Systematic Review/Meta-analysis

ANNALS OF MEDICINE & SURGERY

OPEN

Current trends in burden and management of pediatric osteomyelitis in the African continent: a systematic review of the last decade

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Introduction: In low-income countries faced by a constraint of resources, pediatric osteomyelitis is a major cause for morbidity, and its true burden in Africa has not been fully characterized.
Objectives: To systematically synthesize evidence on the clinical presentation, microbiology, management strategies, outcomes, and novel insights in pediatric osteomyelitis in the last decade within Africa.
Methods: The review was conducted using Pubmed, Scopus, Embase and Google Scholar to identify studies addressing pediatric osteomyelitis in Africa. Relevant literature covering osteomyelitis types, diagnostic criteria, pathogen and resistance data, treatment modalities, outcomes, length of stay, and follow-up duration were included. Nine studies were identified and analyzed.
Results: Among the identified cases ($n = 284$), 83.5% were chronic. The tibia (45.7%) and femur (31.7%) were the most commonly affected sites. Bacterial cultures were available for 130 cases and showed *Staphylococcus aureus* as the leading pathogen (43.9%). Exclusive surgical care was indicated in 51.85% of the cases, and the procedures included sequestrectomy and reconstructive procedures. Notable novel patterns included higher rates of chronic multifocal disease in rural, malnourished children; variable empiric antibiotic regimens driving antimicrobial resistance; and the use of gentamicin loaded beads and vascularized fibula flaps for post-osteomyelitis reconstruction.
Conclusion: Chronic osteomyelitis is the most dominant form in African children. Despite advancements in management in African settings, gaps exist. Future directions include multicenter surveillance of disease burden, surveillance of antimicrobial resistance, community-level interventions for disease monitoring and capacity building for advanced surgical procedures.

Keywords: Africa, microbiology, pediatric osteomyelitis, surgical management

Introduction

Musculoskeletal infection remains a major burden in health systems of low-income countries, with an estimated 12 million children suffering infection[1]. Pediatric osteomyelitis is a major cause of morbidity in African countries, especially in comparison to high-income countries. The incidence in high-income countries is 8 per 100,000 children, much lower than the 43 per 100 000 incidence reported in low-income countries[2–4]. This burden is reflected in African clinical practice. A study from Gambia showed 15.4% of pediatric inpatient days were due to osteomyelitis, while another study from Uganda showed 3.5% of surgical procedures in pediatric groups were for osteomyelitis[5]. These studies showed that osteomyelitis still has a heavy epidemiologic impact.

Pediatric osteomyelitis leads to serious short- and long-term morbidity, especially in resource-limited settings. Common sequelae include growth plate destruction, causing limb deformities, joint destruction, and pathological fractures[6]. One Nigerian series found anemia, septic arthritis, and pathological fractures as the most common complications of osteomyelitis in childhood[7]. In

HIGHLIGHTS

- Chronic osteomyelitis comprised 83.5% of pediatric cases in Africa.
- *Staphylococcus aureus* caused 43.9% of culture-positive pediatric osteomyelitis cases.
- Tibia (45.7%) and femur (31.7%) were the most frequently affected bones.
- Chronic multifocal disease linked to rural residence and malnutrition.
- Management included gentamicin beads and vascularized fibula flaps.

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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Annals of Medicine & Surgery (2026) 88:2636–2647

Received 15 August 2025; Accepted 16 November 2025

Published online 19 March 2026

http://dx.doi.org/10.1097/MS9.0000000000004453

addition, the rates of chronic infection and disability are high when compounded with health system deficiencies, such as delays in seeking healthcare or poor follow-up. A Tanzanian study reported 31% of children had recurrent infection on follow-up, and it was mostly among those who presented more than 3 months after symptom onset[5]. The sequelae of pediatric osteomyelitis are an important area of concern for African health systems.

Management of pediatric osteomyelitis combines both conservative and invasive approaches. Empiric antibiotics are usually given immediately, awaiting culture results for further tailoring to antibiotic sensitivity[6]. Early, uncomplicated cases can typically be cured with antibiotics alone, but most children require surgery[6]. The antibiotic course usually lasts 4–6 weeks, including an initial intravenous phase and later transitioning to oral therapy dependent on clinical improvement[6]. Surgical therapy is indicated for complicated cases, including those with chronic infection and abscesses[6]. The invasive interventions include incision and drainage of pus, and debridement of necrotic bone or sequestrum. Advanced therapy, such as bone reconstruction, is also required for chronic cases. In African practice, laboratory access is limited, which means most clinicians rely on empiric antibiotic regimens, which may be ineffective[8]. Guidelines from high-income countries advocate for earlier switching to oral therapy and standardized care paths, but these protocols are not widely adopted in the African setting, leading to variable durations of intravenous therapy and timing of surgical interventions[6].

Antimicrobial resistance is becoming an emerging challenge in the management of infectious diseases in Africa. *Staphylococcus aureus*, the most common cause of osteomyelitis, is showing resistance to first-line therapy[8]. A study from Ghana showed 47% of *S. aureus* isolates from children were resistant to chloramphenicol and 17% resistant to cloxacillin[8]. Methicillin-resistant *S. aureus* (MRSA) is also on the rise, as indicated by a South African study, which showed 15% of community-acquired *S. aureus* were resistant[8]. These high resistance rates are driven by widespread antibiotic misuse and further complicate empiric therapy.

Pediatric osteomyelitis in Africa remains an understudied topic. Past reviews have emphasized that published data are scarce and only involve single-center case series or retrospective studies[5]. There is a paucity of large datasets to be able to draw conclusions on incidence and outcomes. The data also show that there is wide heterogeneity in cases. A review showed that intervention rates range from 8% to 80% in different centers, which indicates a lack of consensus with regard to management[6]. Important data aspects, such as functional outcomes and recurrence rates, are often missing. Overall, the true burden of pediatric osteomyelitis remains uncharacterized.

