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Dear Reader,

We are pleased to share with you Issue 4, Volume 2 of the Uganda National Institute of Public Health (UNIPH) Quarterly Epidemiological Bulletin.

This issue aims to inform stakeholders at district, national, and global levels on disease outbreak investigations, public health surveillance and interventions undertaken in detecting, preventing and responding to public health events in the country in the recent past.

In this issue, we present a variety of issues including: Articles on investigation of Anthrax, O'nyong nyong, Plague and Leprosy. We also highlight the Ebola Virus Disease outbreak in neighbouring DRC which spilled over into Uganda on 11 June 2019.

We wish to express utmost gratitude to Dr Bao-Ping Zhu for his committed and passionate service while with the Uganda Public Health Fellowship Program as US-CDC Resident Advisor over the last five years and wish him many blessings in his next endeavours.

For further information on anything in this publications please contact us on: dorynegona@musph.ac.ug, yvettewibabara@musph.ac.ug, pmuwereza@musph.ac.ug, musewaa@musph.ac.ug, OR lbulage@musph.ac.ug

We hope this will be an informative and enjoyable read and shall appreciate hearing back from you.

Thank You.

Inside this issue:

Ebola Virus Disease outbreak spills over into Uganda

By Doreen N. Gonahasa

On 11th June 2019, Ministry of Health declared the 6th outbreak of Ebola Virus Disease (EVD) in the country, in Kasese district, South Western Uganda. The first reported case was a five-year-old child with a recent history of travel to the Democratic Republic of Congo (DRC). This child was one of 6 people that travelled from the DRC while still being monitored as suspect cases following a burial of a grandfather who succumbed to EVD. The child was ill and his mother took him for medical care at Kagando Hospital in Kasese District. He presented with symptoms of vomiting blood, bloody diarrhea, muscle pain, headache, fatigue and abdominal pain. The child tested positive for Ebola Zaire by PCR and unfortunately later died on 11th June 2019. Two other members of the family, a grandmother and 3-year-old brother also tested positive for Ebola on 12 June 2019. These later passed away as well.

The Ministry of Health in partnership with the Kasese District Local Government and a number of development and implementing partners responded effectively to the outbreak and curbed spread of Ebola.

PHFP Family bids farewell to Dr. Bao-Ping Zhu

By Cohort 2019 Fellows

On 8th June, the Uganda Public Health Fellowship Program (PHFP) Fellows, alumni, and secretariat saw their very own Dr. Bao-Ping Zhu off to another appointment. The long serving Resident Advisor for the PHFP enjoyed a day of fun and laughter with the fellows, alumni, and secretariat staff as each of them narrated the memorable times they had shared with him. Dr. Bao-Ping joined PHFP in 2015 and was committed to training Fellows in field epidemiology. He was a transformational public health specialist, who was always ready to provide advice and perspective on any issue. His passion for field epidemiology was immeasurable. Through his gift of innovative thinking and an unwavering patience he successfully led five cohorts of disease detectives. Throughout his stay, he made a significant contribution in field epidemiology capacity building and control of public health emergencies in Uganda. His awards and many publications reveal that he was a distinguished character of considerable import! As one Fellow narrates, "Bao's contributions are tangible, I hear him speak every time I am making a presentation". Excellence, commitment, and time keeping are his attributes. If only we had many more like him! He was one of a kind and will be greatly missed as a mentor, a father and friend".

PHFP-secretariat handing over a token of appreciation to the Dr Bao-Ping Zhu a.t the farewell party

Uganda Holds the First African Hepatitis Summit

By Yvette Wibabara

On 18th June, 2019, the Uganda Ministry of Health together with The National Organization for People Living with Hepatitis B (NOPLHB) with support from partners successfully held a high-profile summit on Viral Hepatitis. The three-day event under the theme "Eliminating Viral Hepatitis in Africa: Implementing the Viral Hepatitis Strategy" saw delegates from over 25 African countries convene to share ideas on strategies towards the elimination of viral hepatitis not only in Uganda but Africa at large. Delegates were mainly from African Civil Society groups, WHO and its member states, CDC, World Hepatitis Alliance, African Union, East African Community, patient organizations, policy makers, academia, pharmaceutical industry, and funders. The Summit was intended to strengthen the broader Hepatitis community by sharing ideas, experiences, and best practices in addressing the many challenges of viral hepatitis in the region. The summit was productive as various countries shared their journey in the fight against viral hepatitis on achievements and lessons learnt. Uganda was hailed for its tremendous efforts in the fight against viral hepatitis.

H.E the vice president of Uganda Edward Ssekandi, H.E Deborah Malac, WHO Country Representative, and other delegates after the opening ceremony of the First African Hepatitis Summit

AFENET Trains FETP Alumni from Uganda, Kenya, and Tanzania on Ebola Virus Disease under the AFENET Corps of Disease Detectives umbrella, 1st-5th, April 2019, Kabarole, Uganda

By Angella Musewa

AFENET Corps of Disease Detectives (ACoDD) is a civil voluntary service of culturally competent professional field epidemiologists based on the One Health approach. It aims at ensuring maximum and efficient utilization of the well trained workforce from Field Epidemiology Training Programs (FETPs) across African Field Epidemiology Network (AFENET) member countries to respond to disease outbreaks and other public health emergencies. All graduates and residents of FETPs are automatic members of ACoDD.

When the Ebola Virus Disease (EVD) outbreak was declared in Democratic Republic of Congo in August 2018, countries including Uganda, South Sudan, Burundi, Rwanda, Tanzania, Kenya, and Congo Brazzaville were notified to be at high risk of Ebola spread. This was explained by the large influx of refugees from DRC into its neighbouring countries. Given that situation, the AFENET organized a five days training which targeted graduates of field epidemiology training programs, resident trainees in Uganda, Kenya, and Tanzania. Also in the training were District Health Officers and District Surveillance Focal Persons from the most at risk districts for EVD in Uganda. Facilitation of the training was led by experts from World Health Organization Center for Disease Control and Prevention Uganda, AFENET and Uganda-Ministry of Health. The training involved both classroom interactions and field visits. Key areas covered during the training included; Risk communication, contact tracing, active case search, risk assessment, best hygiene practices during EVD outbreak, Donning and Doffing off PPE during an outbreak and what to know about the Ebola vaccine. Several case scenarios were presented during the training and each participant was assigned a group as means of ensuring active participation. Feedback sessions at the end of each scenario were held and each group had to present their response.

Practical sessions for donning and doffing off of PPE were exhibited by one of the participants with guidance from an experienced member from the Ebola West Africa team. The training ended with a field visit at Bwera hospital and Mpondwe border screening point where a WHO standard tool was used to assess the preparedness and readiness of Uganda to fight Ebola in case a patient presented at Bwera hospital or the border entry point. The AFENET director observed the closure of meeting and each participant received a certificate of completion.

