ORIGINAL ARTICLE

Functional Outcomes of Upper Limb Fractures in Children at Chawama Hospital in Lusaka, Zambia

Chiluba Simwanza[1*], Billiat Chongo[1], Fair Banji Mwiinga[1,2], Yangoy Mulangi[1], Faith Banda Malambo[1], Mutinta Nzima[1], Roster Chihwaka Malimba[1], Walubita Sayela[2]

[1]*Lusaka Apex Medical University, Lusaka, Zambia*
[2]*Ministry of Health, Zambia*

ABSTRACT

Background: Fractures in children represent a major global health problem and account for 10-25% of all childhood injuries. While management of these fractures may include operative and non-operative interventions, functional outcomes vary depending on the interventions used and how soon rehabilitation is instituted post-injury.

Objective: To determine the functional outcomes of upper limb fractures in children at Chawama Hospital in Lusaka, Zambia.

Methods: A quantitative descriptive cross-sectional study design was adopted for this study. The study was conducted among 80 randomly selected children presenting at Chawama Hospital for fracture rehabilitation. A modified researcher-assisted questionnaire adapted from the International Classification of Functioning (ICF) was used to collect data. Using SPSS v27.0, descriptive statistical analysis. All ethical principles were upheld accordingly.

Results: The majority of participants were aged 6–8 years (50%); 65% were males. Most of the fractures were caused by falls (45%), followed by trauma (35%), and child abuse (15%). Post-fracture presentation included pain (100%), joint stiffness (80%), muscle weakness (70%), numbness (45%), and deformity (35%). All fractures were managed conservatively using collar and cuffs (58%), plaster of Paris casts (23%) and arm slings (10%). In terms of fracture outcomes post-fracture, 60% of the participants were able to use the affected limb to eat; 30% were able to use the affected limb to handle objects; 7.5% were able to use the affected limb to dress; and 2.5% were able to use the affected limb to bath.

Conclusion: This study offers guidance on managing paediatric upper limb fractures, emphasizing conservative treatments. It advocates for updated guidelines, improved follow-up systems to reduce re-fracture risks and to ensure full recovery, as well as resource allocation for surgical care and rehabilitation. Additionally, it suggests capacity-building initiatives for healthcare professionals at Chawama Hospital to enhance their skills in diagnosing and treating paediatric fractures.

***Corresponding author:**
Chiluba Simwanza
Lusaka Apex Medical University, Lusaka Zambia
Email: simwanzamaryrose35@gmail.com

Keywords: functional outcomes, upper limb, fractures, children

This article is available online at: http://www.mjz.co.zm, http://ajol.info/index.php/mjz, doi: https://doi.org/10.55320/mjz.52.2.618

The Medical Journal of Zambia, ISSN 0047-651X, is published by the Zambia Medical Association

INTRODUCTION

A child, as defined by the United Nations Convention, is an individual below the age of 18 years. Injuries, particularly bone fractures, are a significant cause of morbidity and mortality among children and adolescents worldwide. In low- and middle-income countries (LMICs), including Zambia, access to proper fracture care is often limited, leading to elevated case fatality rates and long-term complications. Upper limb fractures are common in paediatric and adolescent populations, and they can result in severe functional impairments, significantly contributing to disability and placing a heavy financial burden on individuals, families, and societies".

Upper limb fractures occur frequently in the paediatric and adolescent patient populations. A recent study in Zambia by Mwiinga[1] found that upper limb fractures accounted for 79.5% of fractures in children, with fractures of the radius, ulna, and humerus representing 51.7%, 22.5%, and 19.1% of cases, respectively. This pattern is consistent with findings from other regions. These findings highlight the need for robust health system responses to address the increasing burden of upper limb fractures in children in Zambia. The outcomes and complications of managing such fractures are influenced by factors including the type of fracture, patient characteristics, comorbidities, and treatment approaches. While many fractures in children heal with good functional recovery, complications like infections, arm length discrepancies, delayed union, malunion, or non-union are not uncommon. Strengthening health systems globally to better manage these injuries has been widely advocated. The primary research gap is the lack of clear data on the functional outcomes of childhood upper limb fractures specifically in Zambia. While studies from other regions highlight complications and treatment outcomes, there is insufficient local data on the recovery and long-term consequences of these fractures in Zambian children. Despite literature identifying factors that can influence outcomes such as fracture type, patient characteristics, comorbidities, and treatment approaches, there is no detailed understanding of how these factors play out in the Zambian context. Therefore, this study aimed to evaluate the functional outcomes of upper limb fractures in children at Chawama Hospital in Lusaka, Zambia. This research is essential to address knowledge gaps and inform strategies for optimizing fracture management and outcomes in this population.

