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The Burden of Typhoid Fever in Urban Versus Rural Uganda: Disparities in Access to Treatment and Prevention

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ABSTRACT

Typhoid fever remains a significant public health challenge in Uganda, disproportionately affecting populations with inadequate access to clean water, sanitation, and healthcare services. This review examines the epidemiological differences in typhoid fever between urban and rural areas of Uganda, emphasizing disparities in access to treatment and prevention. Urban centers experience higher population densities, which facilitate rapid disease transmission, while rural areas face greater challenges related to healthcare accessibility, delayed diagnosis, and inadequate treatment. The review also explores socioeconomic and infrastructural determinants that exacerbate disparities, including differences in vaccine availability, sanitation infrastructure, and public health interventions. Furthermore, it evaluates treatment outcomes, comparing the effectiveness of healthcare delivery systems in both settings. Lastly, the review discusses potential policy solutions to bridge these gaps, including improved surveillance, enhanced vaccination strategies, and the expansion of water and sanitation initiatives. By addressing these disparities, Uganda can work toward a more equitable approach to typhoid fever prevention and control.

Keywords: Typhoid Fever, Urban, Rural, Uganda, Sub-Saharan Africa.

INTRODUCTION

Typhoid fever, caused by *Salmonella enterica* serovar Typhi, remains a significant public health concern in many low- and middle-income countries, particularly in sub-Saharan Africa [1]. The disease is primarily transmitted through contaminated food and water and is closely associated with inadequate sanitation, poor hygiene, and limited access to clean drinking water. Uganda is among the countries with a high burden of typhoid fever, where frequent outbreaks highlight persistent challenges in disease control and prevention [2]. Despite global and national efforts to combat typhoid through vaccination programs, improved sanitation infrastructure, and antibiotic treatments, substantial disparities exist in the prevalence, management, and health outcomes between urban and rural populations [3]. The burden of typhoid fever in Uganda is exacerbated by socio-economic and infrastructural inequalities that create distinct challenges for urban and rural communities. In urban areas, high population densities, inadequate drainage systems, and the contamination of water supplies facilitate the rapid spread of the disease [4]. Although urban dwellers often face environmental conditions conducive to disease outbreaks, they typically have better access to healthcare facilities, diagnostic services, and treatment options. In contrast, rural populations, while benefiting from lower population densities, struggle with limited access to essential healthcare services. Long travel distances to health centers, insufficient diagnostic capacity, and inadequate availability of effective treatment contribute to delayed or incomplete management of typhoid fever in rural areas [5]. Furthermore, the increasing prevalence of antibiotic-resistant *Salmonella* strains presents an additional challenge in both urban and rural settings. Resistance to commonly used antibiotics such as ampicillin, chloramphenicol, and fluoroquinolones threatens to undermine treatment efficacy and prolong disease duration [6, 7]. Rural communities, which often have fewer healthcare alternatives and limited laboratory facilities for antimicrobial susceptibility testing, may be disproportionately affected by this growing threat. These disparities in healthcare access, diagnostic capabilities, and treatment outcomes necessitate a deeper investigation into how urban and rural differences impact the epidemiology and control of typhoid fever in Uganda [8]. This review examines the epidemiology, healthcare

access, and treatment outcomes of typhoid fever in urban and rural Uganda. The study aims to identify differences in disease prevalence, transmission dynamics, and outbreak patterns between urban and rural areas, evaluate socio-environmental factors contributing to typhoid fever incidence, compare disparities in healthcare access and diagnostic capabilities, and investigate barriers to timely and effective treatment in rural areas [9]. The study also analyzes treatment outcomes and antibiotic resistance patterns, assessing the effectiveness of current treatment regimens in urban and rural populations, and explores the impact of antibiotic resistance on disease management and recovery rates. Policy recommendations and interventions are proposed to improve typhoid control, including strategies to bridge healthcare access gaps between urban and rural settings [10]. Understanding the disparities in typhoid fever epidemiology, healthcare access, and treatment outcomes is crucial for developing targeted interventions to enhance disease control. This study holds significant public health implications for stakeholders, including policymakers, healthcare providers, and international health organizations. Public health impacts include addressing sanitation deficiencies, expanding vaccination coverage, and strengthening healthcare infrastructure to mitigate the burden of typhoid fever. Strengthening healthcare systems, understanding regional resistance patterns, and advocating for increased investment in water, sanitation, and hygiene (WASH) initiatives, expanded immunization programs, and community-based disease surveillance systems can significantly improve typhoid fever management [11, 12]. Future research directions include identifying key knowledge gaps in typhoid fever control and suggesting areas for further research, such as the development of novel diagnostic tools, alternative treatment approaches, and the impact of climate change on disease transmission. Typhoid fever remains a persistent health challenge in Uganda, disproportionately affecting populations based on their geographic and socio-economic status. Urban areas experience frequent outbreaks due to poor drainage and water contamination, while rural communities face significant barriers to timely and effective treatment, exacerbating disease severity and health outcomes. This review provides a comprehensive analysis of these disparities, offering insights into how targeted public health interventions, improved healthcare infrastructure, and policy innovations can bridge the gap in typhoid fever control.

