MINISTRY OF HEALTH UGANDA

UNIPH Epidemiological Bulletin

Volume 4| Issue 3| July– Sept 2019

Quarterly Epidemiological Bulletin of the Uganda National Institute of Public Health, Ministry of Health

July - September 2019

Dear Reader,

We are pleased to share with you Issue 3, Volume 4 of the Uganda National Institute Public Health (UNIPH) Quarterly Epidemiological Bulletin.

This issue aims to inform districts, national, and global stakeholders on activities undertaken in detecting, preventing and responding to public health events in the country in the recent past. These activities include: disease outbreak investigations and public health surveillance and interventions.

In this issue, we present investigation reports on: Malaria in Oyam, Butambala and Mbale; Yellow fever in Masaka; Animal bite patterns and post exposure prophylaxis at Arua Regional Referral Hospital, and Pediatric Tuberculosis at Mbale Regional Referral Hospital.

For further information on anything in this publications please contact us on: ikyamwine@musph.ac.ug, mnabatanzi@musph.ac.ug, rukundobg@musph.ac.ug or lbulage@musph.ac.ug .

We hope this will be an informative and an interesting read . We will appreciate any feedback about the content in this issue.

Thank You

Inside this issue:

US SECRETARY FOR HEALTH AND HUMAN SERVICES, ALEX AZAR VISITS UGANDA

By Irene B. Kyamwine, PHFP Fellow

On 16 September 2019, the Health and Human Services Secretary, Alex Azar and other delegates from the United States of America were hosted by the Ugandan Minister of Health Jane Aceng. During their visit, they toured the National Institute of Public Health that includes the Emergency Operations Center and the Public Health Fellowship Program. These institutions have been key in the response and control of disease epidemics including Ebola in Uganda. During the tour, the delegation listened to presentations from Fellows on the ongoing and completed projects on the control of infectious diseases; among other activities. The purpose of the Secretary's visit was to further strengthen collaboration between Uganda and the US governments in public health efforts and to increase preparedness and control of epidemic prone and infectious diseases. Uganda was hailed for its tremendous efforts in controlling the spread of Ebola.

U.S. Secretary of Health and Human Services, Alex Azar (3rd from left), US Ambassador to Uganda H.E Deborah Malac, Hon. Minister of Health, Dr. Jane Ruth Aceng, Coordinator UPHFP, Dr. Alex Riolexus Ario, and other delegates listening to a presentation by a Fellow during the visit

EBOLA VIRUS DISEASE SPILLS OVER INTO UGANDA THROUGH KASESE DISTRICT

By Maureen Nabatanzi, PHFP Fellow

On 24 July 2019, following the completion of 42 days of follow-up since the last Ebola confirmed case was registered, Uganda was declared Ebola free. However, the Ebola outbreak in the Democratic Republic of Congo (DRC) which has affected over 3,000 people continues to spill over into Uganda. On 15 July 2019, Uganda's Ministry of Health was notified of a Congolese fish trader with Ebola symptoms visiting Mpondwe market in Kasese District. The case-patient travelled back to Beni in DRC where he tested positive for Ebola at Beni Ebola Treatment Unit (ETU) and died. All contacts from this event tested negative for Ebola. On 29 August 2019, a nine-year-old female of Congolese origin tested positive for Ebola. The case-patient was identified by Uganda's screeners at Mpondwe main crossing point who referred her to Bwera ETU immediately where she was isolated and later died. There were no known contacts in Uganda. The Ministry of Health in partnership with Kasese District Local Government and partners continues to respond effectively and strengthen surveillance at the border crossings to prevent the spread of Ebola.

