 vs. 11), tibial shaft with fibula (N=27 vs. 6), and humerus fractures (N=13 vs. 10), while SJPII performed more ORIFs for bimalleolar ankle (N=32 vs. 7). SJPII favored intramedullary nailing for tibial shaft with fibula (N=30 vs. 6) and femur fractures (N=21 vs. 1) and conducted all hip replacements (N=17 vs. 0). UTH favored external fixation (N=16 vs. 4) and skeletal traction (N=4 vs. 0). Despite similar time to surgery between hospitals, complication rates were significantly higher at UTH (70.5% vs. 35.0%; $p<0.001$), with more infections, bleeding, and reoperations observed.
Conclusion: Significant disparities exist in injury patterns, treatment approaches, and patient outcomes between public and private hospitals in Zambia. The private hospital had greater access to advanced surgeries like intramedullary nailing and hip replacements, while the public hospital relied more on external fixation, skeletal traction, and other less invasive procedures, likely due to resource limitations. Despite similar patient volumes and time to surgery, the public hospital experienced substantially higher rates of postoperative complications, underscoring critical gaps in care infrastructure. These findings emphasize the need to strengthen resources and implement targeted strategies to improve orthopedic trauma care and reduce healthcare inequities in Zambia.
Study Design: Retrospective Cohort; Level III.

Keywords: LMICs, Zambia, orthopedic trauma, orthopedic surgery, surgical disparities

Introduction

Orthopedic injuries remain a major source of morbidity and mortality in low-to- middle-income countries (LMICs) in large part driven by lack of necessary healthcare resources [9, 21, 33, 44, 47]. In addition to insufficient healthcare resources, healthcare workforce shortages, and a payment system that relies on out-of-pocket payments (OOPs) creates challenges to expediting the development of trauma systems capable of handling the trauma that is occurring in Africa [1, 4, 13, 15, 18, 27, 49]. These barriers are compounded by a rising burden of trauma, with mortality and disability rates continuing to increase across Africa [12, 16, 38, 47]. Together, limited resources, financial constraints, and an escalating trauma load create a significant challenge to building effective trauma care systems across Africa. However, if these challenges are strategically addressed, a significant portion of trauma-related death and disability could be avoided [5, 14, 30].

A practical strategy for improving trauma care, without the need for large-scale investments such as constructing new hospitals or expanding medical schools, is to optimize the use of existing resources. This requires a clear understanding of the types of trauma encountered, the treatment approaches currently employed, and the outcomes associated with those treatments. To date, few studies have systematically collected such data in sub-Saharan Africa, and the majority of available research has focused on South Africa [10, 11, 20, 22, 27, 39, 40, 42-43]. This study aims to address that gap by categorizing orthopedic trauma cases, treatment timelines, modalities, and outcomes at one public (University Teaching Hospital, UTH) and one private (St. John Paul II Mission Hospital, SJPII) facility in Zambia.

Zambia is an illustrative case of the healthcare challenges faced in low- and middle-income countries (LMICs) when treating orthopedic trauma. In Zambia, trauma accounts for approximately 20% of premature deaths and 7% of all annual deaths[36]. Zambia is currently undergoing rapid economic change manifested by rapid urbanization and motorization, both which increase the incidence of trauma [36, 41]. In addition, Zambia is a temporary home for more than 35,000 refugees for which the government provides healthcare [45]. These growing intrinsic and extrinsic stressors on an already stretched health system will likely cause even more trauma-related deaths and disabilities if they aren't properly addressed.

This retrospective study compares orthopedic surgical care at one public and one private hospital in Zambia, with a specific focus on time to treatment and short-term outcomes, including postoperative complications and reoperation rates, as available in the medical record. By defining orthopedic injuries encountered, time to treatment, resources available for treatment and outcomes at these facilities, this information can be used to develop care pathways that result in optimal outcomes for patients using currently available resources. In addition, this information can be used from a healthcare investment perspective by defining areas in orthopedic trauma care that warrant more resource allocation and training.

