Investigation of suspected anthrax outbreak in Sinazongwe district, Zambia, 2024

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Summary

Anthrax remains endemic in Luangwa Valley and the Zambezi floodplains of Zambia. This study investigated a suspected anthrax outbreak in Sinazongwe District to describe case demographics and clinical characteristics to confirm the outbreak. Furthermore, assess knowledge, attitudes, and practices relating to anthrax were assessed.

A case series study was employed using a structured questionnaire on Kobo Collect from five active cases. Clinical examinations and sample collection were conducted on human and domestic animal cases alongside environmental sampling. Demographic and clinical data were analysed using Microsoft Excel while collected samples were submitted to the lab for culture and polymerase chain reaction tests to confirm anthrax.

Among the five cases assessed, four were male, aged 11–45 years. Two cases were from the same household, while three belonged to different families. Occupational risk was evident, with two cases being fishermen (n=2) and two livestock farmers (n=2). Three individuals had prior knowledge of anthrax (n=3), while two (n=2) understood transmission routes, and only one was aware of preventive measures. All assessed cases had consumed meat from animal carcasses and presented with skin lesions. All cases received antibiotic treatment.

The outbreak primarily affected males due to occupational exposure. Limited knowledge of anthrax transmission and prevention, coupled with unsafe carcass handling, underscores the need for targeted health education.

Introduction

Anthrax is a zoonotic infectious disease caused by *Bacillus anthracis*, a soil borne pore forming gram positive bacterium (Doganay et al., 2023). Globally, anthrax is recognised as a significant public health and economic burden, particularly in regions where livestock farming plays a central role in the economy and where close interactions

between humans and animals facilitate zoonotic transmission (Pittiglio et al., 2022). Human anthrax cases are primarily classified into three clinical categories: the cutaneous form, which accounts for approximately 95% of reported cases worldwide; the gastrointestinal form; and the pulmonary form (Hampson et al., 2011). Transmission to humans occurs mainly through contact with infected animals or contaminated animal products, with no evidence of person-to-person transmission (McKendrick, 1980).

In sub–Saharan Africa, anthrax remains a persistent challenge to both public and animal health, particularly in regions with extensive livestock farming. The disease affects both domestic and wild herbivores, posing significant risks to human health. Environmental factors such as temperature, precipitation, soil type and vegetation significantly influence the survival and distribution of *B. anthracis* spores, which can persist in the environment for decades (Antonation et al., 2016). During droughts or dry seasons, herbivores grazing close to the soil due to scarce pastures are at greater risk of anthrax spores exposure, while water scarcity may drive livestock herds into wildlife zones where soil contamination levels with spores are higher (Aladejana et al., 2023). The intertwined challenges of anthrax control in sub–Saharan Africa highlight the importance of integrated strategies that address both environmental and epidemiological factors.

In Zambia, anthrax is endemic, with outbreaks frequently reported in the Luangwa Valley and the Zambezi floodplains due to the high interaction between livestock and wildlife. Between January and November 2023, 684 suspected human anthrax cases, including four deaths (CFR 0.6%), were reported across nine provinces. Sinazongwe District, in Southern Province , an area not known for anthrax endemicity, emerged as the epicentre, accounting for 287 cases (42%) and two deaths (50%) of the total (WHO, 2023). The disease then spread to other towns through consumption of infected meat from the epicentre. We investigated an increase in suspected anthrax cases in Sinazongwe district to describe demographic and clinical characteristics of cases; assess knowledge, attitude and practices; confirm the outbreak and recommend prevention and control measures.