UGANDA COMMEMORATES THE WORLD BREASTFEEDING WEEK, 2019

By Irene B. Kyamwine, PHFP Fellow

In the 1st week of August every year, Uganda joins the rest of the world to commemorate the world breastfeeding week. This event advocates for breastfeeding to improve the health of babies around the world. This year's theme 'Empower parents to Enable Breastfeeding' was a call to the public to take part in promoting, protecting, and encouraging breastfeeding. The breastfeeding week activities included a run, a climax event and breakfast meeting at Hotel Protea that was graced by the Minister of State for Primary Health Care, Hon. Dr. Joyce Moriku Kaducu. In her remarks, she confirmed that government is set to tighten regulations on maternity and paternity leave. The climax event held in Kiboga District was graced by Hon. Minister of Health Dr. Jane Ruth Aceng, Member of Parliament for Kiboga District Hon. Kiwanuka Keefa, representatives from UN agencies and other stakeholders. During the ceremony, Hon. Dr. Aceng urged employers to put in place avenues to encourage mothers to breastfeed. She also presented awards to the best performing health centres in the baby-friendly health initiative, 2018.

Hon. Minister of Health Dr. Jane Ruth Aceng inspects a stall at the Breast Feeding Week climax event in Kiboga District

IS ELIMINATION OF MALARIA IN UGANDA STILL POSSIBLE?

By Nabunya Phoebe, PHFP Fellow

In the first week of August 2019, several media outlets reported an increased number of malaria cases in Kampala. On 7 August 2019, the Independent newspaper reported that 5 children are admitted each day in the Acute Care Unit of Mulago National Referral hospital with convulsions and anemia due to severe malaria infection. The report drew the attention of the public to the malaria upsurge that had begun at the start of 2019. According to data by the Ministry of Health, the upsurge progressively spread affecting up to 88 districts by August 2019.

The most affected include Kisoro District which is reporting 4 times the expected case count, districts in the West Nile, and Karamoja regions. This upsurge came after the National Malaria Control Program had reported a 27% decline in malaria incidence and 52% decline in malaria deaths in 2017 (MOH, 2017). This agreed with the 2018 preliminary findings from the Malaria Indicator Survey (MIS), which reported the prevalence of malaria in Uganda to have reduced from 19% to 9% in 2015. This is only 2% short of the 7% prevalence by 2020 tar-

Continues to page 3

Continues from page 2

get which would put Uganda in the malaria pre-elimination phase. Some areas such as Kampala and Kigezi reported a prevalence of less than 1%; exciting many health professionals as the goal set in the malaria reduction strategic plan (MRSP) 2015-2020 seemed tangible.

The 2014 MIS attributed this reduction in malaria prevalence to malaria interventions. These included: prompt diagnosis and treatment of malaria cases, distribution of intermittent preventive therapy to pregnant women to prevent malaria, and distribution of insecticide treated bed nets. This was coupled with social mobilization, behavior change communication, indoor residual spraying, and strengthened surveillance.

Contrary to the expectations of MoH and many health professionals, the malaria cases increased this year causing upsurges across the country. This malaria resurgence in the country threatens earlier achievements. Health facilities especially in the West Nile region have reported as high as 90% of their patients testing positive for malaria in this period. It seems like the gains achieved in the previous years are being reversed. However, this is an opportunity for Uganda to tighten the loose ends on its journey to elimination of malaria.

According to the World Health Organization (WHO), repeated infections over a prolonged period of time make people develop partial immunity allowing mild and even asymptomatic infections to occur. However, this immunity wears off in the absence of re-infection for about 6-12 months rendering the person vulnerable to the full impact of a malarial infection once again. This is what could have happened following the much celebrated gains in the fight against malaria as documented by the preliminary findings of the MIS of 2018. The reduced transmission in the near past led to people's immune systems "forgetting" malaria which alongside the reduced use of preventive measures like mosquito nets, might be responsible for the current increase in the number and severity of malaria this year. The latest MIS of 2018, found that the population had relaxed on the use of the malaria preventive measures in the pretext that malaria was no longer affecting them.

Similar resurgence of malaria in areas where malaria had initially declined has been documented in areas such as China, India, and Sri-Lanka following a failure to sustain malaria interventions. The WHO acknowledges that malaria resurgence after a marked reduction in prevalence is actually the return to a state of equilibrium which has been disturbed. For Uganda to continue with the earlier gains, there is need for continued implementation of interventions and urging the population to heed to existing malaria prevention measures. These include indoor residual spraying, destruction of potential breeding sites, consistent use of mosquito nets, Fansidar for pregnant women to prevent malaria, and seeking prompt care if infected. Ministry of health also needs to ensure continued availability of key interventions including testing, treatment, behavioral change communication, and follow-up of cases in areas with low case counts.