ACoDD trainees from Kenya, Tanzania, and Uganda receiving a briefing from a health worker at Mpondwe border screening Point, Kasese District Uganda

Some of the ACoDD trainees in a group photo during the training

Upcoming Events

WHO Forum on alcohol, drugs, and addictive behaviours: Geneva, 27 – 28 June 2019

The World Health Organization (WHO) Department of Mental Health and Substance Abuse is organizing a global Forum on alcohol, drugs, and addictive behaviours (FADAB) with a primary goal to enhance public health actions areas by strengthening partnerships and collaboration among public health oriented organizations, networks and institutions in the era of Sustainable Development Goals 2030 (SDG 2030)

3rd OHCEA International One Health Conference: Kampala, July 24th – 26th – 2019

Under the theme 'Harnessing One Health for Global Health Security' that will be held in Kampala, Uganda, the conference is drawing participation from a number of countries.

Global Vaccination Summit: Brussels, 12th September 2019

The European Commission and the World Health Organisation will co-host a Global Vaccination Summit in Brussels, Belgium

UN High-level Meeting on universal health coverage: New York, 23 September 2019

The meeting will be held at the United Nations General Assembly. The meeting, 'Universal Health Coverage: Moving Together to Build a Healthier World', will bring together heads of state, political and health leaders, policy-makers, and universal health coverage champions to advocate for health for all .

Continued from page 3

Fatal Pneumonic Plague in Zombo District, West Nile, Uganda, March 2019

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Summary

On 6 March 2019, the Public Health Emergency Operations Centre (PHEOC) received notification of a female adult patient admitted at Warr Health Center III in Zombo District presenting with symptoms of pneumonic plague. The patient tested positive for plague by Rapid Diagnostic Test (RDT). We investigated to determine the scope of the outbreak, the mode of transmission and recommend control measures. We identified 1 suspected and 1 confirmed case-patient, both females aged 35 years. Both case-patients (100%) had signs and symptoms consistent with pneumonic plague. RDT, culture and serology tests were positive of the one case-person tested. The surviving case-patient had been taking care of a sick relative brought in from Congo with similar symptoms who later died. In total, three of the patient's relatives are reported to have died, two while in Congo one in Uganda. Results suggested that plague was imported from Congo and delay in seeking healthcare resulted in death of one case-person. Timely response to the outbreak was effective in minimizing its spread. We recommended the following; continuous surveillance especially at border points, and strengthening collaboration during outbreaks between Uganda and the Democratic Republic Congo Ministries of Health.

Background

Plague, which is one of Uganda's priority zoonotic diseases has three possible presentations; bubonic, septicemic and pneumonic. The incubation period of plague ranges between 1-7 days (1) with variation of 2-8 days for bubonic plague and 1-4 days for pneumonic plague (1). If not quickly and appropriately treated plague is fatal.

Although more recently there are some sporadic cases, improved sanitation has limited the scale of epidemics to focal outbreaks. Advancement in diagnostics and access to appropriate antibiotic therapy have also substantially reduced case-fatality rates. Despite the decrease in human plague cases, plague bacteria continue to circulate in enzootic hosts and their fleas within plague-endemic areas including Democratic Republic of Cong (DRC) and the West Nile region of Uganda, with up to 100% fatality rate of the pathogen for untreated cases (2). West Nile is a densely populated remote area near the borders of DRC and South Sudan.

On 6 March 2019, PHEOC received notification of a female adult patient presenting with fever, cough in blood and difficulty in breathing admitted at Warr Health Center III in Zombo District. The patient tested positive for plague by RDT. We investigated to determine the scope of the outbreak, the mode of transmission, and recommend control measures.

Methods

We defined a suspected bubonic plague case as onset of swollen lymph nodes with fever or chills; and a suspected pneumonic plague case as onset of at least 2 of the following: cough (bloody or wet), chest pain, difficulty in breathing or fever in a resident of Democratic Republic of Congo (DRC) or Zombo District between 1 February and 31 March 2019. A confirmed case was as a suspected case positive for Yersinia pestis by culture or serological tests. We gathered data and information through active case finding and reviewed medical records. We conducted descriptive epidemiology to describe the time, place and person characteristics of the case persons.

Results

We identified 1 suspected bubonic plague case (Case-patient A; fatal) in DRC and 2 suspected pneumonic plague cases (1 fatal) in Zombo, Uganda. On February 26, Case-patient A (4-year-old boy whose father was Congolese) was buried in DRC near the Uganda border after reportedly succumbing to bubonic plague. Case-patient B (35-year-old mother to Case-patient A) fell ill with suspected pneumonic plague while attending to Case-patient A. It was reported that she did not seek any medical attention while in DRC. Case-patient A was brought by family members to a health facility in Uganda on February 28, but died on arrival probably because the disease had progressed due to delay in receiving treatment.

On March 4, Case-patient C (35-year-old sister to Case-patient B), who attended to Case-patient B while she was ill presented with pneumonic plague symptoms. She tested plague-positive by RDT. Further tests by culture were presumptive positive and serology was positive. She was managed at the health facility on antibiotic treatment until recovery. A total of 114 contacts were traced and given antibiotics as prophylaxis. No additional cases were reported.

Further investigations revealed that in the same family three other people were reported to have suffered from bubonic plague in DRC including one fatality. In total, six family members are recorded to have been affected by the outbreak, four while in Congo (Atungkulei, Mahagi District, Ituri Province) and two in Uganda. Figure1 shows a transmission tree as per occurrence of events.

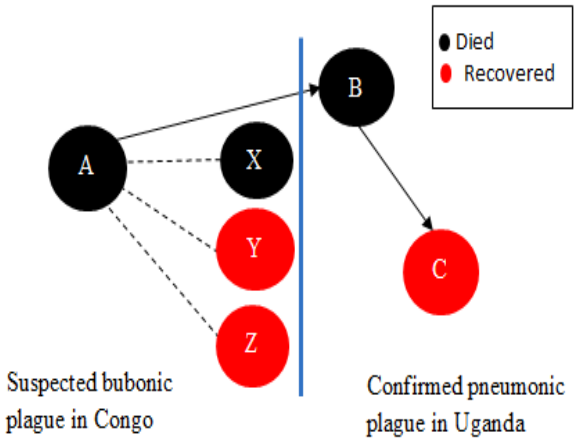

Figure 1: Transmission tree for recorded plague cases

Discussion

This was a mixed bubonic and pneumonic plague outbreak affecting DRC and Warr sub-county, Zombo District. Person, place, and time descriptive evidence showed that the outbreak was associated with travel to the neighbouring DRC where there was already an ongoing outbreak and getting in close contact with an infected case-person. The fatal case was associated with delay in seeking for treatment. Plague has been present for decades in the most southern part of West Nile region in Okoro County, Zombo District and Vurra County, Arua District. Plague hotspots are in the westernmost part of West Nile above the Rift Valley escarpment where elevation is generally >1300m and temperature is relatively low and rainfall high compared to surrounding low lands (2) and this is similar to the Madagascar study where hotspots of pneumonic plague were found in the north-eastern central highlands whose median elevation was within 1200m to 1300m (3).

Continued from page 4

The case-persons affected were both females of 35 years and this is consistent with the Madagascar reports where pneumonic plague was more frequent in adults of 30 years and above (3). Similar studies in Ugandan however reported a median age of 11 years (range 1-70) years although majority of the case-persons above 15 years were women (2). Also in the Madagascar study, persons >35 years of age were showed to have a moderately higher risk for death than did persons ≤35 years of age (3). Pneumonic plague has been commonly documented in adults because of participation in funeral ceremonies and attention given to plague patients including taking care of hospitalised relatives (3), this was true for this outbreak.