METHODS

Study design:

A descriptive cross-sectional study design was adopted using quantitative methods.

Study site:

The study was carried out at Chawama Hospital in Lusaka, Zambia. Chawama Hospital, a First Level facility in Zambia's capital, Lusaka, offers medical, surgical, obstetric, and diagnostic services to a catchment area with a population ranging from 80,000 to 20,000 individuals. It was chosen for the study due to its location in one of Lusaka's most populous and densely packed regions, providing a diverse demographic sample.

Study population:

This study included all children aged 6-12 years presenting at Chawama First Level Hospital with upper limb fractures. The age range 6-12 years was appropriate in studying upper limb fractures in children as it is characterized by rapid development, and heightened involvement in play and sports activities.

Sample selection:

Convenience sampling method was used to select study participants as and when they presented to Chawama First Level Hospital, Physiotherapy clinic.

Sample size:

The minimum sample size was determined mathematically using the Miller and Brewer (2017) as follows:

$$n= N/1+N\ (\alpha)^2$$

Where n is the minimum sample size; N is the study population (based on facility records, there were 102 cases of upper limb fractures in children; and α is the margin of error (0.05 at 95% confidence interval).

Substituting:
$n = 102/1+102\ (0.05)^2$
$n= 102/1+102\ (0.0025)$
$n=81.27$
n=82 children

Data collection:

Data collection was done using a researcher-administered questionnaire adapted from the International Classification of Functioning (ICF). The ICF is a validated tool with a Cronbach alpha coefficient of 0.915. The questionnaire was divided into four sections as follows: Section A captured sociodemographic details, including the age and gender of the participants; Section B focused on the fracture injuries, specifically their causes, such as falls, direct trauma, violence, pathological conditions, or other factors; Section C assessed the fracture management techniques employed used in terms of conservative management (e.g. immobilization in weeks using plaster of Paris (POP) or arm sling), and surgical management; and Section D assessed functional outcomes of upper limb fractures in children.

Data management and analysis:

Submitted questionnaires were checked for completeness and stored securely in a box file to which only the researcher had access. Collected data were sorted; coded; entered into the Statistical Package for Social Sciences (SPSS) v27.0 for Windows. The data were stratified and analysed based on the sections of the data collection tool and study variables. Using SPSS, descriptive statistical analysis was performed. Descriptive statistics included numerical measures such as mean, median, mode and standard deviation. These statistical operations were useful to demonstrate the central tendency and dispersion of the data, in line with the descriptive study design. No inference was done as that was outside the scope of the study. Results were summarized as frequencies and percentages and presented in form of tables and charts for easy interpretation.

Ethics approval

Ethics approval for the study was granted by the Lusaka Apex Medical University Bio-medical Research Ethics Committee (FWA 0029892, IRB 00001131, Ref 00592-23). Signed consent was obtained from the parents or guardians of the participants, and assent forms were signed by participants who were willing to participate in the study.