A systematic review and meta-analysis are warranted, given the issues highlighted above, focusing on the burden and management of pediatric osteomyelitis in Africa. This will compile data on incidence, pathogens, resistance patterns, and treatment outcomes with a focus on identifying trends. Synthesizing the updated literature will guide policymakers and global health leaders to improve the prevention and management of this disease in Africa.

Methodology

This systematic review was carried out following the Declaration of Key Items for Reporting Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines[9].

Study eligibility

Studies were deemed eligible for inclusion if they reported on osteomyelitis in children younger than 18 years and were conducted within African settings. Eligible studies were required to focus on the burden and/or management of osteomyelitis and to have been published between 1 January 2014 and 1 June 2025, to capture the most recent decade of evidence, ensuring that the review reflects current diagnostic practices, management strategies, and epidemiological trends in pediatric osteomyelitis within African settings. Only randomized controlled trials, cohort studies, case–control studies, cross-sectional studies, or case series involving more than five patients were considered. Publications had to be written in English or provide an English translation to ensure consistent interpretation and analysis. Studies were excluded if they involved non-African populations or non-human subjects. Studies addressing osteoarticular infections, including septic arthritis, without providing distinct and stratified data on osteomyelitis were also excluded. Studies focusing exclusively on sickle cell-associated osteomyelitis were not included due to its peculiar clinical presentation and management. Osteomyelitis of odontogenic origin was excluded due to its distinct etiology and management, which differ from long-bone disease in children. Case reports with fewer than five patients were omitted to avoid anecdotal evidence and ensure synthesis from studies with broader clinical relevance.

Search strategy

A comprehensive search through the literature was conducted across the following databases: Pubmed, Scopus, Embase, AJOL, and African Index Medicus. The keywords used were related to the scope of the study and included: "osteomyelitis," "bone infection," "children," "Africa," "treatment," and "burden." The search included synonyms for all 54 African countries. Gray literature was searched via Google Scholar, ProQuest Dissertations, and WHO AFRO databases. The search string is detailed below;

Pubmed

(((((Osteomyelitis[MeSH Terms]) OR (bone infection[Title/Abstract])) OR (bone inflammation[Title/Abstract])) AND (((((pediatric[Title/Abstract]) OR (paediatric[Title/Abstract])) OR (child[Title/Abstract])) OR (infant*[Title/Abstract])) OR (adolescen*[Title/Abstract]))) AND ((Africa[MeSH Terms]) OR (Africa[Title/Abstract])) OR (Algeria[Title/Abstract])) OR (Angola[Title/Abstract])) OR (Benin[Title/Abstract])) OR (Botswana[Title/Abstract])) OR (Burkina Faso[Title/Abstract])) OR (Burundi [Title/Abstract])) OR (Cabo Verde[Title/Abstract])) OR (Cape Verde[Title/Abstract])) OR (Cameroon[Title/Abstract])) OR (Central African Republic[Title/Abstract])) OR (Chad[Title/Abstract])) OR (Comoros[Title/Abstract])) OR (Congo[Title/Abstract])) OR ("Cote d'Ivoire"[Title/Abstract])) OR (Ivory Coast[Title/Abstract])) OR (Democratic Republic of the Congo[Title/Abstract])) OR (Djibouti[Title/Abstract])) OR (Egypt[Title/Abstract])) OR (Equatorial Guinea[Title/Abstract])) OR (Eritrea[Title/Abstract])) OR (Eswatini[Title/Abstract])) OR (Swaziland[Title/Abstract])) OR (Ethiopia*

[Title/Abstract])) OR (Gabon[Title/Abstract])) OR (Gambia [Title/Abstract])) OR (Ghana[Title/Abstract])) OR (Guinea [Title/Abstract])) OR (Guinea-Bissau[Title/Abstract])) OR (Kenya[Title/Abstract])) OR (Lesotho[Title/Abstract])) OR (Liberia[Title/Abstract])) OR (Libya[Title/Abstract])) OR (Madagascar[Title/Abstract])) OR (Malawi[Title/Abstract])) OR (Mali[Title/Abstract])) OR (Mauritania[Title/Abstract])) OR (Mauritius[Title/Abstract])) OR (Morocco[Title/Abstract])) OR (Mozambique[Title/Abstract])) OR (Namibia[Title/Abstract])) OR (Niger[Title/Abstract])) OR (Nigeria[Title/Abstract])) OR (Rwanda[Title/Abstract])) OR (São Tomé[Title/Abstract] AND Príncipe[Title/Abstract])) OR (Sao Tome[Title/Abstract] AND Principe[Title/Abstract])) OR (Senegal[Title/Abstract])) OR (Seychelles[Title/Abstract])) OR (Sierra Leone[Title/Abstract])) OR (Somalia[Title/Abstract])) OR (South Africa[Title/Abstract])) OR (South Sudan[Title/Abstract])) OR (Sudan[Title/Abstract])) OR (Tanzania[Title/Abstract])) OR (Togo[Title/Abstract])) OR (Tunisia[Title/Abstract])) OR (Uganda[Title/Abstract])) OR (Zambia[Title/Abstract])) OR (Zimbabwe[Title/Abstract]))) AND ((“2014/01/01”[PDAT]: “2025/06/01”[PDAT])).

Scopus

TITLE-ABS-KEY(osteomyelitis OR “bone infection” OR “bone inflammation”) AND TITLE-ABS-KEY(pediatric OR paediatric OR child OR infant OR adolescent) AND TITLE-ABS-KEY(Africa).

Google scholar

(“pediatric osteomyelitis” OR “osteomyelitis in children”) AND Africa AND (management OR treatment OR burden).