Even with the reducing incidence, Uganda still has a high potential for malaria transmission given the favorable climatic conditions and many sites for mosquito breeding. This resurgence should be used as an advocacy tool to propel Uganda forward to pre-elimination of malaria.

Upcoming Events

National Measles, Rubella, and Polio mass immunization campaign, 16-20 October 2019

The Ministry of Health is to roll out a national five-day campaign from 16 to 20 October 2019. During the campaign, all children between nine months and 15 years of age will receive the measles, rubella, and polio vaccine. The campaign will target eight million children in Primary and Secondary schools, and communities.

5th Uganda National Field Epidemiology Conference, Kampala, 24 October 2019

The Uganda Public Health Fellowship Program (PHFP) is organizing the 5th National Field Epidemiology Conference under the theme, "5 Years of Protecting Uganda and the World through Field Epidemiology and Services." The conference will cover all aspects of public health surveillance, outbreak investigations, public health emergencies, and application of epidemiologic methods in the advancement of public health and preventive medicine.

TEPHINET Global Scientific Conference, Atlanta, 28 October - 1 November 2019

The Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET) will have its 10th global conference in Atlanta, United States. It is an opportunity for field epidemiology training programs (and other public health experts) to share knowledge and experiences related to the public health issues facing their countries.

This year, PHFP will be represented by 4 fellows presenting papers on "Fatal Rift Valley Fever Outbreak Caused by Exposures to Meat from Sick and Dead Livestock: Uganda, July 2018" by Angella Musewa; "Anthrax Outbreaks among Domestic Ruminants Associated with Butchering Infected Livestock and Improper Carcass Disposal: Three Districts, Uganda, 2016-2018" by Fred Monje; "Cutaneous Anthrax Outbreak Associated with Handling Dead Animals, Rhino-camp Sub-county, Arua District, Uganda, January-May 2018" by Vivian Ntono, and "Uganda Ebola Virus Disease Preparedness Assessment and Risk Mapping, August-September 2018" by Carol Nanziri.

15th Joint Annual Scientific Health (JASH) Conference, 6-8 November 2019

Makerere University College of Health Sciences (MakCHS) together with the Uganda Medical Association (UMA); Uganda National Association of Community and Occupational Health (UNACOH), and World Health Organization (WHO) is organizing the 15th JASH conference. This year's conference is being organized under the them: 'Unmasking Silent Epidemics'.

Outbreak of Malaria associated with Increased Commercial Activities around Swamps and Amplified Vector Density, Oyam District, Uganda, January-June 2019

Katusiime Maureen[1], Gerald Rukundo[1], Steven Ndugwa Kabwama [1], Alex Riolexus Ario [1]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda

Summary

In June 2019, Oyam District revealed an upsurge of malaria cases beyond the action threshold. We investigated to determine the scope of the outbreak, identify exposures associated with transmission and recommend evidence-based control measures. We defined a confirmed case as a positive malaria rapid diagnostic test (mRDT) or malaria microscopy from 1 January-30 June 2019 in a resident or visitor of Acaba Sub-county, Oyam District. We identified cases by reviewing records at health facilities in Acaba Sub-county. We interviewed case-patients and asymptomatic age- and parish-matched controls to determine exposures associated with illness. We conducted entomological and environmental assessments in the most affected villages within the Acaba Sub-county. We found 9,235 confirmed case-persons (AR=29%) and 1 death. Females (AR=38%) were affected more than males (AR=20%) (p<0.001). Children <18 years were more affected (AR=37%) than adults >18 years (AR=27%) (p<0.001). Among 83 case-patients and 83 controls, 66 (80%) case-patients and 33 (40%) controls engaged in commercial ventures <500m from a swamp (OR_{MH}=12, 95%CI 3.7-39); 18 (22%) case-patients and four (5%) controls lived <500m from rice irrigation sites (OR_{MH}=8.0, 95%CI 1.8-35); and 23 (28%) case-patients and four (5%) controls had water pools <100m from household for 3-5 days after rainfall (OR_{MH}=7.3, 95%CI 2.2-25). Seventy (84%) controls and 60 (72%) case-patients used bed nets (OR_{MH}=0.5, 95% CI 0.0-0.4); 40 (48%) controls and 15 (18%) case-patients wore long-sleeved clothes during evening hours (OR_{MH}=0.12, 95%CI 0.0-0.4). Indoor resting vector density was 19 mosquitoes/household/night. All seven (100%) breeding sites observed <500m from households had Anopheles larvae; sand pits (25/250mls) and brick pits (16/200mls) had the highest average larvae concentrations. This outbreak was facilitated by breeding sites near homes and commercial ventures, compounded by poor use of individual preventive measures. We recommended removal of potential breeding sites, mass case management of malaria, and increasing community awareness on use of insecticide-treated bed nets and protective clothing