There was delay in diagnosis due to delay in seeking for treatment for the case-person that died in this outbreak. High frequency of pneumonic plague in adults has been attributed to delayed diagnosis of bubonic plague which then progresses to secondary pneumonic plague. In this outbreak, the delay in seeking care might have been caused by long distance travel from DRC to Uganda. In this outbreak, pneumonic plague case fatality rate (CFR) was 50% and the case person had history of travel to the DRC. This is consistent with studies in Madagascar where death was more common for pneumonic case-patients who had recently travelled to a plague-endemic region. Field investigations in DRC and India reported to have found that index case-patients usually travelled long distances (50–200 km) between probable places of infection and their home villages. Recent trips (i.e., trip in a plague-endemic area for 10 days before reporting) has been reported to be strongly (2 fold) associated with pneumonic plague (3). Usually delay in treatment from day 2 up to day 5 has been shown to dramatically increase death rates for both bubonic and pneumonic plague. The average duration from full onset of pneumonic plague to death is 1.9 days (3). In this outbreak however, there was no information on the date of onset of clinical signs of the case-person that died.

The confirmed case was Rapid Diagnostic Test positive, culture presumptive positive, and serology positive. Plague RDT has proven to be highly sensitive and can be used in remote settings and is an important preliminary diagnosis tool that has led to early detection of outbreaks and rapid implementation of control measures in multiple countries in Africa. Tools for early detection and treatment, as well as properly trained health workers, are critical to reducing overall plague deaths and progression of bubonic plague to pneumonic plague (3). Diagnostic capability has been shown to provide considerable savings in terms of treatment, chemoprophylaxis, and pesticide treatment (3). This outbreak was contained because there was early detection of plague by the RDT and response in form of isolation and treatment of the suspected case, contact tracing, and prophylaxis administration to contacts, community sensitization and strengthening of the surveillance system in the region. The US Centres for Disease Control and prevention (CDC)/Uganda Virus Research Institute Plague (UVRI) program has enhanced plague surveillance in the West Nile region and this is reflected in their aim; to understand the plague ecology and epidemiology in the West Nile Region and develop appropriate diagnostics, patient treatment and care guidelines and effective public health interventions. The program has strived to sensitize communities about plague and put in place an effective surveillance for plague that has resulted into a decrease of plague cases over the years until this outbreak.

Limitations

Although descriptive data suggested that the outbreak originated from the DRC, we could not further verify that claim. Failure to further verify was majorly because of lack of logistical support and limited cross-border collaborations between the DRC and Uganda.

Conclusion and Recommendations

This was a mixed bubonic and pneumonic Plague outbreak likely imported from the DRC and associated with a fifty percent death rate due to delayed health care seeking. The outbreak affected only one family; implying close contact and the contagious nature of pneumonic plague. All contacts were traced, given antibiotic prophylaxis and followed up for a week. None of the contacts developed plague during or after follow-up.

We recommended strengthening of cross-border collaborations between the Ugandan, Democratic Republic of Congo Ministry of Health bodies, and the World Health Organization (WHO) during response to such outbreaks.

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Democratic Republic of Congo Ebola Outbreak Should Constitute a Public Health Emergency of International Concern

By Kenneth Bainomugisha

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A Public Health Emergency of International Concern (PHEIC) is an extraordinary event which is determined to constitute a public health risk to other States through the international spread of disease and to potentially require a coordinated international response. PHEIC emanate from the World Health Organization (WHO) International Health Regulations (IHR) 2005. The purpose of IHR (2005) is to prevent, protect against, control, and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade.

International Health Regulations (2005) is implemented using a framework of core capacities required to detect, assess, notify and report events, and respond to public health risks and emergencies of national and international concern, as stipulated in Articles 5 and 13, and Annex 1, of the Regulations. The eight (8) core capacities for implementation of IHR (2005) are legislation and policy, coordination, laboratory, surveillance, response, preparedness, risk communication, human resources, and points of entry. They guide states on prevention, preparedness, and response to IHR-related hazards and these may be biological (zoonotic, food safety, and other infectious hazards), chemical, radiological or nuclear in nature.

The determination of a PHEIC follows a strict criterion and thus must conform to being;

- to constitute a public health risk to other Member States through international spread of disease and
- to potentially require a coordinated international response

However, this still follows a prescribed decision instrument with a set of the following questions;

- Is the public health impact of the event serious?
- Is the event unusual or unexpected?
- Is there a significant risk of international spread?

Continues to page 6

Continued from page 5

Is there a significant risk of international travel or trade restrictions?

And if the answer to any two of the above questions is YES, requires a member state to notify WHO.

The questions may further require determination of; if the event may result into high number of people falling sick (morbidity) and death (mortality), the event have potential for high impact assessed on population at risk, cases in health staff; highly infectious, factors affecting response e.g. war, natural catastrophe, high population density but also requiring immediate or potential need for external assistance.

If the cause of the event is unknown, circumstances unusual, cases worse than usual, treatment failures, event unusual for place/ season or/and caused by eliminated/eradicated agent. Suspected or known intentional or accidental release of chemical, biological or radiological agent.

In relation to international spread an assessment to ascertain if similar cases in other countries where it was unexpected and factors alerting to cross-border implications. The event is caused by epidemic-prone organism, source suspected/ known to be related to food import/export, index case with international travel history, in area with international tourism/ traffic, person or goods. Additionally, if similar events previously led to restriction on travel/ trade, attracts media attention and in border areas with limited capacity for control.

The declaration of a PHEIC is a prerogative of the Director General of WHO who upon advice of committee of experts and in accordance with the criterion discussed above determines if an event constitutes a PHEIC. The declaration typically triggers more funding and political attention.

Since the IHR (2005) came into force, a first PHEIC was issued in April 2009 when the H1N1 (or swine flu) pandemic. The second PHEIC was issued in May 2014 with the resurgence of polio after its near-eradication, deemed "an extraordinary event, on, August 8, 2014. WHO declared its third PHEIC in response to the outbreak of Ebola Virus Disease (EVD) outbreak in Western Africa and on February 1, 2016, and the fourth PHEIC in response to clusters of microcephaly and Guillain–Barré syndrome in the Americas, which at the time were suspected to be associated with the ongoing outbreak of Zika virus.

On the 01 August 2018; the National Minister of Health Democratic Republic of Congo declared an EVD outbreak in Beni town located North Kivu Province, DRC. The outbreak has spiralled for 10 months with minimal success registered in prevention and management of case-patients. According to WHO, as of 22nd June 2019, a total of 2239 EVD case-patients (2145 confirmed, and 94 probable) have been identified out of which 67.3%(1506/2239) died. Case-patients continue to rise among health workers, with the cumulative number infected rising to 5.5% (122/2239) of the total cases. The outbreak started from Mangina town spreading to towns of Mandima, and Mambasa in Ituri Province, Beni, Butembo, Oicha, Musienene, and Mabalako in the North Kivu Province with some case-persons crossing to Kasese District, Uganda.