RESULTS

Eighty children were successfully recruited and interviewed using a researcher-administered questionnaire, representing a participant response rate of 98%. The findings of this study have been presented in the form of frequency tables and charts for ease of interpretation as follows:

Sociodemographic characteristics

The majority of participants were aged 6–8 years (50%, n=40), followed by those aged 9–10 years (30%, n=24), and 11–12 years (20%, n=16). Additionally, over two-thirds of the participants were male (65%, n=52), as detailed in Table 2 below:

Table 2: Sociodemographic characteristics of participants

Variable	Indicators	Frequency (n)	Percent (%)
Age (in years)	6-8	40	50
	9-10	24	30
	11-12	16	20
Gender	Male	52	65
	Female	28	35

Fracture injury information

The leading cause of upper limb fractures was falls, accounting for 45% (n=36) of cases, followed by trauma at 35% (n=28), child abuse at 15% (n=12), and other causes at 5% (n=4), as illustrated in the accompanying bar chart:

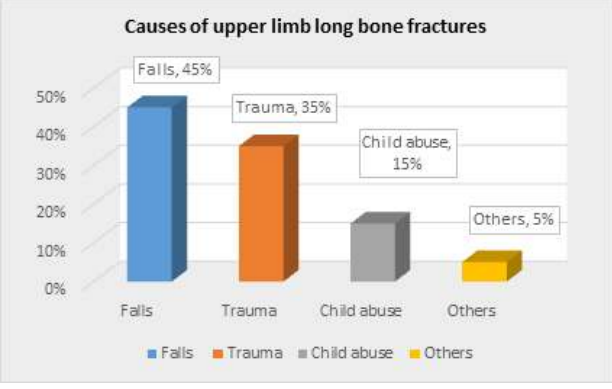

Figure 1: Causes of upper limb fractures in children

Notable clinical features observed upon presentation after upper limb fractures included weakness in the affected limb, loss of sensation, pain at the fracture site, and reduced range of motion. Pain was reported universally (100%), making it the most common complaint, followed by joint stiffness (80%), muscle weakness (70%), numbness (45%), and deformity (35%), as detailed below:

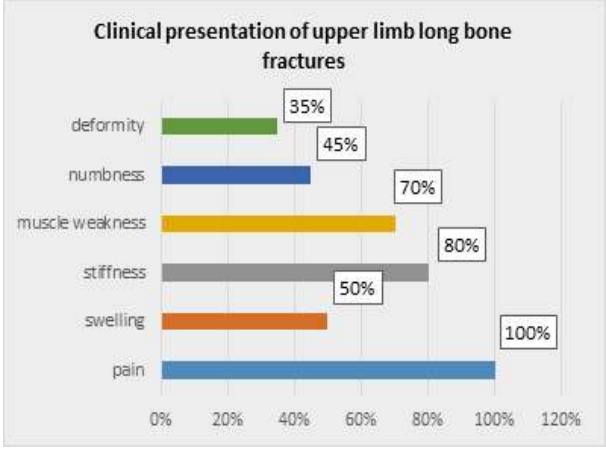

Figure 2: Notable clinical presentation post upper limb fracture

Fracture management techniques

All fractures in the study were managed conservatively, with the majority treated using collar and cuffs (58%), followed by plaster of Paris casts (23%) and arm slings (10%), as illustrated in the accompanying pie chart:

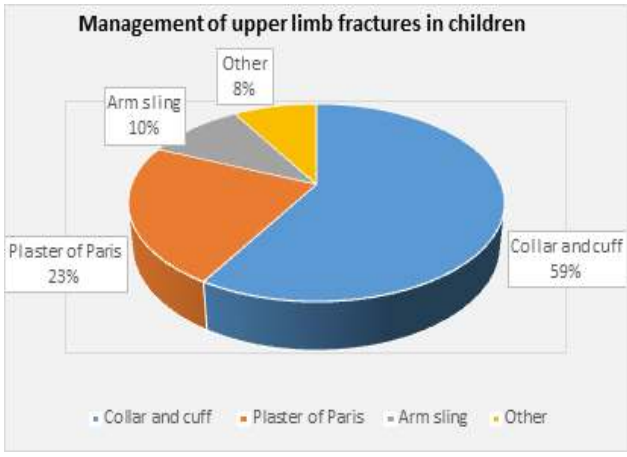

Figure 3: Management of upper limb fractures in children

Functional outcomes of upper limb fractures in children

A number of functional outcomes were reported post upper limb fractures as follows: two-thirds of the participants were able to eat using the affected limb post fracture; 30% were able to handle objects using the affected limb post fracture; 7.5% were able to dress using the affected limb post fracture; and only 2.5% were able to bath using the affected limb post fracture, as shown in Table 3 below:

Table 3: Functional outcomes post upper limb fractures in children

Activities of Daily Living	Frequency (n)	Percent (%)
Eating using affected limb	48	60.0%
Handling objects using affected limb	24	30.0%
Dressing using affected limb	6	7.5%
Bathing using affected limb	2	2.5%

DISCUSSION

While childhood is an important period of rapid growth and discovery, it is also a period of increased risk for injuries that could affect a child in later life. Documenting the functional outcomes of upper limb fractures is important in the formulation of strategies that aim at minimizing the impact that these injuries may cause in children. The aim of this study was to determine the functional outcomes of upper limb fractures in children aged 6-12 years presenting at Chawama First Level Hospital in Lusaka District. Below is a discussion of the findings:

Sociodemographic characteristics of participants

The study revealed a predominance of male participants, consistent with findings from previous studies[1, , , 12]. In contrast, in Kenya, Tony et al. found that most paediatric fractures occurred in the female population (58.3%) than among the males (41.7%). in their study conducted in Kenya This trend can be attributed to the petulance of boys, to their adventurous nature and greater involvement in risky physical activities or more violent games compared to girls. In contrast, the lower incidence of fractures among girls may be influenced by societal expectations in typical Zambian settings, where girls are encouraged to exhibit more traditionally feminine behaviour from an early age. As a result, they are less likely to engage in high-impact play activities, which are common among boys. These behavioural differences may contribute to the observed gender disparity in fracture rates.

The majority of participants in this study were aged 6-8 years, a trend that aligns with the age distribution seen in a similar study done in Benin. However, other studies have reported different patterns, such as a bimodal distribution of fractures in the 4-6 years and 12-14 years age groups, or a trimodal distribution with peaks in the 4-5, 8-11, and 16-year age groups. These findings suggest that children are more susceptible to fractures than adults, largely due to their involvement in high-impact activities like play. Children's higher activity levels and engagement in various physical activities contribute to their increased vulnerability to fractures compared to adults. Furthermore, their young age indicates that they also have a still immature sensory and psychomotor development which prevents them from having a good perception of danger, and promotes their lack of attention in traffic when going to school or at their place of learning.

Causes of upper limb fractures in children

This study identified falls as the leading cause of fractures, followed by trauma, a finding that aligns with other studies done in Zambia[1], in Senegal and in India. Studies have shown that children under the age of 15 years are particularly vulnerable to fractures due to risky behaviours, such as climbing trees, chasing moving vehicles, engaging in rough contact sports, fighting, and playing in ways that expose them to falls and trauma[8,]. To reduce the risk of such injuries, physiotherapy practitioners play a crucial role in strengthening muscles, enhancing range of motion, and improving flexibility and balance, which can help lower the likelihood of falls and accidents that lead to fractures. Although fractures as a result child abuse are less frequent due to the recent improvements in the reporting and enforcement of human rights, as well in child welfare activities, our study reported that as much as 15% of the upper limb fractures were due to child abuse. In a study done in Malawi in sub-Saharan Africa, Gallaher et al. attributed 8.1% of trauma in children to voluntary violence. On the contrary, some previous studies did not record any childhood fracture due to assault or child abuse [1, 16]. This discrepancy could be attributed to the fact that children in the latter studies were usually accompanied to the hospital by their parents and/or guardians who could be potential abusers. Health systems should have child-friendly services and victim support units where cases of assault or child abuse can be handled without interference from guardians.

Clinical presentation post upper limb fracture in children

In this study, pain emerged as the most common clinical presentation, followed by joint stiffness, resulting from upper limb fractures in children. Similarly, Abbas[4] highlighted that pain can persist even after a fracture has healed, often due to nerve or soft tissue damage. This lingering pain can significantly impact a child's quality of life, affecting daily activities and overall well-being. Additionally, joint stiffness, another common complaint, can limit mobility and cause functional impairments, underscoring the importance of comprehensive post-fracture care, including physiotherapy and rehabilitation efforts to address underlying causes and improve mobility.