Embase

(“osteomyelitis”/exp OR “bone infection”:ti,ab OR “bone inflammation”:ti,ab) AND (“pediatrics”/exp OR pediatric:ti,ab OR paediatric:ti,ab OR child:ti,ab OR infant*:ti,ab OR adolescen*:ti,ab) AND (“Africa”/exp OR Africa:ti,ab) AND (management:ti,ab OR treatment:ti,ab OR burden:ti,ab) AND [2014-2025]/py.*

Study selection and data management

The retrieved references were exported into Zotero citation manager for initial deduplication. Literature from Google Scholar and AJOL were extracted using Publish or Perish software. Relevant articles identified through reference tracking and citation chaining were also included. Following this, Rayyan QCRI was used to conduct blinded, collaborative screening. Two reviewers independently screened the titles and abstracts based on the eligibility criteria. Full-text articles were then retrieved and reviewed for inclusion and disagreements were resolved through discussion and consultation with a third reviewer.

A PRISMA 2020 flow diagram was used to document the screening and selection process including reasons for exclusions at the full-text stage. This is demonstrated in Figure 1.

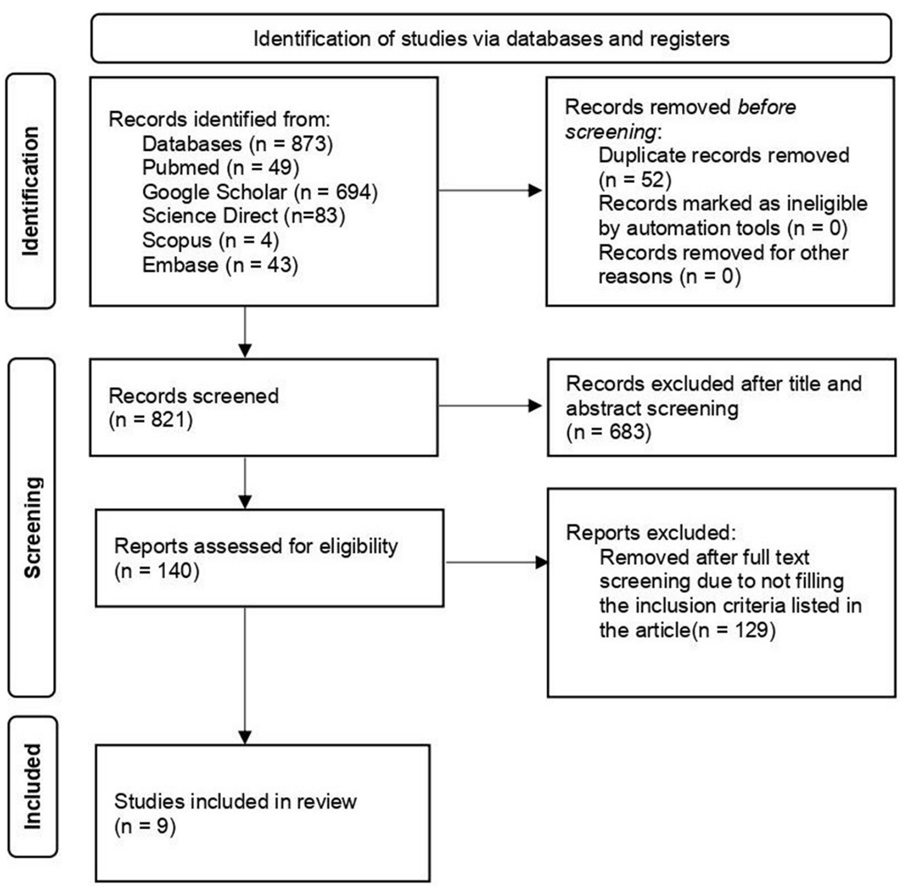

Figure 1. PRISMA flow diagram.

Data extraction

A standardized, pre-piloted data extraction form was used. Extracted information included: author(s), year, country, study design, sample size, age/gender distribution, osteomyelitis type, diagnostic criteria, pathogen and resistance data, treatment modalities (medical and surgical), outcomes (e.g., healing rate, relapse, and complications), length of stay, follow-up duration, authors recommendations, and novel insights from the studies.

Risk of bias assesments

Two reviewers independently assessed study quality and disagreements were resolved by consensus. The tools used include the Joanna Briggs Institute (JBI) checklists for cross-sectional studies and case series, as well as the Newcastle–Ottawa Scale (NOS) for cohort studies.

Data synthesis

The data collected were synthesized descriptively and summarized to highlight key metrics concerning the burden and management approaches for pediatric osteomyelitis in Africa. All information was reported as originally documented, with no additional variables or modifications introduced.

We conducted aggregate pooled analysis for two endpoints; chronic osteomyelitis proportion among classified cases and *S. aureus* proportion among culture-positive cases. A total of 95% confidence intervals were computed using Wilson method in R (version 4.3.0, DescTools package). Confidence intervals were only reported for these two endpoints as other subtypes of osteomyelitis, and organisms were infrequently or inconsistently reported. All scripts and calculation outputs are archived in the project's Open Science Framework (OSF) repository to enable reproducibility. No between-study weighting or heterogeneity modeling was performed.

Protocol registration

The protocol for this review was retrospectively registered on the OSF under the title *"Current Trends in Burden and Management of Pediatric Osteomyelitis in Africa"* (registration DOI:https://doi.org/10.17605/OSF.IO/CVEY3). The registration documents the predefined eligibility criteria, search strategy, and data synthesis plan for transparency.

Results

Study characteristics

A total of eight studies met the inclusion criteria, comprising data from 388 pediatric patients diagnosed with osteomyelitis across seven African countries: Nigeria (n = 2), Uganda (n = 2), and one each from Somalia, Ethiopia, Burkina Faso, Benin, and Gabon. Study designs included retrospective observational studies (n = 5), cross-sectional studies (n = 2), and a prospective descriptive study (n = 1). Patient ages ranged from 6 months to 17 years. A summary of included studies is provided by Tables 1 6 and 8, and Figure 2.