The current EVD outbreak in Eastern Democratic Republic of Congo presents a precarious challenge where the outbreak is happening in a protracted war zone. It's hence not so much of a surprise that an imported EVD outbreak occurred in Uganda in June 2019. Subsequently, with further spread in Eastern DRC, WHO found it appropriate to declare the EVD outbreak in DRC a Public Health Event of International Concern. This will enable the international community intensify efforts to bring the outbreak under control..

Investigation of suspected O'nyong nyong fever Outbreak in Kampala District, Uganda, February 2019

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Summary
On 21st February 2019, Ministry of Health received an alert on suspected O'nyong nyong fever outbreak in Kampala by a private hospital. We conducted investigations to confirm the outbreak and identify potential exposure factors. We identified one confirmed female case-patient residing in Kampala District. She had travel history to Kitgum District with a stopover in Gulu District. She reportedly had mosquito bites in Kitgum and did not sleep under a mosquito net in Gulu. We concluded that mosquito bites in Kitgum and not sleeping under a mosquito net were the potential exposure factor for infection. We recommend sleeping under a mosquito net and wearing long-sleeved clothes when outside in the evening to reduce exposure to mosquito bites.

Background
O'nyong nyong Fever is a neglected mosquito-borne disease caused by O'nyong nyong virus (ONNV), which is an *Alphavirus* (1). The name '*O'nyong nyong*' was derived from Acholi tribe meaning '*joint breaker*' (2). The virus was first isolated during a 1959–1962 epidemic that affected 2 million people in Uganda, Kenya, Tanzania, Mozambique, Malawi and Senegal (3, 4). An estimated 1 million cases were affected during a 1996 outbreak in south-western Uganda and northern Tanzania (5, 6) approximately 34 years after the first confirmed outbreak.

A*nopheles funestus and Anopheles gambiae* mosquitoes primarily transmit ONNV though *aedes* and *culex* mosquitoes can spread this virus as well (3, 7, 8). O'nyong nyong infection presents with fever, joint pains (without effusions); primarily in the large joints, headache, generalized maculopapular skin rash (often itchy), posterior cervical lymphadenopathy, and conjunctivitis (red eyes); bleeding gums or nosebleeds are rarely reported (6). The incubation period of O'nyong nyong is estimated to be 8 days..

On 21st February 2019, Ministry of Health was notified on suspected O'nyong nyong fever outbreak following 2 suspected case-patients that were reported at a private hospital in Kampala. We conducted investigations to confirm the outbreak and identify potential exposure factors.

Methods
We reviewed medical records of the private hospital and interviewed medical staff for more details regarding the diagnosis. We took two serum samples from the case-patient for laboratory testing at Uganda Virus Research Institute (UVRI). We later interviewed the case-patient to identify potential exposure factors.

Findings
We identified one confirmed case-patient. The case-patientwas a 35-year old female residing in Bunga, Kampala District. She had travelled to Padibe, Kitgum District between 23 and 25 January 2019. She reportedly had painful mosquito bites in Padibe as she sat outdoors one evening. She spent the night in Gulu on the 25 January 2019 before traveling back to Kampala on 26 January 2019. She reportedly did not sleep under a mosquito net while in Gulu. On 30 January 2019, she experienced excruciating joint pains that started from the lower limbs and slowly moved to upper limbs and also had on and off fevers. She later presented with chest pain and difficulty in breathing. She developed an itchy rash on her trunk 4 days after symptom onset. She was diagnosed with urinary tract infection from the first private hospital she visited.

Continued from page 6

The symptoms persisted and she went to another private hospital where a provisional diagnosis of O'nyong nyong fever was made. She was negative for brucellosis, dengue, shistosomiasis, and typhoid fever. Her white blood cell count was low with elevated C-reactive protein of 71.9mg/l (Normal =<10mg/l). She tested positive for O'nyong nyong virus by IgM serological tests (Titres 10,240) done at UVRI.

Discussion

This was a confirmed case of a recent Onyong nyong fever infection based on the serological tests taken with high titres. We suspected that the case-person had the exposure to infection in Kitgum based on the minimum incubation period of O'nyong nyong. Our assumption is backed by the proximity between Kitgum and Gulu; which has a history of O'nyong nyong outbreaks (3, 4). The reports of Case-patient experiencing mosquito bites in Kitgum while outdoors in the evening and not sleeping under mosquito net in Gulu were potential exposure factors.

O'nyong nyong disease surveillance is not adequate in the country. A sero-survey on healthy Ugandan blood bank donors concluded that ONNV disease could be a more likely cause of febrile illness with arthralgia (10). Definitive diagnosis O'nyong nyong fever is difficult without appropriate diagnostic tests because of similar clinical presentations with other illnesses including Chikungunya fever.

Limitations of the study

Previous o'nyong nyong fever outbreaks in Uganda were prolonged and affected a large number of people. We did not conduct further investigations in Kitgum District to establish whether there was an on-going outbreak in the area.

Conclusions and Recommendations

An outbreak of O'nyong nyong fever occurred in Kampala District. One case-patient of O'nyong nyong fever was identified and was likely exposed in Kitgum District. The potential exposure factors were mosquito bites in the evening and not sleeping under a mosquito net. We recommended reducing exposure to mosquito bites through sleeping under mosquito nets and wearing long-sleeved clothes when outdoors during evening time. We recommend strengthening of surveillance for O'nyong nyong fever in Kitgum District and surrounding areas by Ministry of Health. An epidemiological investigation in Kitgum District would also determine whether other people were affected since the disease is known to cause prolonged outbreaks.

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On-going transmission of Leprosy and inadequate control measures in Lira and Alebtong Districts, Uganda, revealed by an epidemiological investigation, February - March 2019

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Executive Summary

On 25 Feb 2019, the Lira District Biostatistician reported to Ministry of Health that 38 cases of leprosy had been identified in the last quarter of 2018. We investigated to confirm the existence of an outbreak and identify the potential exposures. We reviewed the leprosy register at Lira regional referral hospital and conducted active case finding to generate a line list. We also conducted a case-control study to identify possible exposures. We identified 12 confirmed cases in 4 sub-counties of Barr, Ogur, Lira (Lira District) and Apala (Alebtong District). Barr was the most affected (Attack Rate=1.2 per 10,000). The possible exposures were; history of living in a camp, contact with a leprosy case patient, and poor hygiene practices although these were not statistically significant.40% of the cases had defaulted treatment which suggested possible on-going transmission. We referred all the identified case patients who were not yet on treatment to Lira Regional Hospital for initiation of Multi-Drug Therapy MDT. We also sensitized the VHTs on identifying leprosy lesions and referring patients to the health facilities for treatment and recommended screening of household members of case-patients so that any cases identified are initiated on treatment as early as possible.

Introduction

Leprosy is a chronic disease caused by a bacillus, *Mycobacterium leprae*. The average incubation period is 7-5 years (1). Leprosy is transmitted via droplets, from the nose and mouth, during close and frequent contacts with untreated cases. It mainly affects the skin, the peripheral nerves, mucosa of the upper respiratory tract, and the eyes. Leprosy is curable and treatment in the early stages can prevent disability(2).