Background

Malaria remains a major public health problem with Uganda ranking 5th among the highest malaria-burden countries globally. Uganda also has some of the highest transmission rates in the world (1) and sixth highest number of deaths from malaria in Africa (2). Malaria accounts for 30-50% of outpatient visits at health facilities, 15-20% of all hospital admissions, and up to 20% of all hospital deaths of which 27.2% occur among children under five years of age in Uganda. In June 2019, routine analysis of surveillance data at Ministry of Health revealed an upsurge of malaria cases beyond the action threshold in the entire Oyam District with Acaba Sub County was the most affected. We investigated to determine the scope of outbreak, identify exposures for transmission, and recommend evidence-based control measures.

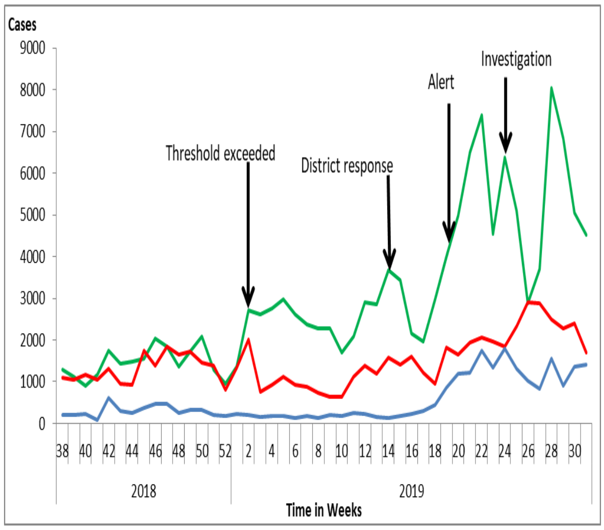

Figure 1: Normal channel graph showing a spike in malaria cases in Oyam District from week 2 of 2019 onwards

Methods

We defined a confirmed case as a positive malaria result using mRDT or microscopy from 1 January 2019 to 30th June 2019 in a resident or visitor of Acaba Sub-county in Oyam District, Uganda. We reviewed medical records in the outpatient registers to identify cases. We conducted descriptive epidemiology to describe the time, place, and person characteristics of the case persons. We conducted environmental and entomological assessments in the most affected villages to identify potential breeding sites and vector density respectively. We conducted hypothesis generating interviews in 20 households and a case control study to identify exposures of transmission among 83 cases and 83 controls, matched by age and parish.

Results

We found 9,235 confirmed case-persons (AR=29%) with median age 20 years (IQR: 6-21 years) and mean age 26.4 (SD±18.1). Obangangeo Parish was the most affected (AR=47%) followed by Abanya (AR=37%) and Dogapio (AR=36%). Females (AR=38%) were more affected than males (AR=20%). Children <18 years were more affected (AR=37%) than adults >18 years (AR=27%) The epidemic curve showed an increase in malaria cases from April, peaking in May and June. The rains were intermittent from February and increased for subsequent months (Figure 2).