Type of osteomyelitis

Among the cases where osteomyelitis classification was reported (n = 284), chronic osteomyelitis was the most prevalent form, accounting for 83.45% (n = 237; 95% confidence interval of 78.7–87.3). Acute cases comprised 11.62% (n = 33), and subacute cases accounted for 4.93% (n = 14). However, in some studies, the osteomyelitis classification (acute, subacute, or chronic) was not provided. A summary of the various forms of osteomyelitis is provided in Table 2.

Anatomical distribution

The tibia was the most frequently affected site, observed in 45.73% (n = 166) of cases, followed by the femur at 31.68% (n = 115) and the humerus at 10.20% (n = 37). Less frequently involved bones included the radius (3.58%), fibula (1.93%), ulna (1.38%), metatarsals (0.83%), and calcaneus (1.93%). Multifocal involvement was observed in cases of chronic recurrent osteomyelitis and infectious spondylodiscitis. A summary of involved anatomical regions is provided by Table 3 and Figure 3.

Etiological agents

Culture data were available for 130 cases. *S. aureus* was the predominant organism, isolated in 43.85% (n = 57) of cultures (95% confidence interval of 35.6–52.4). Other identified pathogens included *Pseudomonas aeruginosa* (6.15%), *Proteus mirabilis* (5.38%), *Escherichia coli* (3.85%), *Klebsiella spp.* (3.85%), and *Streptococcus spp.* (4.62%). No growth was reported in 27.69% (n = 36) of samples. Tuberculous etiology was identified in spinal osteomyelitis cases, with *Mycobacterium tuberculosis* responsible for over 70% of infections in one series. A summary of the etiologic agents is provided in Table 4 and Figure 4.

Management strategies

Of the 270 cases for which treatment modality was reported, surgical management was the primary strategy in 51.85% (n = 140), medical therapy alone in 30.74% (n = 83), and combined medical and surgical therapy in 17.41% (n = 47). Surgical procedures included sequestrectomy, curettage, external fixation, incision, and drainage, and in some cases, bone grafting and flap reconstruction. Antibiotic therapy, often empiric due to limited laboratory support, was universally applied. The use of gentamicin-impregnated Polymethylmethacrylate beads (PMMA) cement was reported in select surgical cases.

Clinical outcomes

Outcomes were documented for 142 patients. Clinical recovery, defined as resolution of infection and return to baseline func-

Table 1

Geographic distribution of included studies.

Countries	Studies
Nigeria	2
Uganda	2
Somalia	1
Ethiopia	1
Burkina Faso	1
Benin	1
Gabon	1

Figure 2. Geographic distribution of included studies.

tion, was achieved in 76.06% (n = 108) of these cases. However, 20.42% (n = 29) were lost to follow-up, and 3.52% (n = 5) experienced documented complications. Complications included deformities, pathological fractures, joint stiffness, donor site morbidity, flap necrosis, and neurological deficits. Persistent infection and treatment failure were reported in chronic and multifocal cases.

Table 2

Classification of pediatric osteomyelitis cases by type.

Types	Frequency	Percentage (%)
Acute	33	11.62
Subacute	14	4.93
Chronic	237	83.45

A summary of the management strategies and clinical outcomes is provided in Table 5.

Emerging insights in pediatric osteomyelitis: epidemiology, diagnosis, and management

Patterns of disease presentation varied across settings. Omoke *et al* observed that infants in urban areas more often presented with acute osteomyelitis, whereas those from rural areas tended to have chronic diseas[7]. This rural–urban disparity was also reflected in the findings of Kissou *et al*, who reported that chronic multifocal osteomyelitis occurred more frequently among rural, malnourished children, suggesting that both geographic and nutritional factors influence disease chronicity[10].

These contextual differences were mirrored in diagnostic capacity and antimicrobial stewardship practices. In Ethiopia,

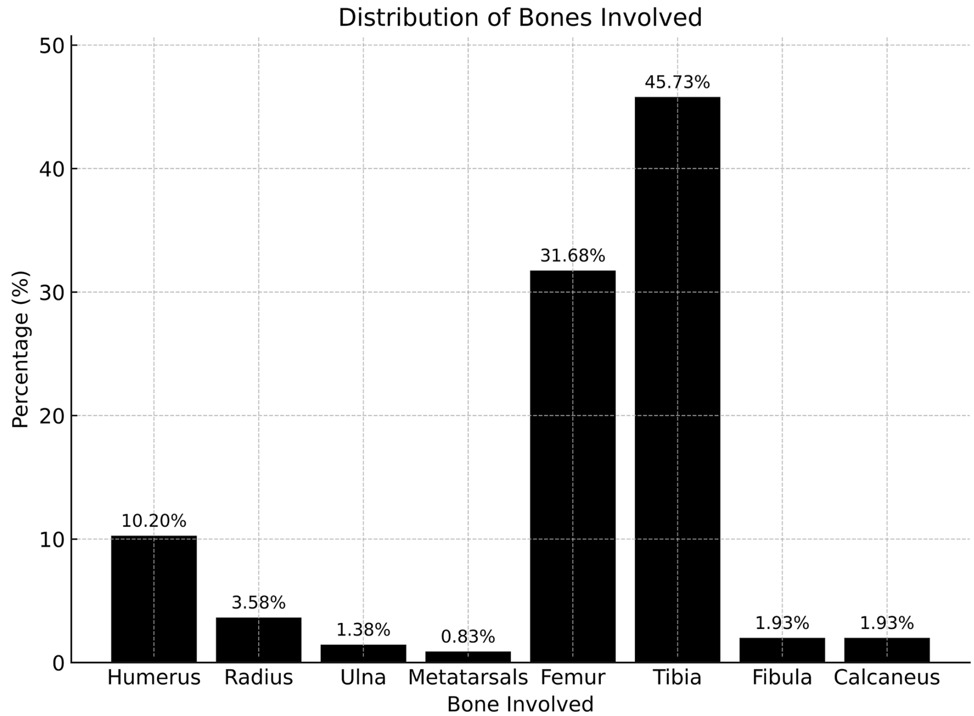

Figure 3. Most frequently affected bones.