Methods

Investigation site

The study was conducted in Sinazongwe district, a rural area in Zambia's Southern Prov-

ince. The district covers an area of approximately 4813.6 km² and has a human population of approximately159055 and Livestock population (cattle, goats and Sheep of approximately 146000(Census report, 2022). The human population is predominantly rural, with over 70 percent engaged in livestock rearing and Fishing as a primary livelihood. The district is divided into 6 administrative wards, with healthcare services provided by 34 healthcare facilities. According to the Ministry of Health line list from March 2024 to November 2024, Sinazongwe recorded over 199 suspected anthrax cases, although 98% of these cases were not laboratory confirmed. The distribution of cases was as follows: 15 cases (8%) in children under five years, 38 cases (19%) in individuals aged 5–15 years, and 146 cases (73%) in those over 15 years (IDSR 2023),

Study design and population

To investigate the suspected anthrax outbreak, we conducted a descriptive case series study. The study focused on five active suspected human anthrax cases reported from Nabukowa and Sikaneta Health Posts.

Data Collection

Data were collected using a structured questionnaire on Kobo Collect Tool, a mobile-based data collection application. The questionnaire captured demographic information, clinical history, knowledge, attitudes, and practices (KAP) related to anthrax. It also included details on the health services provided to the cases, such as laboratory investigations, treatment received, and follow-up care. The data collection process involved interviews with the five active cases. Clinical data were collected from health facility records, and community-level data were obtained through discussions with healthcare providers and community leaders.

Sample Collection

Human, animal and soil samples were collected and transported to Zambia National Public Health Institute Reference Laboratory for confirmation.

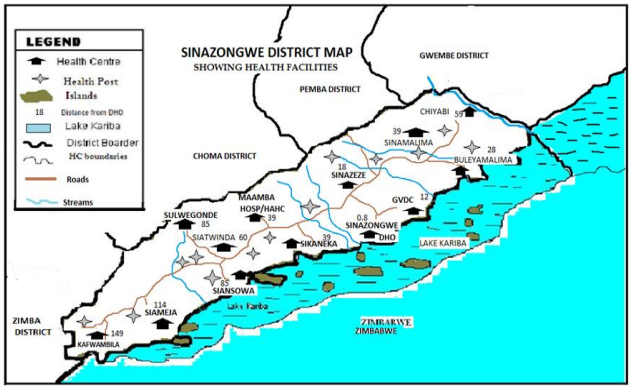

Figure 1 Map of the Investigation Site in Sinanzongwe District

Data Analysis

The collected data were analysed descriptively to summarize the demographics, KAP, and health services provided to the cases. Frequencies and proportions were used to analyse categorical variables; each case was described in detail while narrative synthesis was used to describe community-level findings. Laboratory tests were conducted to confirm anthrax.

Ethical Considerations

Permission to investigate was obtained from Zambia National Public Health Institute, Southern Provincial Health Office and Sinazongwe District Health Office. All participants provided both verbal and written informed consent before participating in the study. Anonymity and confidentiality of the participants' data were strictly maintained throughout the investigation.

Results

Demographic and clinical characteristics of cases

This investigation revealed that more males than females were affected, with majority of those affected being below 40 years (Table 1)

Table 1: Demographic Characteristics of suspected cases of Anthrax, Sinazongwe district, 2024. (N = 5).

Demographic characteristic	Frequency (%)
Sex	
Male	4 (80%)
Female	1 (20%)
Age group	
<40	3 (60%)
≥40	2 (40%)
Place of residence	
Lusinga	2(40%)
Tobonte	1 (20%)
Siavwemu	1 (20%)
Chande	1(20%)
Occupation	
No occupation	1 (20%)
Livestock farmer	2 (40%)
Fishermen	2 (40%)
Marital status	
Single	2 (40%)
Married	2 (40%)
Separated	1(20)
Level of education	
Primary	5 (100%)
Religion	
Christianity	5 (100%)

Clinical symptoms observed

All five cases (n=5, 100%) presented with characteristic skin lesions and swelling around the lesion, consistent with cutaneous anthrax, along with body weakness. Additionally, three cases experienced headaches, while two had fever. Muscle aches and vomiting were reported in one case each. None of the five cases had any underlying medical conditions (Figure 2 and 3).