Methods

Study Design: A retrospective cohort study was conducted in spring 2025 and involved a chart review of 512 orthopedic patients treated between 2021 and 2025 who were treated at either the University Teaching Hospital (UTH), a public referral center, and St. John Paul II Orthopedic and Surgical Hospital in Lusaka, Zambia. The aim was to obtain information on the type of orthopedic trauma encountered at these two institutions as well as time to treatment and some limited clinical outcome data.

Data Source: Clinical and administrative data were obtained from two tertiary-level institutions in Lusaka, Zambia: The University Teaching Hospital (UTH), a public referral center, and St. John Paul II Orthopedic and Surgical Hospital, a private specialist facility. Both hospitals maintain standardized patient records, which were accessed with institutional approval and appropriate ethical clearance.

Inclusion and Exclusion Criteria: Patients were eligible for inclusion if they underwent surgical treatment for an orthopedic injury and had complete medical records available for review during the study period (2021-2025). Patients were excluded if they had incomplete or missing demographic, treatment, or outcome data. Patients were also excluded if they were treated non-operatively or had surgeries for oncologic or congenital conditions not related to acute orthopedic trauma.

Data Extraction: A total of 512 patient records were reviewed from both institutions. Extracted variables included demographic data (age and sex); clinical characteristics such as injury type and classification (e.g., hip fracture, tibial fracture, ankle fracture), surgical treatment modality, and need for additional procedures; and health system factors including wait time to surgery, treatment cost, facility type (public vs. private), and insurance status. Time to surgery was calculated from the date of injury to the date of initial surgical intervention; time to initial presentation or admission was not consistently recorded and thus not included. For this study's purposes, outcomes refer specifically to measurable postoperative parameters, rather than long-term functional status or mortality, which were not consistently available during data collection. Data was abstracted using standardized extraction forms to ensure consistency across sites.

Risk of Bias Assessment / Statistical Analysis: Descriptive statistics were used to summarize patient demographics and clinical characteristics. Categorical variables were compared using chi-square or Fisher's exact tests, while continuous variables were analyzed using independent t-tests. Associations between wait times, facility type, cost, insurance status, and outcomes were assessed using multivariate logistic regression to adjust for potential confounders such as age, gender, and mechanism of injury. A p-value < 0.05 was considered statistically significant. Analyses were conducted using excel.

Results

A total of 512 patients who underwent orthopedic surgery were included, with 258 patients treated at the University Teaching Hospital (UTH, public) and 254 at St. John Paul II Hospital (SJPII, private) (Table 1). The overall average patient age was 39.0 years, with SJPII patients significantly older (43.5 years) than those at UTH (34.5 years) ($p<0.001$). Male patients represented 65.0% of the cohort, with a slightly higher proportion at UTH (67.8%) compared to SJPII (62.2%), (P=.182).

Mechanism of Injury

Falls were the most common cause of injury overall (48.0%, N=246), particularly at SJPII (N=144). Road traffic accidents (RTAs) were the second most common mechanism, with pedestrian RTAs (N=87), passenger-related RTAs (N=80), and driver RTAs (N=43). Assaults and other mechanisms were also causes of injury. Common fracture types included tibial shaft fractures with associated fibula fractures, intertrochanteric femur fractures, distal radius fractures, bimalleolar ankle fractures, and pelvic and acetabulum fractures (Figure 1).

Fracture Incidence by Hospital

487 orthopedic fractures were managed surgically during the study period: 248 at the public hospital (UTH) and 239 at the private hospital (SJPII) (Figure 1). The most frequently treated injuries were femur fractures (N=105),

tibial shaft fractures with associated fibula fractures (N=93), and distal radius fractures (N=90). These injuries were relatively evenly distributed across both hospitals (Femur: 52 UTH, 53 SJPII; Tibial shaft with Fibula: 53 UTH, 40 SJPII; Distal radius: 54 UTH, 36 SJPII). However, bimalleolar ankle fractures were treated more commonly at SJPII (N=35) compared to UTH (N=10), and tibial plateau fractures were more frequent at SJPII (11 vs. 7). Skeletal trauma requiring pelvic fracture management was comparable (8 UTH, 7 SJPII), while acetabular fractures were only reported at SJPII (N=2).