Mulualem *et al* quantified the prevalence of pediatric chronic osteomyelitis using radiographic findings and found it to be as high as 86%[11]. Kissou *et al* identified high resistance to first-line antibiotics in their clinical setting, highlighting the need for locally informed treatment guideline[10]. In contrast, Cyprien *et al* described reliance on clinical criteria and basic imaging due to financial constraints, underscoring the diagnostic adaptations required in low-resource setting[12].

Innovations in surgical management further demonstrated how local resources shape care. Loro *et al* reported the first successful use of vascularized fibula flap reconstruction for post-osteomyelitis bone defects in a resource-limited environment[13]. Similarly, Cici *et al* described the use of gentamicin-loaded cement in children, noting its practicality and adaptability where resources are constrained[14]. Together, these insights illustrate how epidemiological patterns, diagnostic capacity, and treatment innovations intersect to inform context-specific approaches to pediatric osteomyelitis.

Table 3

Most Frequently Affected Bones.

Sites	Frequency (fr)	Percentage (%)
Humerus	37	10.20
Radius	13	3.58
Ulna	5	1.38
Metatarsals	3	0.83
Femur	115	31.68
Tibia	166	45.73
Fibula	7	1.93
Calcaneus	7	1.93

A summary of the emerging insights in pediatric osteomyelitis are provided in Table 6.

Quality assessment

The methodological quality of the included studies was assessed using the JBI checklists for cross-sectional studies and case series, as well as the NOS for cohort studies[17,18]. The cross sectional studies had variable quality. Two cross sectional studies had low risk of bias, while the remaining two had moderate risk of bias. The two case series showed high methodological quality. Two of the cohort studies had a low risk of bias, and the remaining one had a moderate risk of bias. A summary is provided by table 7

Discussion

Evidence base and geographic representation

This review synthesizes evidence from eight studies conducted across seven African countries, capturing a spectrum of pediatric osteomyelitis presentations. The included studies predominantly originated from Nigeria and Uganda, reflecting better-documented research in these countries, but also encompassed less frequently reported contexts such as Somalia, Burkina Faso, Benin, Gabon, and Ethiopia. This breadth is important because, historically, the literature on pediatric osteomyelitis in Africa has been skewed toward a few referral centers, limiting the representativeness of findings[1,5]. In contrast, high-income countries have benefited from large population-based registries that provide more robust epidemiological estimates[6]. The geographic spread of our included studies offers valuable diversity but also underscores the need for coordinated, multicenter African research to generate higher-quality, generalizable data.

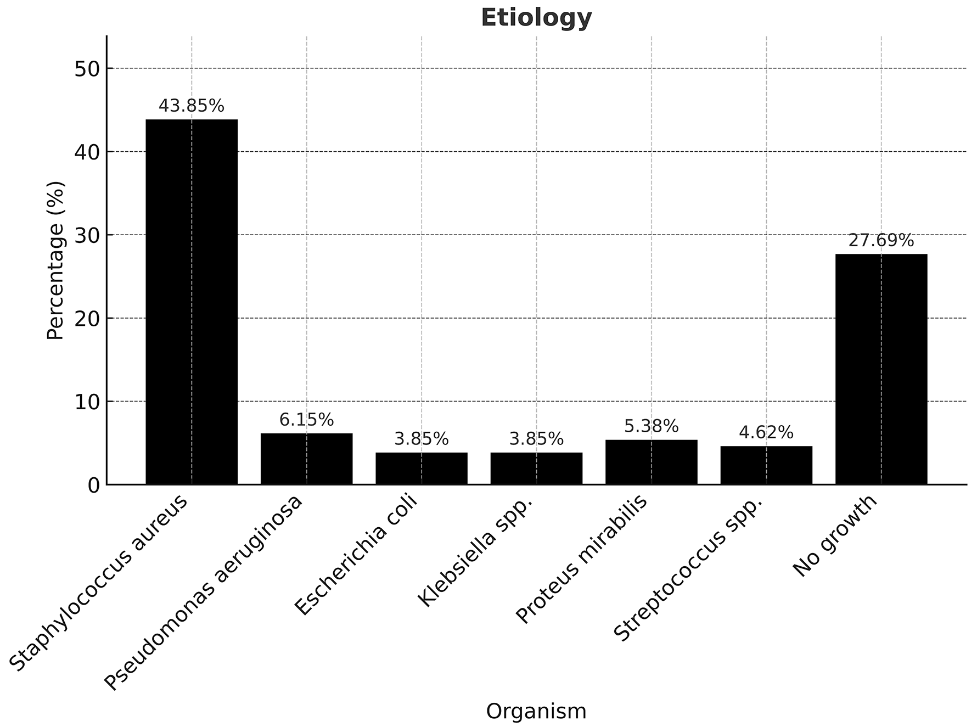

Figure 4. Causative microorganisms.

Burden and type of osteomyelitis

Our findings confirm that chronic osteomyelitis is the dominant form in African children, accounting for over four-fifths of reported cases. These findings are consistent with reports from Tanzania and Nigeria, where chronic presentations comprise more than 60% of pediatric osteomyelitis cases[5,7]. In contrast, acute hematogenous osteomyelitis is far more common in high-income countries, where early diagnosis and access to antibiotics reduce progression to chronicity[20]. The predominance of chronic disease in our review likely reflects delayed presentation, often due to health-seeking behavior where treatment is initially sought from traditional bone setters, herbalists, and patent medicine dealers[7]. This disparity highlights the urgent need for community-level education and referral systems that enable earlier detection and treatment.