Figure 3: Picture of a swamp encroached on by human activities (rice and yam growing) in Acaba Sub-county, January-June 2019

Continues to page 5

Continued from page 4

Entomological assessment found Anopheles gambiae sensu lato and Anopheles funestus as the most common vectors; average indoor resting density was 19 mosquitoes per house per night.

Hypothesis generating interviews found 95% of households had kitchens detached from main house, 95% did not use mosquito repellant, 68% had human activity within 100m from swamp and 63% entered bed after 9pm. We hypothesized that having human activity within 500m from swamp was associated with malaria infection.

Case control findings

Sixty seven percent (66/99) of case-patients engaged in commercial ventures like yam cultivation within 500m from swamp compared to 33% (33/99) of controls (OR_{MH}= 12, 95%CI 3.7-39) two weeks before symptom onset; 82% (18/22) of case-patients lived within 500m from rice irrigation activity compared to 18% (4/22) of controls (OR_{MH}=8, 95%CI 1.8-35) two weeks before symptom onset and 85% (23/27) of case patients had water pools around households for 3-5 days after rainfall compared to 15% (4/27) of controls (OR_{MH}=7.3, 95%CI 2.2-25). Furthermore, 46 %(60/130) of case-patients used mosquito nets compared to 54% (70/130) of controls (OR_{MH}=0.5, 95%CI 0.0-0.4) two weeks before symptom onset; 27% (15/55) of case-patients wore long-sleeved clothes during evening hours compared to 40/55 (73%) of controls (OR_{MH}=0.12, 95%CI 0.0-0.4) two weeks before symptom onset.

Discussion

Our investigation revealed an overall attack rate in Acaba sub county was 329 cases per 1000 population which was much higher than the incidence of malaria in Uganda of 191/1000 population (4) and AR of 12.1/1000 in Northern Ethiopia (5). The high AR in our study might be attributed to area difference in the burden of malaria and duration of the illness. Oyam District is a high transmission area for malaria and the duration of illness was long compared to the Ethiopian study.

People whose houses were within 500m to 1 km from breeding sites (swamp, rice irrigation and yam growing) were more likely to have malaria infection than those beyond 1km. This finding is consistent with those in Ethiopia (6). A possible explanation is the fact that most vectors travel shorter distances from breeding sites. A Gambian study found that the number of mosquitoes caught in houses declined steeply with distance to nearest breeding habitat (7). Secondly, possibly human activity within 500m from existing swamps increased the number of breeding sites which could have created desirable conditions for the multiplication of the vectors that bit and infected people. These sites hold fresh stagnant water that provides active breeding sites for malaria vectors (1).

In addition, water logging around household for 3-5 days after rainfall and having empty containers around household were independently associated with malaria. These risk factors increase the number of breeding sites for the mosquitoes around the home similar to findings of a malaria outbreak investigation conducted in Ethiopia (5).

Sleeping under treated nets and wearing long clothes to cover arms and legs provided significant protection against malaria. Personal protection to prevent vector contact is effective, affordable, and simple to apply. Hence the continued need to integrate such strategies into routine awareness and behavior change communication messages to fight against malaria.

Conclusion and recommendations

This outbreak was associated with human activity around swamps which increased breeding sites for vectors coupled with increased mosquito density. We recommended vector surveillance and larval source management, Mass Action against Malaria including increasing awareness of community on malaria prevention measures through behavioral change communication (BCC), interpersonal communication (IPC) and Information Education and Communication (IEC).

References

World Health Organization.(2018) WORLD MALARIA REPORT 2018. 2018.

MoH, (2014) THE UGANDA MALARIA REDUCTION STRATEGIC PLAN 2014-2020

Mawejje H.D, Wilding C.S, Rippon E.J, Hughes A, Weetman. D, Donnelly M.J (2013) Insecticide resistance monitoring of fieldcollected Anopheles gambiae s.l. populations from Jinja, eastern Uganda, identifies high levels of pyrethroid resistance. Medical and Veterinary Entomology. 2013 Sep;27(3):276-83.