Figure 2 Anthrax skin lesions of some of the cases assessed during investigations

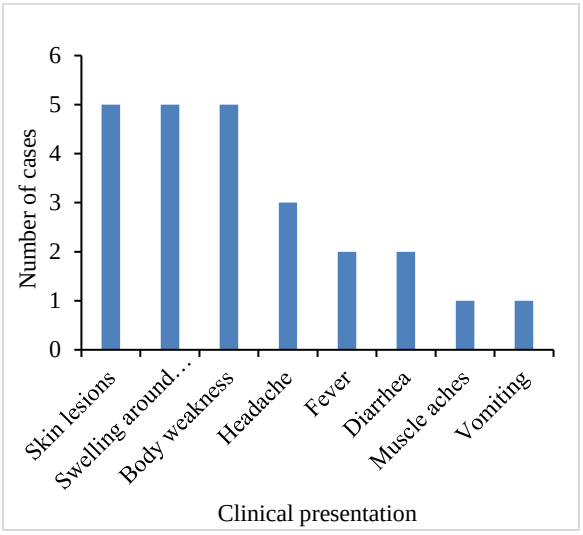

Figure 3 Figure 3: Signs and symptoms of Anthrax among suspected cases, Sinazongwe district 2024

Knowledge, Attitudes, and Practices (KAP)

During community sensitization meetings involving 54 community members, 31 members (57.4%) attributed the anthrax cases to the consumption of contaminated carcasses. Another 10 members (18.5%) believed that poor animal vaccination coverage in livestock was the primary cause, while 8 members (14.8%) pointed to improper disposal of carcasses as a contributing factor. Additionally, 5 members (9.3%) expressed no opinion on the matter.

From the cases assessed, three (n=3; 60%) reported knowing what anthrax is, while two (n=2; 40%) were unaware. Similarly, two cases (n=2; 40%) knew how anthrax is transmitted, but three (n=3; 60%) did not. Only one case (n=1; 20%) was aware of anthrax prevention methods, while the majority (n=4; 80%) lacked knowledge of preventive measures. All cases (n=5, 100%) admitted to consuming meat from animal carcasses prior to falling ill (Figure 5).

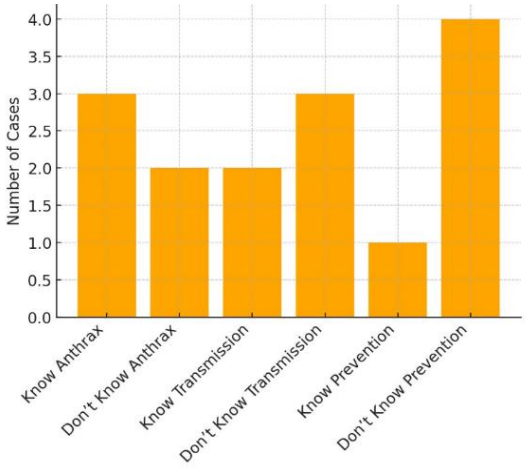

Figure 4 Knowledge among cases at Nabukowa Health Post, Sinazongwe district, 2024.

Confirmation of the outbreak

Only one sample was collected from five active cases and yielded a negative result.

Discussion

Laboratory analysis of soil, animal, and human samples from the 2024 anthrax outbreak in Sinazongwe District yielded negative results. However, affected individuals exhibited classic cutaneous anthrax symptoms, consistent with global epidemiological patterns, where cutaneous anthrax accounts for over 95% of human cases(McKendrick, 1980).. Notably, all reported cases had a history of consuming meat from animal carcasses, a well-documented risk factor for anthrax transmission (Mwakapeje et al., 2018). This indicates that exposure likely occurred through ingestion of contaminated meat, leading to infection despite the absence of laboratory confirmation. These findings highlight the need for a more comprehensive surveillance approach, integrating clinical diagnosis, epidemiological evidence, and laboratory confirmation to enhance anthrax detection and response