Table 1: Patient Demographics *characterized by age, sex, time to surgery, surgical urgency and mechanism of injury.*and** indicate significance at p<0.050 and p<0.001 respectively. Abbreviations: SJPII, St. John Paul II Mission Hospital (private); UTH, University Teaching Hospital (public); RTA, road traffic accident; SD, standard deviation.*

Patient Characteristics by Hospital				**Hospital Comparison**		
Characteristic	**Total (N=512)**	**SJPII (N=254)**	**UTH (N=258)**	**Test**	**P-Value**	**Significance**
Age, mean (years)	39	43.5	34.5	T-Test	< 0.001	**
Sex, n (%)						
Male	333 (65.0%)	158 (62.2%)	175 (67.8%)	Chi2	0.182	
Female	179 (35.0%)	96 (37.8%)	83 (32.2%)			
Time to Surgery, mean (days ± SD)	18.5 ± 79.0	18.8 ± 102.9	18.2 ± 44.1	T-Test	0.929	
Surgical Urgency, n (%)						
Non-Urgent	327 (63.9%)	169 (66.5%)	158 (61.2%)	Chi2	0.871	
Urgent	95 (18.6%)	50 (19.7%)	45 (17.4%)			
Mechanism of Injury, n (%)						
Fall	246 (48.0%)	144 (56.7%)	102 (39.5%)	Chi2	< 0.001	**
RTA–Pedestrian	87 (17.0%)	20 (7.9%)	67 (26.0%)			
RTA–Passenger	80 (15.6%)	24 (9.4%)	56 (21.7%)			
RTA–Driver	43 (8.4%)	34 (13.4%)	9 (3.5%)			
Assault	26 (5.1%)	10 (3.9%)	16 (6.2%)			
Other	26 (5.1%)	18 (7.1%)	8 (3.1%)			
Unknown	5 (1.0%)	5 (2.0%)	0 (0.0%)			