MoH Surveillance Monitoring and Evaluation Unit (2019) National Malaria Annual Report 2017-2018, Kampala, Uganda. http://health.go.ug/Publications

Tesfahunegn. A., Gebretsadik. B and Gebregziabher. E (2019) Risk factors associated with malaria outbreak in Laelay Adyabo district northern Ethiopia, 2017: Case-Control Study Design. BMC Public Health (2019) 19:484 https://doi.org/10.1186/s12889-019-6798-x

Thomas CJ, Cross DE, Bøgh C (2013) Landscape Movements of *Anopheles gambiae* Malaria Vector Mosquitoes in Rural Gambia. PLoS ONE 8(7): e68679. https://doi.org/10.1371/journal.pone.0068679

Tukei BB, Beke A, Lamadrid-Figueroa H (2017) Assessing the effect of indoor residual spraying (IRS) on malaria morbidity in Northern Uganda: a before and after study. *Malaria Journal* **volume 16**, Article number: 4 (2017).

Malaria Outbreak Facilitated by Increased Vector-Breeding Sites sustained by Intermittent Rainfall: Mbale District, Uganda, June 2019

Gloria Bahizi[1], Daniel Kadobera[1], Fred Monje[1], Benon Kwesiga[1], Alex Riolexus Ario[1]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda

Summary

In June 2019, the Ministry of Health's National Malaria Control Program received notification of an increase in malaria cases in Mbale District, Uganda which exceeded the action thresholds. The most affected sub-counties were Bumbobi and Nyondo located in the midlands. We investigated to assess the outbreak's magnitude, identify transmission risk factors, and recommend evidence-based control measures. We defined a con-

Continues to page 6

Continued from page 5

firmed case as a positive malaria result using mRDT or microscopy from 1 January 2019 to 30 June 2019 in a resident or visitor of Bumbobi or Nyondo sub-county in Mbale District, Uganda. Cases were found by reviewing out patient registers in health facilities and a matched case control study was conducted. We identified 8,827 case-persons (overall attack rate [AR] =33%). Females (AR=36%) were more affected than males (AR=27%). The 5-18-year age-group (AR=26%) was the most affected. The area had intermittent rainfall patterns from January with short spells of no rainfall; the propagated outbreak began in epidemiologic week 10 in March 2019. In the case-control study, 52% (74/143) case-patients and 5.5% (4/73) controls had artificial soil erosion control pits near their homes which held stagnant water for several days following rainfall (AOR=16, 95%CI=4.0-61); 23% (11/47) of case-patients and 67% (72/108) of controls wore long-sleeve clothes during evening hours (AOR=0.19, 95%CI=0.076-0.45); 6.7% (7/104) of case-patients and 30% (41/138) of controls slept under a bed-net (AOR=0.16, 95%CI=0.016-1.7. Entomological assessment indicated active breeding sites; Anopheles gambiae species were the predominant vector. We recommend draining of erosion pits immediately after the rain and educating communities on malaria prevention measures.

Introduction

Malaria is one of the leading causes of disease and death in the world. Globally, it is estimated that 3.4 billion people are at risk of being infected with malaria and developing disease. According to the World Health Organization report of 2018, malaria caused nearly 219 million cases and 445,000 deaths with an estimated 90% deaths in 2016 being in the WHO African Region [1].
Malaria occurs mostly in tropical and subtropical areas of the world. Africa is the most affected due to a combination of factors such as the presence of the Anopheles mosquito which is responsible for the high transmission and the spread of the Plasmodium falciparum which causes malaria. Malaria transmission in Uganda exhibits seasonality which follows the rainfall pattern.[2]
The weather conditions allow the vector to thrive hence transmission occurs all year round with the presence of breeding sites and favorable temperatures.
In Uganda, Malaria is endemic in approximately 95% of the country, affecting over 90% of the population and is listed as the sixth leading cause of death [3]. We investigated to assess the outbreak's magnitude, identify transmission risk factors, and recommend evidence-based control measures.

Methods

We defined a confirmed case as a positive malaria result using mRDT or microscopy from 1 January 2019 to 30 June 2019 in a resident or visitor of Bumbobi or Nyondo sub-county in Mbale District, Uganda. We reviewed outpatient registers in health facilities of the two most affected sub-counties. We described the case-persons by person, place, and time. Environmental and entomological assessments of the most affected villages in the sub counties were done. We generated hypotheses and conducted a case control study to compare exposures among cases and controls, frequency matched by age and village with a ratio of 1:1.