Anatomical distribution

The tibia and femur emerged as the most frequently affected bones, consistent with patterns observed across sub-Saharan Africa and internationally[5,21]. Their predilection is likely related to their rich vascular supply and sluggish flow through sinusoidal vessels, their susceptibility to trauma, and their proximity to the skin surface, which facilitates pathogen entry[22,23]. Similarly, a sub-Saharan study showed that tibial involvement accounted for 46% of chronic cases, followed by femoral involvement at 26%[24], which closely aligns with our pooled findings. While upper limb involvement is less common, the humerus still featured prominently in both our review and Nigerian studies[7], suggesting the need for vigilance regarding non-weight-bearing bones as well.

Microbiological profile

Consistent with global literature, *S. aureus* was the predominant organism, isolated in nearly half of the positive cultures in our included studies[2]. African studies repeatedly report similar dominance, with prevalence estimates ranging from 42% to

Table 4

Causative microorganisms.

Cultures	Frequency (fr)	Percentage (%)
Staphylococcus aureus	57	43.85
Pseudomonas aeruginosa	8	6.15
Escherichia coli	5	3.85
Klebsiella spp.	5	3.85
Proteus mirabilis	7	5.38
Streptococcus spp.	6	4.62
No growth	36	27.69

Table 5

Management strategies and clinical outcomes in pediatric osteomyelitis.

Management	Frequency	Percentage (%)
Medical	83	30.74
Surgical	140	51.85
Combined	47	17.41
Outcomes	**Frequency**	**Percentage (%)**
Recovery	108	76.056
lost to follow-up	29	20.42
Complications	5	3.52

Table 6

Emerging insights in pediatric osteomyelitis: epidemiology, diagnosis, and management.

Study (Author, Year)	Country	Emerging insights
Njoku Isaac Omoke, 2018[7]	Nigeria	Identified link between infant/urban settings and acute osteomyelitis, with rural/older children more often having chronic disease
S.A. Kissou, 2018[10]	Burkina Faso	Found that multifocal osteomyelitis is more common in rural, malnourished children
Zavier Zomalheto, 2018[15]	Benin	Reported a high proportion of tuberculosis-related spinal infections in children
Tayebwa Edson, 2019[16]	Uganda	Demonstrated that drug susceptibility patterns can guide antimicrobial selection
Antonio Loro *et al*, 2021[13]	Uganda	Documented the first reported use of vascularized fibula flap reconstruction for post-osteomyelitis defects in Africa
Biruk Mulualem, 2023[11]	Ethiopia	Provided first recent quantification of pediatric chronic osteomyelitis magnitude (86% prevalence)
Mba Mba Cyprien, 2023[12]	Cameroon	Described resource-adapted reliance on clinical and radiographic diagnosis
Hakan Cici, 2025[14]	Somalia	Introduced innovative use of gentamicin-loaded cement spacers for local infection control

63%[7,25]. MRSA remains variably reported, but recent trends indicate a rising prevalence of community-acquired MRSA, posing challenges for empiric therapy[8]. Gram-negative bacilli, particularly *P. aeruginosa*, also appeared in our review and are known to complicate chronic cases and post-traumatic infections[26]. The substantial proportion of culture-negative results reflects both prior antibiotic exposure and limitations in microbiological infrastructure, a finding echoed in a Tanzanian study[25]. Expanding laboratory capacity is critical to guide targeted therapy and monitor antimicrobial resistance, a priority also emphasized by the WHO[27]. Furthermore, most studies did not include standardized susceptibility testing, and data from North African countries are absent, which limits the ability to map continental antimicrobial resistance trends. This heterogeneity underscores the need for region-specific resistance surveillance to guide empiric therapy.

Recent bibliometric reviews provide broader context for these findings and highlight global disparities in pediatric surgical research output. Shu *et al* conducted a 30-year bibliometric analysis of pediatric minimally invasive surgery and found that most high-impact publications originated from high-income countries, with limited representation from Africa and other Low and Middle Income Countries in the region[28]. A subsequent analysis demonstrated similar trends in the emerging field of artificial intelligence in pediatric surgery[29]. These global patterns parallel our observations of sparse, heterogeneous African data on osteomyelitis, which underscores the need for robust antimicrobial surveillance and multi-country research.

Management approaches

Our pooled data demonstrate a predominance of surgical management, particularly sequestrectomy, in more than half of the cases, with antibiotics used universally. This is consistent with established principles for chronic osteomyelitis, where debridement of necrotic bone is essential for infection control[26]. A study from Kenya has shown excellent outcomes when surgery is combined with prolonged, pathogen-directed antibiotic therapy, often exceeding 6 weeks[30]. However, antibiotic regimens in our included studies were frequently empirical due to limited culture data, risking suboptimal coverage and fostering resistance. The use of local antibiotic delivery systems, such as gentamicin-impregnated PMMA beads, reflects adaptations from high-income countries that could potentially benefit African settings, though cost and availability remain barriers[31].

Clinical outcomes and sequelae

Overall recovery rates appear favorable; however, this must be interpreted cautiously due to substantial loss to follow-up and underreporting of complications. Our review documented sequelae such as deformities, pathological fractures, and joint stiffness. Similar outcomes have been reported in Tanzanian cohorts, where recurrence predominantly occurred in individuals with delayed presentation[25]. High-income settings report significantly lower rates of sequelae, highlighting the consequences of late diagnosis and inadequate early management[2]. This underscores the need to integrate orthopedic infection management into broader child health strategies in Africa.

