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Typhoid Fever among Children Under 15 Years in Africa: Epidemiology, Clinical Burden, Diagnosis, Treatment and Prevention

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ABSTRACT

Typhoid fever remains a preventable cause of illness and death among African children, especially where safe water, sanitation, and hygiene are limited. Caused by Salmonella Typhi, it spreads mainly through food or water contaminated with human faeces. Disease burden varies across Africa, but school-aged children are heavily affected in high-incidence areas. Diagnosis is difficult because symptoms are nonspecific, blood-culture services are scarce, prior antibiotic use reduces detection, and unreliable serological tests are still common. Rising multidrug resistance further limits treatment choices and highlights the need for antimicrobial-susceptibility monitoring and responsible antibiotic use. Typhoid conjugate vaccines offer effective, long-lasting protection and can be given from six months of age, making them suitable for childhood immunisation programmes. However, vaccination alone is insufficient. Control requires better water and sanitation systems, safer food practices, stronger surveillance and laboratories, improved treatment policies, and research into epidemiology, prevention, diagnosis, complications, and care for children under 15.

Keywords: typhoid fever; children; Africa; *Salmonella Typhi*; antimicrobial resistance; typhoid conjugate vaccine; water and sanitation

INTRODUCTION

Typhoid fever is a human-restricted bacterial infection caused by Salmonella Typhi and transmitted mainly through contaminated food or water. After ingestion, the bacteria invade the intestine, spread through the bloodstream, and may affect organs such as the liver, spleen, gallbladder, and bone marrow. The disease remains a major public health concern in low- and middle-income countries, especially in sub-Saharan Africa, where poor sanitation, unsafe water, overcrowding, poverty, and weak health systems sustain transmission [1]. Children under 15 are particularly vulnerable because of immature immunity, poor hygiene, contaminated environments, and unsafe food practices. Typhoid can cause prolonged fever, abdominal symptoms, weakness, weight loss, complications, school absence, and financial hardship for families [2]. Diagnosis is difficult because symptoms resemble other febrile illnesses, while laboratory capacity is limited. Antimicrobial resistance further complicates treatment. Prevention requires safe water, improved sanitation, hygiene, food safety, surveillance, vaccination, and stronger healthcare systems across endemic African communities and vulnerable populations [3]. Typhoid fever remains a major but preventable cause of illness among African children, especially in communities with unsafe water, poor sanitation, and weak food hygiene. Its true burden is uncertain because surveillance systems and laboratory testing are limited, leading to misdiagnosis, underreporting, delayed treatment, and unnecessary antibiotic use [4]. The rise of antimicrobial-resistant S. Typhi further complicates treatment by reducing effective options and increasing the risk of severe illness, complications, and death. Although vaccination, improved water and sanitation, accurate diagnosis, and responsible antibiotic use can reduce typhoid, access remains unequal. Consolidated evidence is needed to guide policy, practice, and future research [5]. This review examines evidence on typhoid fever among African children under 15, focusing on epidemiology, transmission, risk factors, clinical features, diagnosis, antimicrobial resistance, treatment, and prevention. It is significant because it can improve understanding of the disease, help healthcare workers recognise symptoms, address diagnostic limitations, and make better treatment decisions. The findings may guide policymakers in prioritising clean water, sanitation,

hygiene, food safety, vaccination, and antimicrobial stewardship. The review also identifies research gaps, including weak surveillance, limited age-specific data, and insufficient evidence from rural populations, ultimately supporting efforts to reduce illness, complications, absenteeism, costs, and preventable deaths across the continent.

Epidemiology and Disease Burden

Typhoid fever is unevenly distributed across Africa, with incidence varying widely between countries, districts, cities, and neighbourhoods. High-burden areas occur in West, Central, East, and Southern Africa, although weak surveillance means the true burden is often underestimated. Standardized monitoring through the Typhoid Fever Surveillance in Africa Program, conducted at 13 sites in ten sub-Saharan countries, confirmed invasive Salmonella infections in both urban and rural settings and revealed major differences in incidence [6]. Some locations have reported more than 300 cases per 100,000 person-years, especially among children aged five to 15 years, though rates can change rapidly due to outbreaks, climate, migration, water failures, sanitation conditions, and healthcare access. Children bear a large share of disease, with school-aged children exposed through unsafe food, shared sanitation, contaminated water, and crowded environments. Preschool children are also at risk and may develop severe, culture-confirmed disease [7]. However, age patterns may be distorted by differences in care-seeking. The paediatric burden is underestimated because many children never reach formal care, blood culture is often unavailable, antibiotics reduce culture sensitivity, small blood samples are collected, cases are misdiagnosed, mild illness goes untested, and community deaths lack confirmed causes. WHO therefore supports laboratory-based and population-based surveillance for reliable incidence estimates [8].