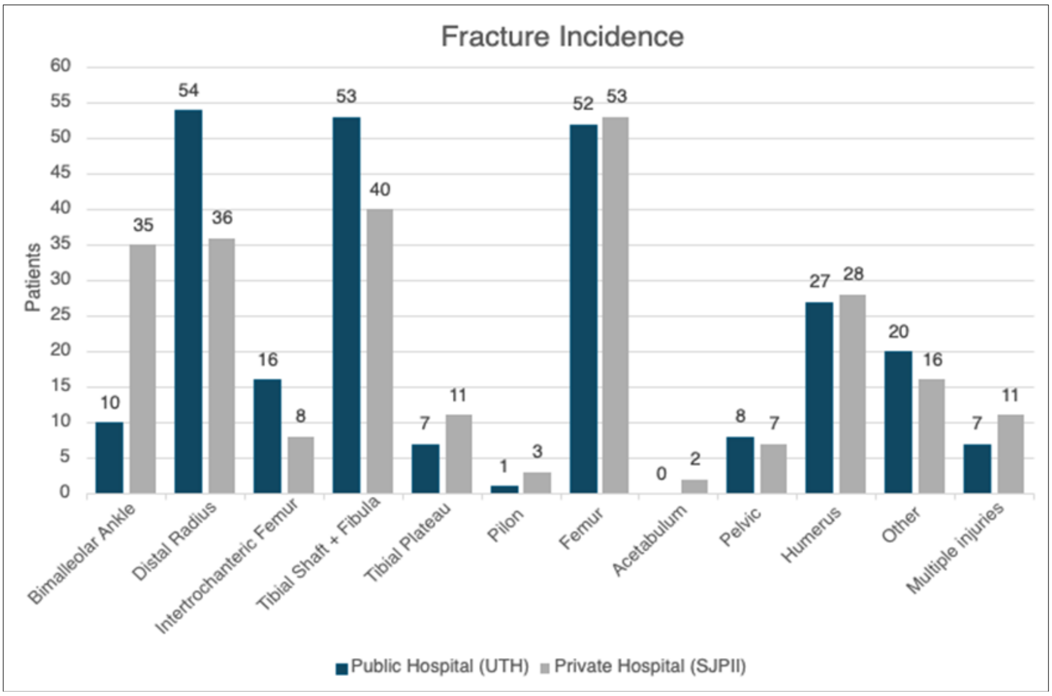

Fig 1: Fracture Incidence *by anatomical location compared between public and private hospitals observed. Fisher Test indicates there is a statistically significant difference between the public and private hospital (P=0.003). Abbreviations: SJPII, St. John Paul II Mission Hospital (private); UTH, University Teaching Hospital (public).*

Surgical Management

The average time to surgery was similar between hospitals: 18.2±44.2 days at UTH and 18.8±103.1 days at SJPII (P=0.929). However, significant differences in surgical management were observed between the public and private hospitals (Table 2). ORIF was more frequently performed at UTH for femur fractures (N=33 vs. 11), tibial shaft with fibula fractures (N=27 vs. 6), and humerus fractures (N=13 vs. 10), while SJPII conducted more ORIFs for bimalleolar ankle fractures (N=32 vs. 7) and pelvic fractures (N=2 vs. 1). IM nailing was used significantly more at SJPII, particularly for tibial shaft with fibula (N=30 vs. 6) and femur fractures (N=21 vs. 1). UTH favored external fixation (N=16 vs. 4) and skeletal traction (N=4 vs. 0), while hip replacements were performed exclusively at SJPII (N=17 vs. 0). UTH also reported a higher number of procedures categorized as "Other", especially for distal radius fractures (N=31 vs. 15).

Table 2: Surgical Data *by surgical type for common orthopedic injuries compared to public and private hospitals. Abbreviations: SJPII, St. John Paul II Mission Hospital (private); UTH, University Teaching Hospital (public); ORIF, Open Reduction Internal Fixation; IM Nailing, Intermedullary Nailing; PRIF, Percutaneous Reduction Internal Fixation; PCSF, Percutaneous Screw Fixation; DHS, Dynamic Hip Screw; MUA, Manipulation under Anesthesia.*

Procedure Type	Bimalleolar Ankle Fracture	Distal Radius Fracture	Intertrochanteric Femur Fracture	Tibial Shaft fracture w/ Fibula Fracture	Tibial Plateau Fracture	Pilon Fracture	Femur Fracture	Acetabulum Fracture	Pelvic Fracture	Humerus Fracture
ORIF UTH	7	21	13	27	6	1	33	0	1	13
ORIF SJPII	32	21	8	6	8	2	11	2	2	10
IM Nailing UTH				6			1			0
IM Nailing SJPII				30			21			6
External Fix UTH		1	1	12			1		1	
External Fix SJPII		0	0	2			2		0	
PRIF UTH					1					
PRIF SJPII					0					
PCSF UTH					0					
PCSF SJPII					2					
Metal Plate & Screws UTH							12			
Metal Plate & Screws SJPII							7			
Skeletal Traction UTH							1		3	
Skeletal Traction SJPII							0		0	
Hip Replacement UTH							0		3	
Hip Replacement SJPII							13		4	
Other UTH	3	31	0	7	0	0	3		0	5
Other SJPII	3	15	4	2	1	1	1		1	0
Other Procedures	MUA	MUA + cast, MUA and pinning	DHS fixation	MUA and cast, debridement	Total Knee Arthroplasty	MUA + cast	MUA + cast		Girdle Arthroscopy	