Emerging insights in pediatric osteomyelitis: epidemiology, diagnosis, and management

Our review found clear rural–urban differences in pediatric osteomyelitis. Urban infants tended to present with acute disease, while rural children more often had chronic or multifocal disease, with malnutrition frequently present in rural cases. These patterns reflect broader evidence that poverty, limited

Table 7

Quality assessment scores and risk interpretations for included studies.

Study Name	Year	Tool used	Final score	Interpretation
Tayebwa Edson *et al*[16]	Not stated	JBI Checklist – Cross-sectional Studies	6/8	Low
Zavier Zomalheto *et al*[15]	Not stated	JBI Checklist – Cross-sectional Studies	4/8	Moderate
Emeagui *et al*[19]	Not stated	JBI Checklist – Cross-sectional Studies	5/8	Moderate
Biruk Mulualem *et al*[11]	Not stated	JBI Checklist – Cross-sectional Studies	8/8	Low
Hakan Cici *et al*[14]	Not stated	JBI Checklist – Case Series	10/10	Low
Antonio Loro *et al*[13]	Not stated	JBI Checklist – Case Series	10/10	Low
Njoku Isaac Omoke *et al*[7]	Not stated	Newcastle-Ottawa Scale (Cohort Studies)	6/9	Moderate
S.A. Kissou *et al*[10]	Not stated	Newcastle-Ottawa Scale (Cohort Studies)	8/9	Low
Mba Mba Cyprien *et al*[12]	Not stated	Newcastle-Ottawa Scale (Cohort Studies)	8/9	Low

Table 8

Summary of included studies.

Study	Country	Sample Size	Age (mean ± SD or Range)	Osteomyelitis type (fr)	Primary sites (fr)	Pathogens (frequency)	Management strategies (fr)	Treatment outcome	Complications
Omoke, 2018[7]	Nigeria	76	9.9 ± 5.1 years	Acute (16), subacute (10), and chronic (50)	Clavicle (2), humerus (12), radius (3), ulna (3), pubis (1), femur (24), tibia (35), fibula (1), cuboid (1), and metatarsals (3)	*Staphylococcus aureus* (34), *Pseudomonas aeruginosa* (7), *Escherichia coli* (4), *Klebsiella* (4), *Proteus* (3), *Streptococcus* (3), and no growth (26)	Antibiotics (20), sequestrectomy + antibiotics (19), incision and drainage and antibiotics (17). Sequestrectomy + fasciocutaneous flap + antibiotics (2). Curettage + antibiotics (1)	Recovery in 50 patients; lost to follow-up 9, 17 discontinued due to financial constraints	Anemia, septic arthritis, and pathological fractures
Loro, 2021[13]	Uganda	44	2–14 years	Not reported	Tibia (27), femur (8), radius (6), and humerus (4)	Not reported	Sequestrectomy (24), sequestrectomy + external fixation (27), external fixation to allow sequestrum demarcation (8), external fixation for pre-op. distraction (8), external fixation + fibula osteotomy (2), external fixation + incision and drainage (1), incision and drainage (8), screw replacement and fixator adjustment (10), bone graft (2), and vascularized fibula flap (44)	Successful treatment (37)	Flap failure (6), donor neurapraxia (3), paddle necrosis (11), graft fracture (2), skin-graft loss (6), fixator failure (1), and non-union (2)
Cici, 2025[14]	Somalia	8	2–11 years	Not reported	Femur (2), tibia (3), humerus (2), and radius (1)	*Staphylococcus aureus* (3), MRSA (1), *Streptococcus pyogenes* (1), No growth (3)	Debridement + gentamicin-loaded PMMA cement and Cement removal ± fixation (8)	100% infection-free at mean 19 months follow-up	Deformities (2) and contracture (1)
Mulualem, 2023[11]	Ethiopia	168	13.4 (SD: ± 3.940)	Chronic (168)	Tibia (67), femur (56), humerus (10), calcaneus (4), fibula (2), other foot bones (2), radius (2), ulna (1), and hand bones (1)	Not reported	Not reported	Not reported	Pathological fractures (20), deformities, and joint issues
Emeagui, 2020[19]	Nigeria	40	8.1 (SD: ± 4.23), 6 months and 17 years	Acute (17), subacute (4), and chronic (19)	Tibia (22), femur (10), calcaneum (3), humerus (7), radius (1), ulna (1), and multiple site osteomyelitis with an associated septic arthritis (1)	*Staphylococcus aureus* (11), *Proteus* (3), and no growth (5)	Antibiotics (40)	Not reported	Not reported

(*Continues*)

Table 8

(Continued).

Study	Country	Sample Size	Age (mean ± SD or Range)	Osteomyelitis type (fr)	Primary sites (fr)	Pathogens (frequency)	Management strategies (fr)	Treatment outcome	Complications
Kissou, 2018[10]	Burkina Faso	11	Mean 11.8 years (range 6–14 years)	Chronic multifocal osteomyelitis (SCMO)	Femur (10), tibia (9), and fibula (6)	*Staphylococcus aureus* (5), *Escherichia coli* (1), *Pseudomonas aeruginosa* (1), *Proteus mirabilis* (1), *Streptococcus pneumoniae* (1), and *Klebsiella pneumoniae* (1)	Antibiotics (11), sequestrectomy + bone curettage + fistulectomy (7)	3 successful outcomes, 5 unfavorable outcomes, and 3 lost to follow-up	Hip dislocation, pathological fracture, and bone loss
Zomalheto, 2018[15]	Benin	29	Not reported	Infectious spondylodiscitis (chronic, tuberculous and pyogenic forms)	L2–L3 disc (45.2%), L3–L4 disc (19.4%)	*Mycobacterium tuberculosis* in 72.4%, other bacteria in 6 cases (mainly gram-negative bacilli; 62.5%)	Tuberculosis: 12 months (2 months HRZE + 10 months HR)Pyogenic: 3 months (antibiotics)	Not reported	Neurologic complications in 31%, Paraparesis in 3.4%
Cyprien, 2023[12]	Gabon	12	8.5 years (range: 2–15 years)	Chronic multifocal osteomyelitis	Femur (40%), tibia (26.6%), and humerus (20%)	*Staphylococcus aureus* (33.3%), *Enterobacter cloacae* (16.7%), Gram-negative bacilli (16.7%), *Streptococcus spp.* (16.7%), and Sterile cultures (16.7%)	Antibiotics (12), sequestrectomy + curettage + drainage (4), Subperiosteal/Brodie abscess incision and drainage (3).	Favorable evolution (partial/total symptom resolution) (10)	Persistence of infection (40%), pathological fracture (20%), skeletal deformity (20%), and near joint stiffness (20%)