Transmission and Risk Factors

Typhoid transmission is driven mainly by faecal contamination of food and drinking water, especially among children living in households without piped water, protected sources, functional latrines, or reliable waste disposal. Water may become contaminated at the source, during transport, storage, or handling, while intermittent supplies and flooding can force families to use unsafe alternatives and allow sewage to pollute wells and homes [9]. Rapid urbanization and overcrowding further increase risk in informal settlements where sanitation infrastructure is inadequate, toilets and water points are shared, and open drains carry waste near homes, schools, and markets. Poor food hygiene also contributes, particularly when food is prepared with contaminated water, handled by infected persons, or sold without handwashing facilities, safe storage, and proper waste disposal. Raw produce, unpasteurized milk, undercooked foods, and unsafe ice may spread infection [10]. Transmission can continue within households because some recovered patients remain chronic carriers and shed *Salmonella Typhi* for long periods. Poverty worsens exposure and delays care by limiting access to treated water, transport, laboratory testing, and antibiotics. Weak surveillance, limited laboratory capacity, staff shortages, and fragmented reporting systems can also allow outbreaks to remain undetected and increase complications among affected children and vulnerable communities across many African settings [11].

Clinical Presentation in Children

Typhoid fever in children usually presents as a prolonged febrile illness, although symptoms vary with age, nutritional status, prior antibiotic use, and disease duration. Common features include persistent or rising fever, headache, fatigue, weakness, poor appetite, abdominal pain, nausea, vomiting, diarrhoea or constipation, early cough, enlarged liver or spleen, and occasionally raised spots. The World Health Organization recognizes prolonged fever, fatigue, headache, nausea, abdominal pain, constipation, and diarrhoea as typical, but no single sign confirms the diagnosis [12]. Infants and younger children often have nonspecific symptoms that may resemble sepsis, malaria, pneumonia, or acute gastroenteritis. They may show irritability, poor feeding, lethargy, vomiting, diarrhoea, or abdominal distension. In endemic areas, malaria and typhoid are sometimes suspected together, but diagnosing "typhoid-malaria" without laboratory evidence may result in unnecessary use of both antimalarial and antibacterial medicines, increasing costs, adverse effects, and antimicrobial resistance risks, and may delay identification of the true underlying illness [13].

Complications and Mortality

Without effective treatment, typhoid fever can become severe and life-threatening, with untreated mortality ranging from 10% to 30%, compared with about 1% to 4% when appropriate therapy is given. In children, major complications include intestinal bleeding or perforation, peritonitis, septic shock, encephalopathy, hepatitis, myocarditis, pneumonia, acute kidney injury, dehydration, anaemia, and relapse [14]. Intestinal perforation is especially serious in African children and usually develops during the second or third week of untreated or poorly treated illness after ulceration of intestinal lymphoid tissue. Warning signs include sudden severe abdominal pain, guarding, abdominal distension, vomiting, absent bowel sounds, and sepsis. Mortality is higher when surgery is delayed or when children present with organ failure, malnutrition, or extensive peritoneal contamination. A Ugandan study reported about 21% mortality after surgery. Outcomes also depend on timely access to paediatric surgery, anaesthesia, blood transfusion, intensive care, intravenous fluids, effective postoperative infection control, and skilled clinical teams overall [15].

Diagnosis

Diagnosing typhoid fever in children is difficult because its symptoms overlap with malaria, dengue, brucellosis, invasive salmonellosis, urinary infection, rickettsial disease, and other febrile illnesses, so laboratory confirmation is recommended. Blood culture is the preferred test because it confirms S. Typhi and allows antimicrobial susceptibility testing, but sensitivity is only about 40–60% and is reduced by low blood volume, prior antibiotics, delayed sampling, low bacteremia, poor transport, and weak laboratory systems. Age-appropriate blood volumes are essential to avoid false negatives [16]. Bone-marrow culture is more sensitive and may remain positive after antibiotics, but it is invasive and impractical for routine use. Stool culture is mainly useful for detecting persistent shedding or chronic carriage. Widal and other serological tests have limited specificity and may encourage overdiagnosis and unnecessary antibiotic use. Molecular tests can detect bacterial DNA, but cost and infrastructure limit access, highlighting the need for affordable, accurate point-of-care diagnostics in Africa.