Epidemiology of Typhoid Fever in Uganda

Typhoid fever is a significant public health concern in Uganda, particularly in urban slums and rural communities with inadequate sanitation and limited access to clean water [13]. The disease, caused by Salmonella enterica serovar Typhi, is primarily transmitted through the ingestion of contaminated food and water. The incidence and prevalence of typhoid fever vary across different regions, with urban centers generally reporting higher case numbers than rural areas due to rapid transmission in overcrowded environments. Densely populated slums in urban areas experience recurrent typhoid outbreaks due to contaminated water supply and inadequate waste management systems. Rural regions may have underreported cases due to limited disease surveillance, restricted healthcare access, and reliance on traditional medicine. The absence of diagnostic facilities in some remote areas further complicates the accurate assessment of typhoid prevalence. Studies indicate that Uganda has a high burden of typhoid fever, with periodic outbreaks affecting thousands of individuals annually [14]. However, the actual burden may be underestimated due to gaps in reporting and laboratory-confirmed case detection. Risk factors for the transmission and persistence of typhoid fever in Uganda include contaminated food and water sources, poor sanitation and hygiene practices, socioeconomic status, limited healthcare access and vaccine coverage, and seasonal variations. Flooding and water contamination, infrastructure damage, and increased food contamination are some of the factors contributing to this trend. Addressing the epidemiology of typhoid fever in Uganda requires a multi-pronged approach, including improved water and sanitation infrastructure, enhanced disease surveillance, increased vaccination coverage, and public health education on hygiene practices [15]. Urban areas report higher incidence rates due to rapid disease transmission, while rural areas may have an underestimated burden due to surveillance limitations. Addressing the disease's epidemiology requires improved water and sanitation infrastructure, enhanced disease surveillance, increased vaccination coverage, and public health education on hygiene practices.

Disparities in Access to Healthcare

Access to healthcare is influenced by factors such as geographic location, financial capacity, and medical infrastructure. Disparities exist between urban and rural populations, affecting the quality and timeliness of care received. Urban areas have a higher concentration of hospitals, clinics, and diagnostic facilities, which benefit from better-equipped institutions, more healthcare professionals, and advanced medical technologies [16]. However, affordability remains a major concern, particularly for low-income residents who struggle to access healthcare due to high consultation fees, medication costs, and expenses associated with specialized treatments. Rural areas suffer from a severe shortage of healthcare facilities, leading to delayed treatment and worsening health conditions. Rural health centers are often understaffed and underequipped, making it difficult to provide comprehensive medical care. The financial burden is also significant, as rural populations tend to have lower incomes and limited health insurance coverage. Diagnostic challenges exist in both urban and rural healthcare settings. Urban healthcare settings have access to advanced diagnostic tools, such as blood cultures, imaging technology, and rapid diagnostic tests (RDTs),

which enable healthcare providers to make accurate diagnoses and prescribe appropriate treatments. However, rural health centers often lack adequate or absent diagnostic facilities, leading to misdiagnosis, inappropriate treatment regimens, and hampering disease surveillance and control efforts. Health infrastructure plays a crucial role in addressing healthcare disparities. Urban hospitals and pharmacies are generally well-stocked with essential medicines, including antibiotics and specialized treatments, reducing treatment delays [17]. However, rural health facilities often experience stockouts due to supply chain disruptions, inadequate funding, and logistical challenges, forcing patients to seek alternative treatments. This lack of essential drugs contributes to prolonged illnesses, complications, and increased mortality rates, particularly for treatable conditions.