Leprosy is still endemic in Uganda with some districts, being hot spots with unusually high numbers(3). The National Tb and Leprosy Program (NTLP) strategic plan 2015-2019 aims at reducing the incidence of Grade 2 disabilities among new leprosy cases from 2.3 per million population in 2014 to less than 1 per million population by 2019/20(4). In order to achieve this goal, NTLP targets to increase Multi Bacillary MDT completion from 91% in 2014 to 95% in 2020. On 25 Feb 2019, PHFP was notified by the Lira district Biostatistician of a report of 38 leprosy cases in the last quarter of 2018. We investigated to verify the existence of an outbreak and establish the potential exposure factors.

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Continued from page 7

Methods

We defined a confirmed case as onset of any 2 of cardinal symptoms of leprosy (Hypopigmented reddish lesion on skin, Loss of sensation in skin patch, enlargement of peripheral nerves) in a resident of Lira and Alebtong districts in the last 5 years.

We reviewed the leprosy register in Lira Regional Referral hospital and actively searched for cases in the affected communities and generated a line list. We performed descriptive epidemiology of the cases and generated hypotheses. To know whether this an outbreak, we reviewed records in the District Health Information System 2 (DHIS2) and trends in hospital visits due to Leprosy from 2012-2018. We used hospital visits as proxy to new cases. We conducted a case control study to test the hypotheses.

Results

We identified 12 confirmed cases from 4 sub-counties of Barr, Ogur, Lira (Lira District) and Apala (Alebtong District). The Median age of the case-patients was 48 years, ranging from 24 to 72 years. Majority of the case-patients had signs and symptoms consistent with Leprosy. These were; numbness or tingling sensation 83% (9/12), pale/ reddish skin patches 83% (9/12), loss of sensation in the skin patch 83% (9/12) (Figure 1). Females (attack rate=3/10,000) were more affected than males (AR=2.3/10,000). 92% (11/12) had lived in an Internally Displaced Persons (IDP) camp between 2005 and 2006

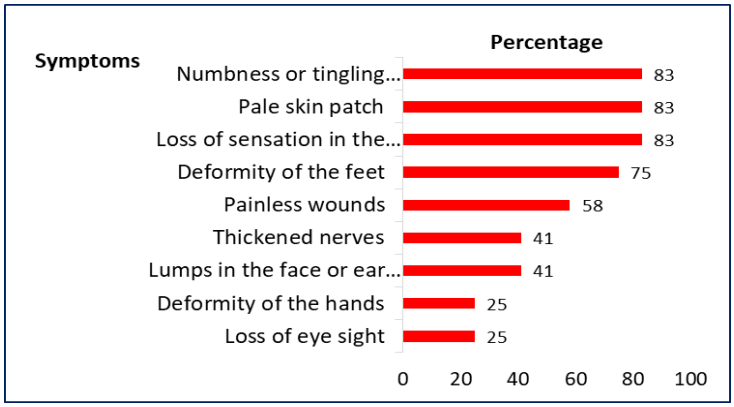

Figure 1. Distribution of signs and symptoms among leprosy case -patients Lira and Alebtong Districts, 2013-2018

More leprosy cases identified in the year 2016 (Figure 2).

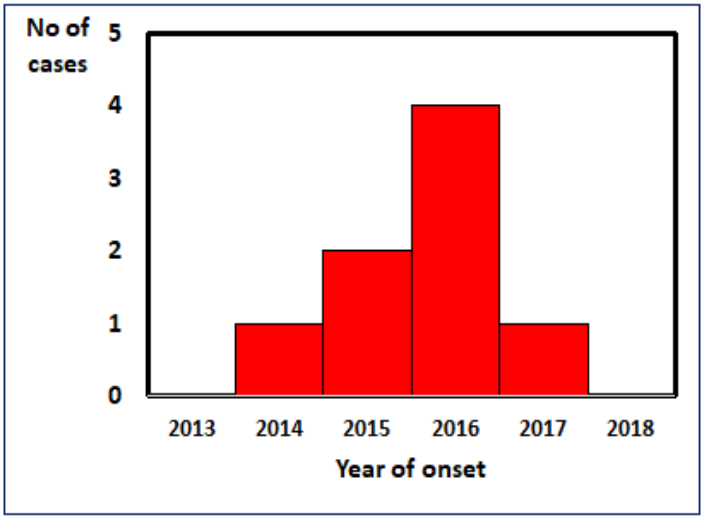

Figure 2: Epidemic curve of leprosy case-patients, Lira and Alebtong districts, Uganda 2013-2018

We identified 6 cases-patients from Barr (AR=1.2/10,000); 3 from Ogur (AR=0.7/10,000), 2 from Apala, and 1 from Lira. The cases were scattered with no specific pattern (Figure 3).

Hypothesis generating interviews revealed that 100% (12/12) had low level of education, 92% (11/12) had lived in a camp, 42% (5/12) had a history of living with a leprosy patient, 25% (3/12) had poor hygiene practices. We hypothesized that history of living in a camp was associated with Leprosy.

Case control study findings

Having lived in an IDP camp and being in contact with a person with leprosy were associated with acquiring leprosy though not statistically significant (Table 1).

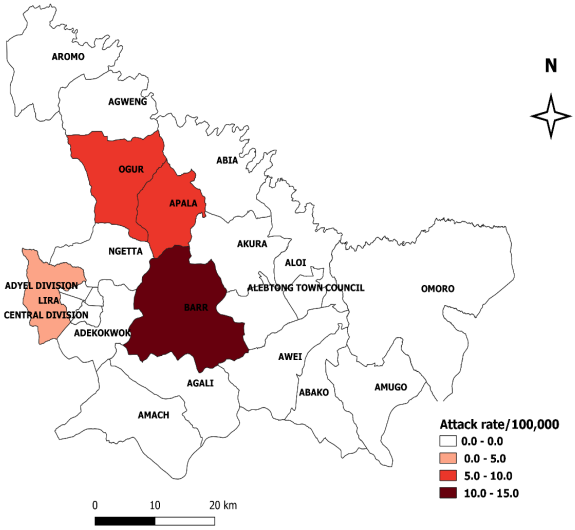

Figure 3: A map of Lira and Alebtong Districts showing attack rates of Leprosy by sub-county, 2013 - 2019

Table 1: Association between exposures and leprosy among 72 respondents in Lira and Alebtong Districts, 2013-2018

Exposure variable	% case (n=12)	% controls (n=60)	Odds ratio (95%CI)
Low level of education	100	87	Undefined
Lived in a camp	92	75	3.7 (0.4-30)
Contact with a leprosy case	42	27	3.6 (0.7- 18)
Poor hygiene practices	25	13	2.2 (0.5-9.7)
BCG vaccination	50	69	0.4 (0.1-1.5)

Discussion

Our investigation confirmed presence of leprosy cases in Lira and Alebtong districts likely associated with history of living in a camp, contact with a person with leprosy, and poor hygiene practices. However, this association was not statistically significant likely due to a small sample size. Most of the cases were scattered in the communities and remote from health facilities, with about 40% reporting defaulting treatment. The high default rate suggests possible ongoing transmission in the community. This transmission is further compounded by the fact that 92% of the cases reported no screening of their family members for Leprosy. And so, there is a missed opportunity for early identification of cases.

Ninety two percent of the cases had lived in an IDP camp between

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2005 and 2006. It is possible that the exposure may have been the IDP camp. This could probably be due to the limited living space coupled with the crowding usually faced by people residing in IDP camps which increased their contact with case-persons and hence possible transmission of leprosy.