Joint stiffness was another significant complication observed in this study following upper limb fractures, which is in contrast with findings from the study by Mwiinga[1]. Stiffness can severely impact a child's ability to regain full function of the affected limb, often requiring targeted rehabilitation. On the other hand, deformity was the least reported complication in this study. This aligns with a Malawian study, which found that fractures are less likely to result in deformities in urban areas compared to rural areas. The better healthcare infrastructure and access to timely medical interventions in urban areas likely contribute to more effective fracture management, reducing the risk of deformities.

Mode of management of upper limb fractures in children

In this study, all upper limb fractures in children were managed conservatively, primarily using collar and cuff methods, as well as plaster of Paris casting. The use of the collar and cuff method aligns with findings from a study by Kalaluka (2017), which indicated that in Zambia, this technique is commonly used for managing elbow supracondylar fractures. Other scholars have also supported the use of the collar and cuff method, highlighting its benefit due to the relatively shorter immobilization period. However, in contrast, Chabala reported that plaster of Paris casting was the most frequently used method for managing these fractures. This is supported by findings from a Senegalese study by Zeng et al. in which the large majority of patients were treated a cast in. The findings suggest that clinicians should carefully select the most appropriate fracture management technique to promote optimal healing while minimizing complications associated with prolonged immobilization, such as joint stiffness or muscle weakness. The choice of management method should be based on factors such as fracture type, patient age, and the potential risks of different immobilization methods. Tailoring the treatment approach to individual patient needs can help reduce complications and enhance recovery outcomes.

Functional outcomes of upper limb fractures in children

Most participants in this study were able to eat and handle objects using their affected limb, though activities such as dressing and bathing proved more challenging. This aligns with the findings from a study by Rouvillain et al., which noted that while simpler tasks like handling and holding objects can be manageable, more complex activities involving the fractured limb are often difficult to perform. Healthcare providers should offer Information, Education, and Communication (IEC) to caregivers, advising them on proper care to prevent further complications or abnormalities. Additionally, caregivers should be informed about the risks of re-fracture and the importance of proper rehabilitation to ensure the child's full recovery and avoid future issues related to the injury.

CONCLUSION

The study found that upper limb fractures in children were more common among males; in the age 6-8 years; and were predominantly caused by falls. Common modes of management for paediatric upper limb fractures included collar and cuff, Plaster

of Paris cast and arm sling. Post-fracture, all participants presented with residual pain. In terms of functional outcomes, participants reported difficulties in bathing and dressing up using the affected upper limb. These findings call on healthcare providers to engage in continuous professional development to enhance their skills in diagnosis, management and follow-up post-fracture. Furthermore, policymakers for health care should direct resources towards programs that contribute to better functional outcomes in children with upper limb fractures, such as rehabilitation and improved surgical care.

Implications to practice

The results of this study provide valuable guidance on optimal approaches for managing upper limb fractures in children, particularly regarding conservative interventions. The findings could also serve as a basis for advocating updated guidelines for paediatric fracture care and the development of more robust follow-up systems to monitor recovery post-fracture. Additionally, healthcare policymakers should direct resources towards areas that contribute to better functional outcomes in children with upper limb fractures, such as rehabilitation programs and improved surgical care. Moreover, healthcare professionals at Chawama Hospital could benefit from capacity-building initiatives to enhance their diagnostic and treatment skills for paediatric fractures.

What is already known on this topic:

1.The pattern of fractures in children

What this study adds:

1. This study provides insight into the management methods used and highlights the functional outcomes of upper limb fractures in children
2. This study also adds to the body of knowledge on the management of paediatric upper limb fractures

Study limitations

The following limitations were noted:

1. This study was hospital-based and as such, the functional outcomes of upper limb paediatric fractures reported may not necessarily be generalizable to the general population in this catchment area
2. The study used convenience sampling which could have led to selection bias as the sample is chosen based on ease of access rather than random selection. To mitigate this bias, the researchers used stratified sampling within convenience sampling on the basis of residence and cause of fracture

Recommendations

The study makes the following recommendations:

1. Healthcare policymakers should direct resources towards areas that contribute to better functional outcomes in children with upper limb fractures, such as rehabilitation programs and improved surgical care
2. There is need to strengthen and update guidelines for paediatric fracture care and the development of more robust follow-up systems to monitor recovery post-fracture
3. Continuous professional development for healthcare providers should be promoted to enhance skills in diagnosis and management of paediatric fractures
4. Further studies could be undertaken to investigate factors associated with functional outcomes post paediatric fracture at Chawama Hospital

DECLARATIONS

Acknowledgements

The contribution of all who made this undertaking possible is acknowledged as follows: the management, staff and parents, and patients at Chawama First Level Hospital in Lusaka Province, Zambia, as well as Faculty members at the Lusaka Apex Medical University.

Conflicts of interest

Authors declared that they have no conflicts of interest

Competing interests

Authors declared that they have no competing interests

Funding statement

No external funding was received for the study

Authors' contributions

Chiluba Simwanza: principal investigator, and drafting discussion section of manuscript

Billiat Chongo: research supervisor, and drafting of manuscript abstract

Yangoy Mulangi: drafting of methodology section of manuscript

Fair Banji Mwiinga: overall conceptualization of manuscript

Faith Banda Malambo: drafting of results section of manuscript

Mutinta Nzima: drafting of introduction section of manuscript

Roster Chihwaka Malimba: proof-reading of manuscript

Lweendo Mapani: manuscript referencing

Walubita Sayela: Data analysis and visualization

REFERENCES

1. Mwiinga F. The Pattern of Fracture Occurrence among Children Aged 1-17 Years Presenting at Solwezi General Hospital in Solwezi District, Zambia. *Med J Zambia* [Internet]. 2022 Jan 12 [cited 2025 Jan 21];48(3):159-70. Available from: https://mjz.co.zm/index.php/mjz/article/view/146
2. Abbas S, Chokotho L, Nyamulani N, Oliver VL. The burden of long bone fracture and health system response in Malawi: A scoping review. *Injury*. 2024 Feb;55(2):111243. doi:10.1016/j.injury.2023.111243. Epub 2023 Nov 28. PMID: 38096746.
3. Morin C, Bisogno J, Kulkarni S, Morel G. Treatment of late-presenting developmental dislocation of the hip by progressive orthopaedic reduction and innominate osteotomy. Our results with more than 30 years of follow up. *J Child Orthop*. 2011 Aug;5(4):251-60. doi:10.1007/s11832-011-0346-2. Epub 2011 Jun 2. PMID: 22852031; PMCID: PMC3234895.
4. Global Burden of Disease (GBD) 2019 Fracture Collaborators. Global, regional, and national burden of bone fractures in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. *Lancet Healthy Longev*. 2021 Sep;2(9):e580-e592. doi:10.1016/S2666-7568(21)00172-0. PMID: 34723233; PMCID: PMC8547262.
5. Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386(9993):569-624. doi:10.1016/S0140-6736(15)60160-X.
6. Tandon S, Khanna N, Chivate R, Dey S, Gulia A, Narula G, et al. Solitary bone plasmacytoma of humerus presenting as a nonhealing fracture in a child: a rare entity. *J Pediatr Hematol Oncol*. 2022 Jan 1;44(1):e233-e236. doi:10.1097/MPH.0000000000002332. PMID: 34654755.
7. Bilge O, Kekeç AF, Atılgan N, Yaka H, Dundar ZD, Karagüven D, et al. The initial analysis of pediatric fractures according to the AO/OTA fracture classification and mechanisms of injuries. *Ulus Travma Acil Cerrahi Derg*. 2022 Oct;28(10):1500-1507. doi:10.14744/tjtes.2021.24469. PMID: 36169459; PMCID: PMC10277376.
8. Karthik SM. Pediatric Femur Fractures Treatment & Management. 2023. Drugs & Diseases> Orthopedic Surgery.
9. Karlsson E, Mäki-Torkko E, Widén S, Gustafsson J, Manchaiah V, Mahomed-Asmail F,

et al. Validation of the Brief International Classification of Functioning, Disability and Health (ICF) core set for hearing loss: an international multicentre study. *Int J Audiol*. 2021 Jun;60(6):412-420. doi:10.1080/14992027.2020.1846088. Epub 2020 Nov 18. PMID: 33207960.