The anthrax outbreak predominantly affected males, a pattern commonly observed in previous outbreaks where occupational exposure plays a significant role (Hendricks et al., 2022). Men are more likely to engage in high-risk activities such as livestock handling, slaughtering, and butchering, increasing their likelihood of exposure to *Bacillus anthracis* spores (Doganay et al., 2023). The affected age range reflects that both adolescents and adults are vulnerable, particularly those engaged in agriculture and animal-related livelihoods, as documented in similar outbreaks in sub-Saharan Africa (Ogunleye et al., 2023).

Occupation was a critical determinant of risk, with livestock farmers and fishermen accounting for 80% of cases. These findings align with reports from Ethiopia and Zimbabwe, where anthrax outbreaks were linked to occupations involving direct animal contact (Antonation et al., 2016). In fishing communities, contamination of water sources with anthrax spores has also been proposed as a possible transmission route, warranting further investigation (Islam et al., 2013)

The investigation highlighted substantial knowledge gaps regarding anthrax transmission and prevention. While 60% of individuals from affected communities recognized anthrax as a disease, only 40% understood how it spreads, and just 20% were aware of preventive measures. This is consistent with

previous research indicating that communities were anthrax is endemic often lack accurate information, leading to unsafe behaviours (Traxler et al., 2019).

A major risk factor in this outbreak was the consumption of meat from animal carcasses, which all cases admitted to before developing symptoms. This aligns with findings from other outbreaks in Zambia and Uganda, where cultural and economic factors contribute to the continued consumption of meat from dead animals despite known health risks (Woods et al., 2004). Strengthening risk communication and food safety measures is essential to addressing this issue.

While the majority of community members attributed the outbreak to eating contaminated meat from dead animals, a minority number attributed it to poor animal vaccination while some linked it to improper carcass disposal. Similar misperceptions have been documented in other anthrax-endemic regions, where communities often fail to recognize the role of preventive veterinary measures (Turner et al., 2014). Addressing these knowledge gaps through culturally appropriate education campaigns is crucial for long-term prevention.

Given the significant knowledge gaps identified, targeted risk communication campaigns were emphasized. Previous interventions in anthrax-endemic areas have demonstrated that community education significantly reduces high-risk behaviors (Sitali et al., 2017). While initial sensitization efforts reached 54 individuals, scaling up to broader community coverage is necessary. Key messages should focus on the risks of consuming meat from dead animals, safe handling of animal products, and the importance of reporting sudden livestock deaths.

Animal vaccination remains the most effective strategy for anthrax prevention. In April 2024, 125,592 animals in Sinazongwe were vaccinated, achieving 86% coverage (Ministry of Fisheries and Livestock, 2024). However, reaching the remaining 14% of unvaccinated livestock is necessary for comprehensive control. Strengthening veterinary surveillance and expanding vaccination campaigns will be crucial in preventing future outbreaks and public protection (Turner et al., 2014)).

Surveillance must be improved to detect and respond to anthrax cases in both human and animal populations. Strengthening laboratory capacity for timely diagnosis, increasing

sample collection rates, and integrating human-animal health surveillance can enhance outbreak preparedness (Sitali et al., 2017).

Conclusion

The anthrax outbreak in Sinazongwe District was linked to the consumption of contaminated meat, with all affected individuals presenting with characteristic skin lesions and receiving treatment. Most cases were involved in fishing or livestock farming, and while some had basic knowledge of anthrax, awareness of its transmission and prevention was limited. Surveillance efforts were inadequate, with minimal sample collection.

Community engagement identified key factors contributing to the outbreak, including carcass consumption, poor vaccination coverage, and improper disposal of infected animals. These findings underscore the need for strengthened public health measures, including enhanced surveillance, targeted community education, and improved livestock vaccination strategies to prevent future outbreaks

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