History of contact with a leprosy case-person was associated with having Leprosy. This was consistent with a systemic review of literature by Pescarini et al 2018 (3) which identified that being a household contact of a leprosy patient increased the chance of getting Leprosy by 3 times.

This was not an outbreak of leprosy as evidenced from past records in District Health Information System 2 (DHIS2) and trends in hospital visits due to Leprosy from 2012-2018. We used hospital visits as proxy to new cases. The records suggested that this was not an outbreak, since there was no much deviation from the expected numbers.

Conclusions

This was not an outbreak of leprosy since the number of cases was not above the expected, however there is ongoing transmission in the community with inadequate control measures. The possible exposures may have been in the IDP camps during the war in Northern Uganda.

Public Health Actions and recommendations

We referred all the identified case patients who were not yet on treatment to Lira Regional Hospital for initiation of Multi-Drug Therapy MDT. We also sensitized the VHTs in identifying leprosy lesions and referring patients to the health facilities for treatment and recommended continuous surveillance to detect any fluctuations in the new cases diagnosed to inform decision making. We recommended screening household members of case-patients to ensure early identification and initiation of treatment to minimize transmission and complications.

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Outbreak of Cutaneous Anthrax Associated with Handling Meat of Dead Cows: Engari Sub-County Kiruhura District, South-western Uganda, May 2018

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Summary

Background: *Anthrax is a zoonotic infection caused by the bacteria Bacillus anthracis. Humans acquire cutaneous infection through contact with infected animals or animal products. During May 2018, Kiruhura District received reports of humans with suspected cutaneous anthrax occurring subsequent to the sudden death of three cows on a farm on May 6 2018. We investigated to determine the magnitude of the outbreak, identify exposure factors, and recommend evidence-based control measures.*

Methods: *We defined a suspected human cutaneous anthrax case as new skin lesions (e.g., papule, vesicle, or eschar) in a resident of Engari Sub-County Kiruhura District from 1-26 May 2018. A confirmed case was a suspected case with a lesion testing positive for B. anthracis by PCR. We searched for cases through medical record review at Engari Health Centre and community visits. To identify specific risk factors among persons with potential contact with the cow, we formed a cohort among all persons whose households received any of the dead cow meat.*

Results: *Cutaneous anthrax occurred in 69% (11/16) of the case-persons who participated in carrying meat from dead livestock (On shoulder, stick, bicycles and motorcycles) compared to 19% (6/73) of the controls (ORadj= 13, 95% CI 3.4-51).*

Introduction

Anthrax is a bacterial zoonotic infection caused by *Bacillus anthracis* (*B.anthracis*) and transmitted to humans through contact with animals and their products such as milk, meat, skins, and hide (1) (2) (4).Human anthrax infection has been classified as cutaneous, inhalational and gastrointestinal.

Cutaneous anthrax is the most common form of anthrax with an incubation period of 1 to 12 days(12), case fatality of 20 % in untreated cases , and less than 1% in cases where antibiotics is used (14) (15) (9). Gastrointestinal (GI) anthrax occurs mainly among populations in developing countries as a result of consumption of undercooked meat from infected or dead animals (15). It has an incubation period of 1 to 7 days and occurs in forms of oropharyngeal and intestinal anthrax. Case fatality rate has been reported at 25-60% but can reach 100%. Inhalational anthrax is a lethal form of anthrax caused by inhalation of pathogenic endospores from infected animal and their products. It has an incubation ranging from 2 days to 6 weeks but may go up to 60 days. Inhalational anthrax case fatality rate is estimated at 86-100% (14).

On 7 May 2018, Farm X reported sudden death of 3 cows. Farm workers opened the carcasses, butchered the meat and sold it to traders around Kanoni and Engari sub-counties. The sub-county chief of Engari received alerts of human cases who had developed symptoms consistent with cutaneous anthrax. We investigated to determine the magnitude of the outbreak, identify exposure factors, and recommend evidence-based control measures.

Methods

Location of Kiruhura District;

Kiruhura District is located in Western Uganda with an estimated total population of 328,077 people.

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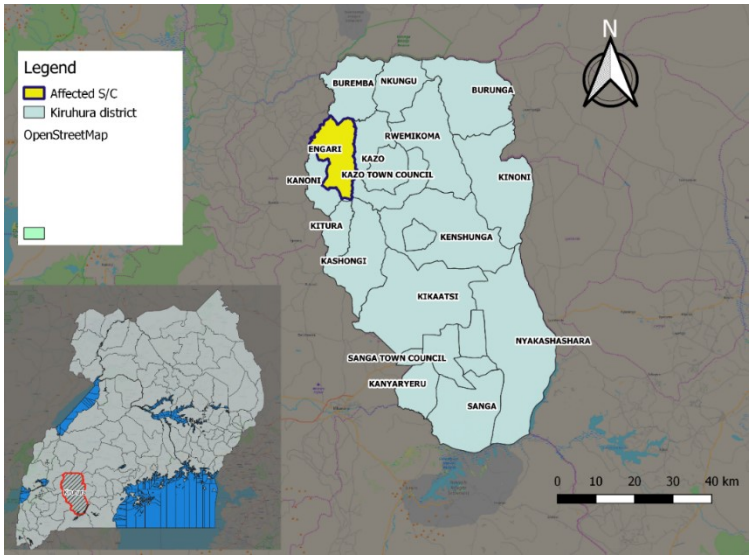

Figure_1; A Map Showing Location of Kiruhura District and the Affected Sub-county, May 2018

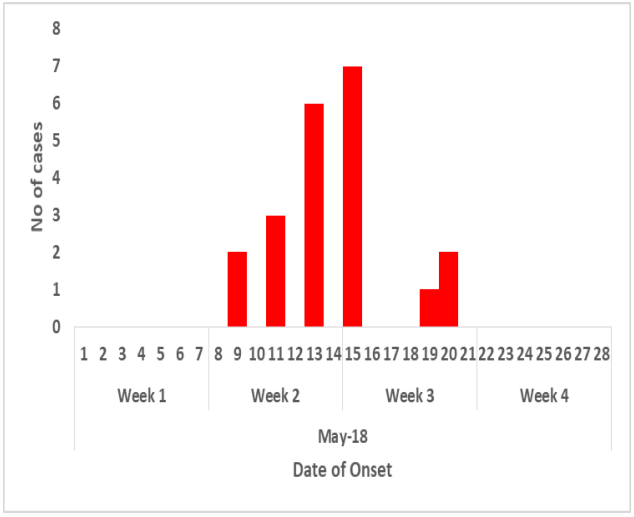

Figure 1: Overall Epidemiological curve showing the distribution of case-persons over time during the anthrax outbreak in Kiruhura District, May 2018.

Case definition and finding

We defined a suspected cutaneous anthrax case as; Onset of skin lesions (e.g., papule, vesicle or eschar) in a person residing in Engari sub-county; Kiruhura District from 1 March to 26 May 2018. We defined a confirmed anthrax case as; suspected case with Polymerase Chain Reaction (PCR) positivity from a clinical sample i.e. swab from skin lesions/vesicles and blood. To identify cases, we visited Engari Health Centre three (111) and private clinics in the affected sub-county.