Treatment Outcomes and Challenges

Antibiotic resistance is a significant challenge in treating infectious diseases, with overuse and misuse of antibiotics leading to the development of resistant strains [18]. In urban areas, self-medication is prevalent due to the availability of antibiotics without prescriptions, further accelerating resistance. In rural regions, limited access to newer and more effective antibiotics exacerbates treatment difficulties. The lack of robust antibiotic stewardship programs and inadequate regulation of pharmaceutical distribution contribute to this growing crisis, making disease management increasingly complex. Healthcare-seeking behavior varies significantly between urban and rural populations, influencing treatment outcomes. Urban residents are more likely to seek medical attention early due to better health literacy, greater awareness of disease symptoms, and easier access to healthcare facilities [19]. Rural residents often delay seeking medical care due to financial constraints, long travel distances, and cultural beliefs that prioritize traditional medicine over biomedical approaches. Additionally, stigma associated with certain diseases may prevent individuals from seeking timely medical help, further exacerbating health disparities. Delayed diagnosis and disease progression are also challenges in resource-limited settings. Rural healthcare facilities often lack advanced diagnostic tools, trained personnel, and reliable laboratory infrastructure, leading to diseases being diagnosed based on clinical symptoms rather than laboratory confirmation. Late-stage presentations are common, particularly for chronic and infectious diseases, where early intervention is crucial to preventing complications and reducing mortality rates. Addressing these challenges requires a multi-faceted approach, including strengthening antibiotic stewardship programs, improving healthcare infrastructure, enhancing public awareness about appropriate healthcare-seeking behaviors, and expanding access to quality diagnostic services [20]. Policymakers and healthcare stakeholders must prioritize these areas to improve treatment outcomes and reduce health disparities between urban and rural populations.

Prevention Strategies and Public Health Interventions

Typhoid fever is a critical disease in Uganda, with the World Health Organization (WHO) recommending the use of typhoid conjugate vaccines (TCVs) [21]. However, the distribution and uptake of TCVs in Uganda remain inconsistent due to logistical and socioeconomic challenges. Urban areas have higher vaccination coverage due to better healthcare infrastructure and proximity to hospitals, clinics, and immunization programs. Rural areas face significant barriers to vaccination, including inadequate cold chain systems, limited healthcare facilities, and transportation challenges [22]. Additionally, vaccine hesitancy due to misinformation or cultural beliefs further reduces coverage. Strengthening outreach programs and mobile vaccination units is essential to bridge this gap and ensure equitable access to immunization. Poor water, sanitation, and hygiene conditions are major contributors to typhoid transmission, particularly in resource-limited settings. Urban areas generally have better access to piped and treated water, but rapid population growth and inadequate sanitation infrastructure often overwhelm existing systems. Expanding access to improved sanitation facilities, promoting household water treatment methods, and constructing protected water sources are essential for reducing typhoid incidence [23]. Community awareness and hygiene practices play a vital role in preventing typhoid fever, but disparities exist between urban and rural populations in terms of knowledge and adherence to preventive measures. Tailoring awareness programs to local languages, engaging community leaders, and incorporating culturally appropriate messaging can enhance the effectiveness of hygiene promotion efforts.

Socioeconomic and Policy Considerations

The Ugandan government has implemented typhoid control programs, focusing on vaccination, improved sanitation, and public health education. However, challenges hinder their effectiveness, particularly in rural areas. Limited financial resources restrict the expansion of these programs, resulting in inadequate vaccine procurement, infrastructure development, and outreach services [24]. The disparity in healthcare access between urban and rural areas affects the efficiency of typhoid control efforts. Policy gaps and implementation challenges further exacerbate the spread of typhoid, particularly in informal settlements and rural communities. Non-governmental organizations (NGOs) and international agencies play a critical role in supplementing government efforts to control typhoid in Uganda. Key contributors include the World Health Organization (WHO), United Nations Children's Fund (UNICEF), Gavi, the Vaccine Alliance, and local NGOs and community-based organizations [25]. However, long-term sustainability of NGO-led programs remains a concern, as many initiatives are dependent on external funding.

To bridge the urban-rural gap, policies should prioritize decentralizing healthcare services, expanding rural sanitation programs, enhancing health education and community engagement, and improving data collection and surveillance. By prioritizing sustainable funding, infrastructure development, and equitable access to healthcare services, Uganda can work towards reducing the burden of typhoid and improving overall public health outcomes

CONCLUSION

Typhoid fever is a significant public health issue in Uganda, with disparities in disease prevalence, healthcare access, and treatment outcomes between urban and rural populations. Urban areas have better healthcare infrastructure, diagnostic tools, and access to effective treatments, while rural communities struggle with inadequate facilities, limited diagnostic capacity, and restricted treatment access. This leads to delayed diagnosis, poor treatment adherence, and worse health outcomes. The increasing prevalence of antibiotic-resistant Salmonella strains complicates treatment efforts in both urban and rural settings. Addressing these challenges requires a comprehensive, multi-sectoral approach that integrates improved healthcare infrastructure, enhanced diagnostic capabilities, and strengthened public health interventions. Policymakers must prioritize the expansion of clean water and sanitation initiatives, increase access to typhoid vaccines, and implement targeted public health campaigns promoting hygiene and food safety practices. Strengthening rural healthcare systems through better-equipped facilities, trained healthcare professionals, and reliable diagnostic services is crucial for early disease detection and timely treatment. Robust surveillance systems should be established to track disease patterns and assess antibiotic resistance trends. By addressing these disparities and implementing sustainable health policies, Uganda can significantly reduce the burden of typhoid fever and move towards equitable healthcare access for all populations.

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