Results

We identified 11,598 confirmed case-persons in the two most affected sub-counties. Overall attack rate was 33%. Bumbobi sub-county was more affected (AR = 38/100) than Nyondo sub-county (AR = 24/100). Females (AR= 36%) were more affected compared to the males (AR= 27%). The 5-18-year age group was most affected AR: 26, followed by children under 5 years (AR: 23)
The epidemic curve showed a continuous increase in malaria cases from Mar 2019. The rainfall pattern plotted against the epi curve shows erratic seasonality coupled with no rain. This was a propagated outbreak sustained by the intermittent rainfall.

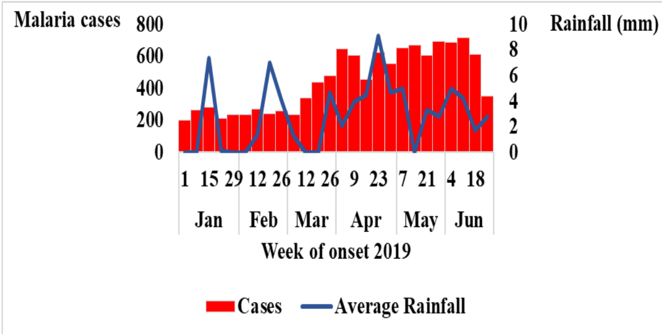

Figure 1: Epi curve of confirmed malaria cases in Bumbobi and Nyondo sub-counties, January- June 2019

Hypothesis generation interviews

Hypothesis generating interviews found 95% of households had mosquito nets but 71% reported them being torn and had had a sick household member two weeks before onset, 89% had erosion control pits. We hypothesized that the malaria outbreak was associated with erosion control pits which held stagnant water for periods after rainfall.

Environmental assessment and entomological findings

Erosion control pits, ditches near the homes, stagnant water, and improper use of drainage system were observed. There were larvae of anopheles mosquitoes in observed stagnant water. All households had at least one LLINs in their house. Ninety four percent of the cases had LLINs however, among those who used and those who did not use LLINs, most of them reported mosquito nets as sources of bedbugs. The pyrethrum spray catch (PSC) yielded 37 *Anopheles gambiae* of which 65% were fed, 8 *Anopheles funestus* with all fed, and 362 culex mosquitoes.

Case-control findings

Fifty two percent of case-patients(74/173) and 5.5% (4/73) of controls had erosion control pits near the homes and gardens (AOR=16, 95%CI=4.0-61) two weeks before symptom onset; 69%(94/102) of case-patients had a sick household member compared 38%(5/13) of the controls AOR=15, 95%CI=5.6-40.9) two weeks before symptom onset. Sixty three percent (49/79) case-patients compared to 40% (20/50) controls had bed bugs on mosquito nets (AOR=2.6 95% CI=1.07-6.4). Sleeping under an insecticide treated mosquito net (AOR=0.16, 95%CI=0.016-1.7) and wearing long clothes in the evenings (AOR=0.19, 95% CI=0.076-0.45); 6.7% (7/104) reduced the odds of malaria infection.

Discussion

This malaria outbreak was facilitated by increased vector-breeding sites sustained by intermittent rainfall. The time of the malaria transmission coincided with the rainfall season in Mbale District which has a bimodal pattern for March to June

Continued to page 7

Continued from page 6

and September to November [4]. Mbale has a topographical make-up of mountainous (highlands) with steep terrain combined with high rainfall and unstable soils, midlands, and the lowlands which make it vulnerable to impact of climate change.