Complications

Postoperative complication rates were markedly higher at the public hospital (Figure 2). Overall, 70.5% of patients at UTH experienced at least one complication, compared to 35.0% at SJPII (*p*<0.001). The most frequently reported complications included bleeding (UTH 82 vs. SJPII 12), excess postoperative pain (UTH 46 vs. SJPII 44), and infection (N=19 vs. 9, respectively). Other complications such as blood clots, dislocations, nerve damage, and miscellaneous adverse events were also recorded, with UTH consistently demonstrating higher frequencies. Nerve damage was more prevalent at SJPII (N=15) compared to UTH (N=5), despite lower overall complication rates. Finally, patients at UTH were significantly more likely to require additional surgical interventions (45.7%) than those at SJPII (2.8%), (*p*<0.001).

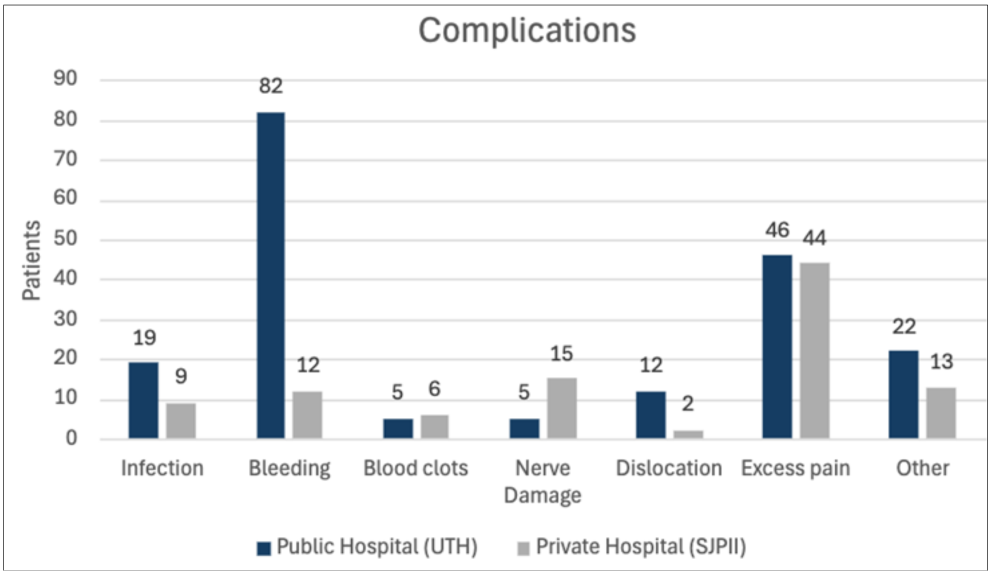

Fig 2: Complications in Public Versus Private Hospitals *stratified by infection, bleeding, blood clots, nerve damage, dislocation, pain, and other complications. Fisher Test indicates there is a statistically significant difference between the public and private hospital (p<.001). Abbreviations: SJPII, St. John Paul II Mission Hospital (private); UTH, University Teaching Hospital (public).*

Discussion

A total of 512 patients undergoing orthopedic surgery were included in this study, with 258 treated at the public University Teaching Hospital (UTH) and 254 at the private St. John Paul II Hospital (SJPII). The average patient age was significantly lower at UTH (34.5 years) compared to SJPII (43.5 years) (*p*<.001), and males comprised a higher proportion at UTH (67.8% vs. 62.2%), (P=.182). Falls accounted for nearly half of all injuries (48.0%), especially at SJPII (56.7%), while road traffic accidents were more frequent at UTH (50.7%). The average time to surgery was similar between hospitals (UTH: 18.2±44.2 days; SJPII: 18.8±103.1 days; P=0.929), complication rates were significantly higher at UTH (70.5%) than SJPII (35.0%) (*p*<0.001).