10. Jenkins MA, Nimphius S, Hart NH, Chivers P, Chivers P, Rantalainen T, et al. Appendicular fracture epidemiology of children and adolescents: a 10-year case review in Western Australia (2005 to 2015). *Archives of Osteoporosis* [Internet]. 2018 Jun 2;13(1):63. Available from: https://link.springer.com/article/10.1007/s11657-018-0478-9
11. Naranje SM, Erali RA, Warner WC Jr, Sawyer JR, Kelly DM. Epidemiology of pediatric fractures presenting to emergency departments in the United States. *J Pediatr Orthop*. 2016 Jun;36(4):e45-8. doi:10.1097/BPO.0000000000000595. PMID: 26177059.
12. Tony OK, Marsa SH, Mukoya WL, Julian WW, Mumbi NF. Patterns of upper and lower limb fractures and the outcomes after management among the pediatric population at Jaramogi Oginga Odinga Teaching and Referral Hospital. *East Afr Med J*. 2018;95(6). Published 2019 Aug 20. eISSN: 0012-835X.
13. Chigblo PS, Tidjani F, Lawson É, Noukpozounkou B, Amossou F, Padonou A, et al. Epidemiology of childhood fractures in Cotonou: A retrospective observational study. *Afr J Paediatr Surg*. 2024 Jan 1;21(1):48-52. doi:10.4103/ajps.ajps_35_23. Epub 2024 Jan 20. PMID: 38259019; PMCID: PMC10903724.
14. Ng'ang'a E, Mutiso VM, Mwangi JC. Pattern of long bone fractures in a paediatric population at Kenyatta National Hospital. *East Afr Orthop J*. 2017;11(2). Published 2018 Jan 23. eISSN: 1994-1072.
15. Nugraha HK, Adiantono A. Epidemiology of fractures and dislocations in children. *Folia Med Indones*. 2017;53(1):81-85.
16. Mohamed AS, Sagna A, Fall M, Ndoye NA, Mbaye PA, Fall AL, et al. Les accidents de la vie courante chez l'enfant à Dakar: à propos de 201 cas. *Pan Afr Med J*. 2017;27:1-7.
17. Verma S, Lal N, Lodha R, Murmu L. Childhood trauma profile at a tertiary care hospital in India. *Indian Pediatr*. 2009 Feb;46(2):168-71. PMID: 19242037.
18. Handavu M, Chiluba D. Prognostic significance of lower and upper extremity long bone fractures after automobile versus pedestrian injuries. *J Trauma*. 2019. Lusaka, Zambia: University of Zambia Press Publishers.
19. Gallaher JR, Wildfire B, Mabedi C, Cairns BA, Charles AG. Intentional injury against children in Sub-Saharan Africa: A tertiary trauma centre experience. *Injury*. 2016 Apr;47(4):837-41. doi:10.1016/j.injury.2015.10.072. PMID: 26584730.
20. Putra FIE, Basuki A. Characteristic of neglected fractures in Dompet Dhuafa General Hospital, Bogor, January 2019 - December 2020: Retrospective study. *Med Prof J Lampung*. 2022;11(4):362-366. doi:10.53089/medula.v11i4.310.
21. Chabala E, Mutale K, Kaunda T. Post limb fractures outcomes and other related disabilities. 2019. Lusaka, Zambia: University of Zambia Press.
22. Zeng FTA, Fall M, Mbaye PA, et al. Fractures of limbs specific to children: the experience of a Senegalese tertiary hospital. *Egypt Pediatr Assoc Gaz*. 2022;70:42. doi:10.1186/s43054-022-00137-8.
23. Rouvillain JL, De Cazes F, Banydeen R, Rome K, Numéric P, De Bandt M, Derancourt C. Incidence and characteristics of proximal femoral fractures in an Afro-Caribbean population. *Orthop Traumatol Surg Res*. 2016 Feb;102(1):77-80. doi:10.1016/j.otsr.2015.10.004. PMID: 26797003.