We described case-persons by time; date of onset of symptoms and exposure date, person and place, and symptom characteristics. Using population data obtained from the Uganda Bureau of Statistics, we computed attack rates by sex, age-group, and village(20).

Laboratory investigations

We collected skin swabs from four case-persons. These included; swabs, rectal swabs, eight ear tissue, two eye and one skin. We performed the Anthrax Bio Threat Alert Lateral Flow Assay (LFA) on the animal samples.as per the manufacturer's instructions(21).

Results

We identified, 22 cutaneous anthrax case persons with no mortality reported. The mean age of the case persons was 28 SD ±15 (range: 4-64). Rupyani village was the most affected (AR=9.2/1000). Cases were reported to occur from 7 May 2018 after exposure to dead animals (Figure 1)

Case control study findings

Cutaneous anthrax occurred in 69% (11/16) of the case-persons who participated in carrying meat from dead livestock (On shoulder, stick, bicycles and motorcycles) compared to 19% (6/73) of the controls (ORadj= 13, 95% CI 3.4-51). Cutaneous anthrax occurred in 38% 38% (6/16) of the case-persons who participated in cutting meat of dead animals developed cutaneous anthrax compared to 26% (19/73) of the controls (OR=1.3, 95%CI 0.42-4.2) although this was not statistically significant.

Laboratory findings

Six (6/10) of the ten animal samples collected, were positive for *B. anthracis*, 6/8 human samples turned positive on PCR.

Discussion

Epidemiologic, laboratory and environmental investigations indicated that this was a cutaneous anthrax outbreak associated with handling dead cows and their products with 0% case fatality in Kiruhura district, Western Uganda. This outbreak occurred during a rainy season (May 2018) a few days after a prolonged dry season. During this outbreak, case-persons presented with fever, reddening of skin areas, wound with black centre, and itching of body parts.

These symptoms have been reported in previous studies to be consistent with anthrax(23)(24).
This outbreak affected more males compared to females. This could be explained by the occupational nature of the infection. Males are involved in animal related activities like butchering, slaughtering, herding animals and hunting which increase their contact with animals. Findings from an outbreak investigation in Tanzania reported that more males were affected compared to females (25). The age group 20-39 years above was most affected compared to children below 9 years. Activities that lead to anthrax infection involving animals are usually done by people with that age group compared to children who are less involved in such activities. Similar studies reviewed report similar age group to be affected by anthrax(26) (22).

This outbreak occurred in a pastoral community and was associated with cutting, skinning, slaughtering, butchering and cleaning waste of infected animals. Elsewhere outside Africa is a study conducted in Bangladesh which reported human cases developed anthrax developed had a history of butchering sick animals, handling raw meat, contact with animal skin, or were present at slaughtering sites. (28).

Rupyani village was most affected compared to other villages.

Conclusions and recommendations

This was a cutaneous anthrax outbreak associated with handling of dead livestock confirmed to have anthrax. We recommended vaccination of all animals in affected sub-county plus surrounding areas and safe disposal of dead animals.

Public Health Actions

We health educated the affected communities about the importance of not consuming meat from dead animals, provided post exposure prophylaxis to all persons who ate meat from the dead cows, educated the community on the dangers of consuming meat from dead animals and participating in safe disposal of dead animals in the affected sub-county.

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Animal Anthrax outbreak triggered by butchering infected carcasses on and or near the pastureland, Kween District, Uganda: January - December 2018

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Summary
On 20th April 2018, 7 people were admitted to Health Centre Y, after skinning, carrying and eating a dead cow at Kaplobotwo village, Kween District. Subsequent epidemiological investigations confirmed human anthrax outbreak and established link to animals. We set out to determine the magnitude of anthrax infection in domestic ruminants; identify possible exposures, and recommend evidence-based control measures. We identified 67 case-herds and line listed 316 animal cases by December 2018. Only Ngenge subcounty (AR/1000=16) in Kween District was affected. Sixty-seven percent (2/3) animal carcasses tested positive by RDT and Gram stain, consistent with B. anthracis. In the case-control study, migration route near or on the pastureland (AOR=5.6, CI=1.9-16); improper carcass disposal sites near or on the pastureland where animals grazed (AOR=2.0, CI=1.1-3.7), and butchering infected animal carcasses on or near the pastureland (AOR=3.8, CI=1.9-7.5) were significantly associated with animal anthrax infection. We recommended immediate vaccination of domestic ruminants at risk against Anthrax followed by annual anthrax vaccinations.

Introduction
On 20th April 2018, 7 people were admitted to Ngenge HCIII, after skinning, carrying and eating a dead cow at Kaplobwotwo village, Kween District. They all presented with blisters, oedema and gram spots that are typical of an anthrax infection. Subsequent epidemiological investigations confirmed human anthrax outbreak and established link to animals. However, the true burden of anthrax in animals and associated factors remained unknown in the district despite the control measures initiated. We conducted an investigation to assess the magnitude of anthrax infection in domestic ruminants; identify possible exposures, and recommend evidence-based control measures.

Methods
We defined a suspected animal case as sudden death with unclotted blood from body orifices in a domestic ruminant from January 2018 to December 2018 in Kween District. A probable case was a suspected case that tested positive for anthrax by the Active Anthrax Detect Rapid Diagnostic Test (AAD-RDT) or microscopy of Gram-stained animal tissue samples.
To identify cases, we reviewed district veterinary anthrax records and conducted active community case finding in the affected sub-county to generate and updated the line list. The variables captured in the line list included the herd number, animal ID, species, breed, date of deaths, method of carcass disposal, vaccination status, signs and symptoms among others.
We described animal cases by animal characteristics, place, and time. We conducted environmental assessment of the anthrax affected areas, including laboratory testing of specimens from dead animals). We conducted a case-control study to compare exposures among case-herds and control-herds, frequency matched by village with a ratio of 1:2.

Results
We line listed 316 animal deaths due to suspected anthrax among 67 kraals in Ngenge Subcounty, Kween District. Symptoms of the animals before death included unclotted blood oozing from body orifices (100%), distended abdomen (91%), and sudden deaths (100%). Cattle were the most affected species in Kween District (Attack rate [AR]/1,000 = 2.9, followed by goats (AR/1000= 0.39 and sheep (AR/1,000= 0.10.
The epidemic curve indicated a continuous sustained transmission among the animal population (Figure 1). The animal deaths due to suspected anthrax increased rapidly and peaked in the month of April before declining in May, 2018. It again increased rapidly to another peak in June, 2018 before declining till September 2018. From September 2018, the animal deaths increased to a smaller peak in October 2018. Thereafter, the animal deaths decreased till December 2018.

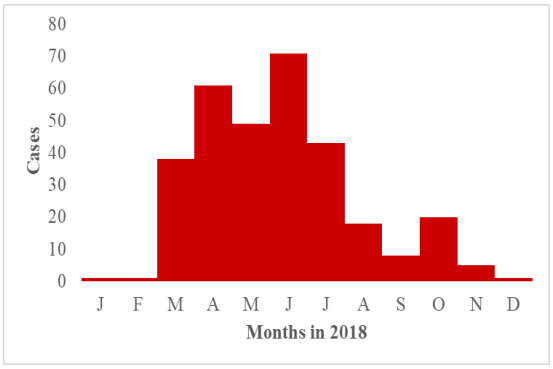

Figure 1: Continuous sustained transmission of animal anthrax outbreak in Ngenge sub County, Kween District, 2018

Only Ngenge sub-county was affected (AR/1000=16) (Figure 2).