access to care, and higher rates of malnutrition in rural areas contribute to delayed presentation and the progression to chronic bone infection. Population studies have similarly linked rural residence and nutritional deficits to higher burdens of complicated or chronic infections in children[32].

Diagnostic capacity and antimicrobial stewardship also differed considerably between settings. The very high radiographic prevalence of chronic osteomyelitis reported in Ethiopia (about 86%) suggests both a significant disease burden and reliance on imaging where it is available. This aligns with other regional analyses showing high rates of radiographic chronic changes in children presenting late[11]. Reports of substantial resistance to commonly used first-line antibiotics in some African settings raise concern that empiric regimens may be less effective without local susceptibility data. This reinforces the need for stewardship programs and routine culture and sensitivity testing to guide therapy[8].

Surgical innovations in resource-limited settings show that practical adaptations can improve outcomes. Case series of vascularized fibula flaps and other autologous reconstructions demonstrate that limb-salvage procedures can be successfully performed for large post-osteomyelitic defects, although they remain technically demanding and resource intensive[33,34]. Similarly, local antibiotic delivery systems such as gentamicin-loaded bone cement, beads, or calcium sulfate carriers have proven to be effective adjuncts to debridement. They provide high local antibiotic concentrations, reduce systemic toxicity, and help maintain mechanical stability. These strategies are particularly useful where prolonged systemic therapy is challenging or when culture-guided therapy is delayed[35].

Limitations and recommendations

This review has notable limitations that warrant cautious interpretation. Most included studies were retrospective, single-center series with heterogeneous diagnostic criteria and outcome definitions, limiting comparability. The study pool was geographically skewed with no representation from North Africa, which restricts generalizability across the continent. Many reported only crude recovery rates without accounting for patients lost to follow-up or those who developed complications, which likely overestimates success and underreports morbidity. Confidence intervals for minor pathogens and non-chronic subtypes were not calculated because data were sparse and heterogeneous across studies. Reporting of outcomes was often incomplete due to poor documentation of follow-up periods, losses to follow-up, and complications. Management data were variably documented and prone to bias, with incomplete details on antibiotic regimens, surgical indications, timing, and antimicrobial resistance. Data on antimicrobial resistance were sparse, which precluded meaningful regional comparison. Furthermore, many treatment decisions relied on limited laboratory support. Therefore, the descriptive pooled analyses should be interpreted as contextual summaries rather than definitive epidemiologic estimates. Collectively, these factors mean the findings should be interpreted with caution; however, they provide valuable insights that can guide future research, improve data quality, and strengthen pediatric osteomyelitis care across Africa

Future research should prioritize prospective, multicenter studies encompassing diverse African regions to better define disease epidemiology, antimicrobial resistance patterns, and long-term outcomes. Standardized diagnostic criteria and treatment protocols, adapted to resource-limited settings, should be developed to improve comparability of data and quality of care. Studies should consistently report follow-up, including outcomes for those lost to care and those experiencing complications, to more accurately reflect true treatment success and morbidity. Strengthening microbiological capacity and antimicrobial resistance surveillance is critical to guide effective empiric therapy and antimicrobial stewardship. Finally, collaborative research and capacity-building initiatives between African institutions and global partners could help bridge evidence gaps and improve patient outcomes.

Conclusion

This systematic review highlights that pediatric osteomyelitis remains a significant yet under-recognized cause of morbidity in Africa, with chronic forms predominating and the tibia and femur being the most frequently affected bones. *S. aureus* is the leading pathogen, but antimicrobial resistance, including methicillin resistance, is emerging as a major threat to effective empiric therapy. Surgical intervention, particularly sequestrectomy, is the most common management approach, though antibiotic regimens vary widely and are often guided by limited microbiological data. Reported recovery rates appear favorable; however, the absence of consistent reporting on losses to follow-up and post-treatment complications likely masks the true burden of recurrence, disability, and long-term sequelae.

These findings emphasize the urgent need for standardized diagnostic criteria, harmonized treatment protocols adapted to resource-limited settings, and robust antimicrobial stewardship strategies. Strengthening microbiology capacity and ensuring systematic follow-up are essential for accurate outcome assessment. While the current evidence base is limited, this review provides a critical foundation upon which to build more rigorous, prospective, and collaborative research to improve the prevention, diagnosis, and management of pediatric osteomyelitis in African healthcare systems.

Ethical approval

This manuscript does not involve patients, and hence, ethical approval was not required.

Consent

This manuscript does not involve patients/volunteers, and hence, consent was not required.

Sources of funding

None.

Author contributions

Initial idea: V.I. and A.M.K. Literature search: V.I. Writing the article: V.I., A.M.K., A.A., O.D.O., A.M.H., J.K., S.A., and A.M. Final approval: V.I., A.M.K., A.A., O.D.O., A.M.H., J.K., S.A., and A.M.

Conflicts of interest disclosure

None.

Research registration unique identifying number (UIN)

This manuscript does not involve any human participants.

Guarantor

Alex Mwangi Kihunyu.

Provenance and peer review

This manuscript was not invited.

Data availability statement

All data about the manuscript are available upon request from the corresponding and principal authors.

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