The predominance of falls at SJPII and road traffic accidents at UTH aligns with broader trauma epidemiology trends in sub-Saharan Africa, where RTAs remain a major cause of orthopedic injuries among younger populations [32, 34]. The younger age and higher male predominance at UTH likely reflect socioeconomic and occupational risks common to public hospital patients, consistent with evidence that males face greater trauma exposure from work-related and transportation activities [35, 46]. Compared to private facilities, public hospitals often serve younger, lower-income, and more socioeconomically vulnerable populations, which may contribute to the increased overall complication rate seen at UTH. These trends reflect broader epidemiological patterns in low- and middle-income countries (LMICs), where rapid urbanization, unsafe working conditions, increased motorization, and inadequate road safety measures have fueled a sustained trauma epidemic [2, 7, 19, 27].

Although the overall time to treatment was not statistically significant between the two hospitals, it was measured from the date of injury to the date of surgery, overlooking key factors such as time to admission and initial presentation. These intervals may differ substantially between public and private institutions and could meaningfully impact surgical delays. For instance, some patients might initially present to public hospitals but later transfer to private facilities due to extended wait times.

Observed differences in surgical management between the public tertiary hospital (UTH) and the private mission hospital (SJPII) likely reflect broader systematic disparities in surgical infrastructure, resource availability, and clinical capacity. Intramedullary (IM) nailing was the predominant treatment for tibial shaft fractures at SJPII (81.8%), while UTH utilized it in only 18.2% of cases, favoring external fixation instead. This divergence may result from limited availability of implants, surgical expertise, or equipment at UTH. However, without detailed fracture classification data, it remains uncertain whether UTH is managing a higher proportion of complex fractures not amenable to IM nailing, or whether resource constraints are the primary barrier. A similar pattern exists for femur fractures, where IM nailing was performed frequently at SJPII (95.5%) but rarely at UTH (4.5%), which relied more on open reduction and internal fixation (ORIF). The absence of hip replacements at UTH, contrasted with their presence at SJPII (N=13), further illustrates disparities in specialized surgical capacity or operative resources. Bimalleolar ankle fractures were surgically managed far more often at SJPII, raising questions about patient referral patterns, case mix, or potential constraints in surgical resources and training at UTH. These differences in operative approaches suggest that, while SJPII provides more definitive, gold-standard treatments, UTH may be limited to temporizing or less optimal options due to systemic limitations. Ultimately, these patterns are consistent with prior studies reporting that public-sector hospitals in sub-Saharan Africa (SSA) often operate under severe resource constraints, leading to deviations from evidence-based fracture care [3, 36].

Differences in complications between the public tertiary hospital UTH and the private mission hospital SJPII likely reflect, at least in part, inequities in surgical resources and care environments. In this study, UTH experienced nearly twice as many complications as SJPII (191 versus 101; $p<.001$), with significantly higher rates of bleeding, infection, excess pain, and dislocations. These elevated rates in the public sector align with reports from sub-Saharan Africa (SSA) attributing complications to delayed interventions, inadequate sterilization, overcrowded wards, and workforce shortages [3, 25]. While SJPII's lower overall complication burden may reflect a more controlled surgical environment, consistent access to appropriate implants, and greater operative capacity, it is notable that SJPII reported a higher incidence of nerve damage for reasons that remain unclear. Beyond these procedural differences, infection rates at UTH were especially concerning given the presumed equivalent infection risks across sites, highlighting potential deficits in perioperative care or hospital sterility. While it is plausible that UTH treated a higher proportion of open or contaminated fractures, potentially elevating its infection rate, this cannot be confirmed with the current data. Regardless, the observed difference highlights the need for both improved infection control protocols and better data collection to stratify infection risk based on injury characteristics. An analysis of the bleeding complications at UTH (N=82) compared to SJPII (N=12) is also warranted to determine whether differences in surgical technique, use of intraoperative pharmacotherapeutics such as tranexamic acid, postoperative venous thromboembolism prophylaxis, or other environmental and patient factors contribute to the elevated bleeding rates at UTH. Interventions to reduce bleeding complications should then be implemented based on these findings. Collectively, these results reveal a complex interplay of factors such as resource availability, surgical expertise, patient case complexity, and institutional capacity that shape treatment decisions and outcomes. However, due to limitations in data granularity, particularly with respect to injury severity and operative indications, these relationships remain speculative and warrant further investigation. While referral of patients to better-equipped centers like SJPII may temporarily reduce disparities, sustainable improvements in infrastructure, training, and quality assurance at UTH are critical. Addressing these gaps is essential to advancing equitable trauma care and bringing public hospital orthopedic management in line with international standards.