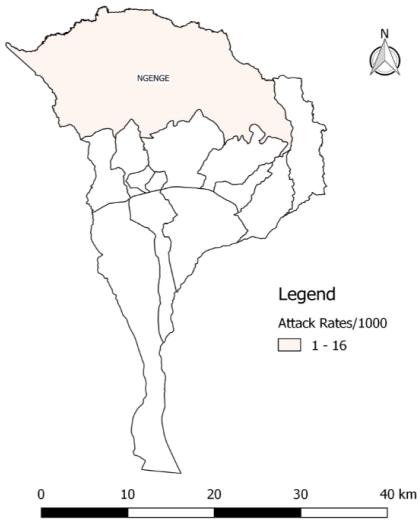

Figure 2: Attack rates by Sub-county of animal anthrax cases in Kween District, 2018

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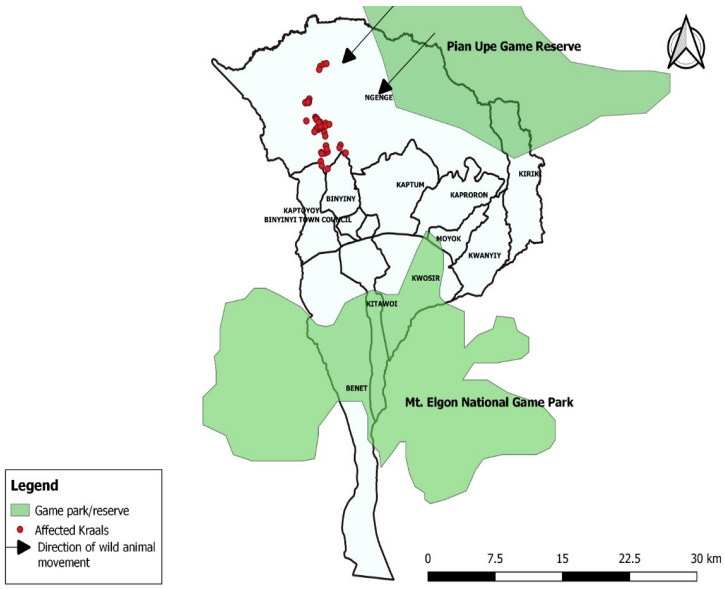

Figure 3: Spot map of animal anthrax cases in Ngenge sub-county, Kween District, 2018

Hypothesis generation interviews

We hypothesized that the outbreak could have been associated with having migration route through or near pasture land where animals grazed, butchering infected animal carcasses on and or near pasture land where animals grazed, and improper disposal of carcasses on and or near pasture land (Figure 4).

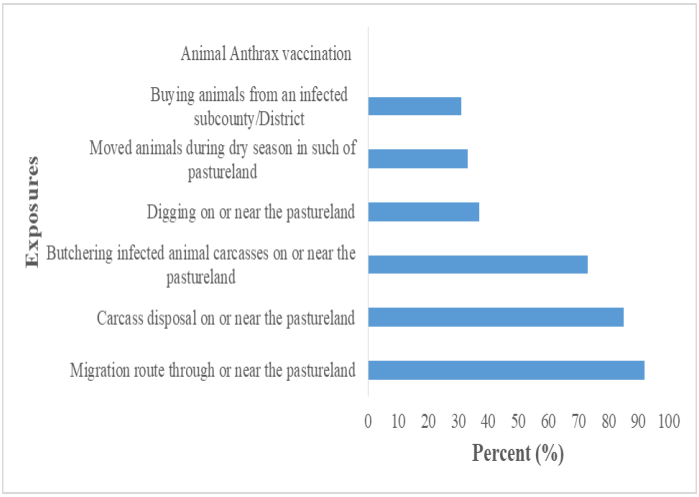

Figure 4: Hypothesis generation interviews among case-herds in Ngenge Sub County, Kween District, 2018.

Environmental assessment and laboratory findings

We observed communal grazing and remains of the animal carcasses in the grazing field. Migration routes in the pasture land were evident. During the study period, sixty-seven percent (2/3) livestock carcasses tested positive by RDT and Gram stain, consistent with *B. anthracis*.

Case-control findings

Migration route near or on the pastureland (AOR=5.6, CI=1.9-16); carcass disposal sites near or on the pastureland (AOR=2.0, CI=1.1-3.7), and dead animals slaughtered near or on the pastureland (AOR=3.8, CI=1.9-7.5) were significantly associated with animal anthrax infection.

Discussion

Our epidemiologic, laboratory and environmental findings demonstrated that this was a continuous sustained transmission among animal population associated with infected carcass disposal sites on or near the pastureland; slaughtering anthrax infected dead animals on the pastureland, and migration routes near or on the pastureland. Improper disposal sites of infected carcasses on the pastureland and slaughtering anthrax infected dead animals on the pastureland exposes anthrax spores that contaminate the pastureland posing a risk to cattle, goats, and sheep. The anthrax spores from the pastureland remain viable for decades (1). The spores shed by an animal dying or dead from anthrax usually provide the source of infection of other animals (2). Our findings are consistent with other studies in Bhutan, Asia that pointed out that anthrax infected carcasses led to spread of anthrax and death among animal herds (3). Similarly, findings from Bangladesh indicated that improper disposal of carcass (dead animals) was associated with repeated anthrax infections among animals (4). Furthermore, findings in North Dokota, USA also reported that death of suspected anthrax infected animals on the pasture land was associated with anthrax outbreak in animals (5).

Besides, migration routes on the pastureland are paths were people pass along with their animals whether dead or alive usually without veterinary inspection. If the meat from dead animal is infected with anthrax, then it may infect the pastureland along the migration route during transportation due to dripping infected blood of the meat. Similarly, if the live animal dies suddenly due to anthrax during transit, it is likely to be slaughtered or abandoned near the migration route in the pastureland thereby posing a further risk to live animals on that pastureland.

Our findings also revealed that cattle were more affected than goats and sheep. This is possibly due to the fact that cattle are grazers while the goats and sheep are browsers. This is consistent with findings from China that found out that cattle were more affected by anthrax compared to goats because cattle ingest lots of soil from ground when grazing, while goats typically browse on grass only, which makes them less exposed to anthrax spores in soil (6).

Our study had the following limitations; given that an animal dies suddenly, it is possible that some animals dropped dead in the field and nobody noticed them. Additionally, some farmers have many animals hence the possibility of failure to notice absence of some. Failure to account for all anthrax related animal deaths in the area may have resulted into an underestimation of the scope of the outbreak.

Conclusions and recommendations

In conclusion, there was evidence of animal anthrax infection in Kween District. Improper disposal of infected carcasses and slaughtering anthrax infected carcasses on or near the pastureland were the main exposures.

We recommended to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and Kween District Local Government to conduct immediate vaccination of domestic ruminants at risk against anthrax followed by annual anthrax vaccinations. Enhanced sensitization of the communities; animal health workers and medical health workers about anthrax exposure was also emphasized.

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