Antimicrobial Resistance

Antimicrobial resistance poses a major challenge to typhoid control. Older first-line drugs, including chloramphenicol, ampicillin, and trimethoprim-sulfamethoxazole, have lost effectiveness in many places, with multidrug-resistant typhoid defined as resistance to all three. Fluoroquinolones were later adopted, but growing resistance has increased reliance on ceftriaxone, other third-generation cephalosporins, and azithromycin. Continued resistance may raise treatment costs, lengthen hospital stays, and increase complications [17]. Genomic studies in Africa have identified resistant S. Typhi lineages in high-burden areas, especially among children under 15. Because resistance varies by country and over time, treatment should follow local susceptibility data whenever possible. Stronger antimicrobial stewardship, culture-based surveillance, and typhoid conjugate vaccination are essential. Resistance is also worsened by unregulated antibiotic sales, incomplete treatment, counterfeit or poor-quality medicines, and treatment decisions based on unreliable diagnostic tests. Coordinated national and regional action is therefore necessary to preserve effective antibiotics, improve diagnosis, and reduce transmission in vulnerable affected communities worldwide [18].

Treatment and Clinical Management

Children with suspected typhoid fever should be evaluated for illness severity, hydration, nutritional status, altered consciousness, abdominal complications, and shock. Management requires prompt effective antibiotics, fluids, correction of electrolyte imbalances, nutritional support, antipyretics, and close monitoring for gastrointestinal bleeding, intestinal perforation, neurological problems, or peritonitis requiring surgical referral. Antibiotic selection should reflect local resistance patterns, disease severity, previous antibiotic use, and the child's ability to take oral medicine. Ceftriaxone and azithromycin are commonly used in endemic areas, but guidelines should be followed [19]. Severe cases usually need hospitalization and parenteral treatment. Where cultures are unavailable, empirical therapy may be started, ideally after collecting blood samples. Treatment should be adjusted once susceptibility results are known. Improvement often begins within days, although persistent fever early in therapy may not mean failure. Deterioration, prolonged fever, or bacteraemia requires reassessment. Relapse is possible, so caregivers must ensure treatment completion and seek care if fever returns.

Prevention and Control

Typhoid prevention and control require vaccination, improved water and sanitation, effective outbreak response, and responsible antibiotic use. Typhoid conjugate vaccines are recommended by WHO because they can be given from six months of age and provide long-lasting protection. Vaccination should be prioritized in high-burden and antimicrobial-resistant settings through catch-up campaigns, routine infant schedules, outbreak vaccination, and targeted programs for high-risk areas. However, vaccines must be supported by safe water, sewage disposal, latrines, handwashing facilities, safe food handling, household water treatment, drainage, waste management, and hygiene education [20]. Schools are sites for vaccination, hygiene promotion, safe water provision, handwashing, and surveillance of fever clusters. During outbreaks, authorities should confirm cases through laboratories, map transmission, test water sources, monitor resistance, provide chlorination and safe water, improve sanitation, communicate hygiene messages, and conduct active case finding. Antimicrobial stewardship should emphasize blood cultures, guideline-based treatment, susceptibility testing, appropriate treatment duration, antibiotic regulation, and public education.

CONCLUSION

Typhoid fever remains a serious yet preventable threat to African children under 15, especially in communities facing unsafe water, poor sanitation, poverty, overcrowding, and weak healthcare systems. School-aged children are most affected, although infants and preschoolers also remain vulnerable. Controlling typhoid requires a coordinated approach that combines typhoid conjugate vaccination with investments in clean water, sanitation, food safety, laboratory-based surveillance, and responsible antibiotic use. Expanding access to blood culture testing and reducing reliance on inaccurate serological tests are essential for proper diagnosis and treatment. Strong political commitment and sustained funding are needed to turn current knowledge into effective action. Preventing typhoid among African children would reduce illness and deaths, lower unnecessary antibiotic use,

improve school attendance, protect household incomes, and support wider child health and development goals. A comprehensive, long-term public health response is therefore necessary to achieve lasting reductions in disease burden across the continent for generations to come.

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