Addressing the disparities between public and private orthopedic care in Zambia demands a comprehensive and collaborative approach. Efforts to improve trauma prevention, including road safety initiatives and fall risk reduction programs tailored to the demographic profiles of each hospital are crucial. At the same time, investing in infrastructure and capacity-building at public hospitals like UTH and SJPII can significantly improve surgical management capabilities and increase surgical capacity. Priorities include increasing access to advanced implants, standardizing perioperative care protocols, and supporting sustained surgical training and mentorship programs[6]. Persistent challenges in training, retaining, and equitably distributing surgical personnel continue to undermine orthopedic treatment capacity in Zambia and require deliberate policy and funding responses [8, 29]. Infrastructure investment must also include expanding the number and geographic distribution of healthcare facilities equipped to deliver safe, sterile, and specialized surgical care- an essential step toward reducing time to treatment and improving access for underserved populations [17]. Zambia's demonstrated success in implementing policies to reduce under-five mortality offers a model for similarly coordinated national strategies aimed at reducing trauma-related injuries [24]. Moreover, collaborative partnerships between private and public sectors and a coordinated strategy that integrates prevention, capacity building, and system strengthening will be vital to bridging the gap in orthopedic trauma care and improving outcomes across all patient populations. Future research should focus on evaluating the long-term impact of such interventions and identifying scalable, cost-effective solutions that address workforce gaps, optimize surgical delivery, and improve patient outcomes in both public and private environments.

Limitations

Several limitations should be considered when interpreting the findings of this study. The retrospective design relies on existing medical records, which may contain incomplete or inconsistent data. Differences in documentation practices between the two hospitals could introduce information bias. Notably, the private hospital (SJPII) used electronic records, while the public hospital (UTH) relied on paper documentation, introducing the possibility of differential data quality and completeness between sites. Data were collected by staff working on clinical floors, using a convenience-based approach that depended on available records rather than systemic sampling. As a result, the dataset may not fully capture the full spectrum of cases or outcomes at either institution. The study population is limited to two tertiary centers in Zambia, which may reduce generalizability to other regions in Zambia or similar low-resource settings. Unmeasured confounders such as socioeconomic status, preexisting comorbidities, and injury severity might have influenced outcomes despite adjustment attempts. Finally, variation in resource availability and treatment protocols between public and private hospitals complicates direct comparisons. Time to surgery was calculated from the date of injury to the date of surgery; however, this metric does not account for delays in presentation or admission. These are integral factors in understanding the broader systemic barriers to timely orthopedic care in Zambia. As such, the measure may not fully reflect the realities of access within the healthcare system. These limitations highlight the need for prospective, multi-center studies to better understand and address disparities in orthopedic care in Zambia.

Conclusion

Significant disparities exist in injury patterns, treatment approaches, and patient outcomes between public and private hospitals in Zambia. The private hospital had greater access to advanced surgeries like intramedullary nailing and hip replacements, while the public hospital relied more on external fixation, skeletal traction, and other less invasive procedures, likely due to resource limitations. Despite similar patient volumes and time to surgery, the public hospital experienced substantially higher rates of postoperative complications, underscoring critical gaps in care infrastructure. These findings emphasize the need to strengthen resources and implement targeted strategies to improve orthopedic trauma care and reduce healthcare inequities in Zambia.

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Conflict of Interest

Not available

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Not available

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