Our study highlighted presence of erosion control pits filled with stagnant water in the affected areas that increased breeding sites. The intermittent rainfall also sustained a conducive environment for mosquitos and was associated with this outbreak as documented elsewhere[7]. Our study found that people found close to these pits were 16 times more affected than those who lived far from them. This finding is also supported by a report from Afar, Ethiopia[8]. The affected villages are situated in the midlands characterized with fertile soils and farming. As main source of livelihood. Whilst beneficial for crops and domestic water use, rainfall in the wet seasons can be expected to increase erosion, especially on steep slopes, as well as flooding in valleys and siltation of streams and rivers. In order to preserve their soil and prevent soil erosion, erosion control pits are dug in the midlands to reduce the speed of runoff. Other modifications included ditches that also preserved water for farming.

Age group of 5–18 years and females were most affected. Similar studies done in India[5], Ethiopia, [6]and Zimbabwe [8] showed children and females were more attacked by malaria. This may be explained by children having lower immunity and adult women carrying out activities such as cooking late in kitchens detached from the house and taking care of animals that exposed them more to mosquito breeding sites.

Our study revealed mosquito net use being protective against malaria infection but this did not show a significant effect on malaria infection. This is consistent with a study in Haiti which assessed the effectiveness of ITNs after a mass distribution. [12] LLINs are frequently used but those in use were in a poor state with visible holes reported by 49% of the cases, poorly hanged or shared by many members of the household. This was also highlighted in Somalia where there was no difference in bed net use among the different groups of people in communities [13]. It was observed that in some households bed nets were not hung because people believed they brought bedbugs. Mosquito nets impregnated with a long-lasting pyrethroid insecticide were found to be effective in repelling and killing bedbugs[14]. Bed bugs came out of

hiding places and for those that wrapped the mosquito nets around the mattress, they would be seen at the top; in others. The presence of bedbugs on LLINs showed an odds of 2.6 of malaria infection compared to those that did not report having seen bed bugs on their mosquito nets. Other protective measures were wearing long clothes when out late in the evenings and having curtains on doors and windows as these minimize human-vector contact. These are strategies that can be incorporated into behavioral change communication to prevent malaria infection as supported by studies done elsewhere in Kenya[15,16].

Conclusions and recommendations

Presence of erosion control pits was significantly associated with the occurrence of malaria outbreak. Lack of awareness on malaria transmission and control highlighted by the belief that mosquito nets brought bedbugs also created laxity on preventive measures. We recommend removal of potential mosquito breeding sites and draining of erosion pits regularly. Community awareness on malaria prevention and control mechanisms should be done. Adequate knowledge about malaria is paramount for the correct application of preventive measures and decreasing the disease exposure.

References

1. World Health Organization. World Malaria Report. (2018). Available at: www.who.int/malaria. (Accessed: 22nd July 2019)

2. Kilian, A., Langi, P., Talisuna, A. & Kabagambe, G. Rainfall pattern, El Niño and malaria in Uganda. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **93**, 22–23 (1999).

3. National Malaria Control Programme & Abt Associates. *An epidemiological profile of malaria and its control in Uganda*. (2013).

4. Mbogga, M. S. Climate profiles and climate change vulnerability assessment for the Mbale region of Uganda. *UNDP Consultancy report. Kampala, Uganda* (2012).

5. Rana: A report on outbreak investigation of malaria... - Google Scholar.

6. Workineh, B., Mekonnen, F. A., Sisay, M. & Gonete, K. A. Malaria outbreak investigation and contracting factors in Simada District, Northwest Ethiopia: a case–control study. *BMC Res Notes* **12**, 1–6 (2019).

7. Dawit. G. Prevalence and risk factors of malaria... - Google Scholar. Available at: https://scholar.google.com/scholar?oi=gsb95&q=Dawit.%20G.%20Prevalence%20and%20risk%20factors%20of%20malaria%20in%20Ethiopia%3B%202012.&lookup=0&hl=en. (Accessed: 6th September 2019)

8. Debela MB, Kahsay AB, Mokonnon TM. Malaria outbreak... - Google Scholar. Available at: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C5&q=Debela+MB%2C+Kahsay+AB%2C+Mokonnon+TM.+Malaria+outbreak+and+contracting+factors+in+Afar+Region%2C+Ethiopia.+J+Public+Health+Epidemiol.+2018%3B10%287%29%3A233%E2%80%9340.&btnG=. (Accessed: 6th September 2019)

9. Community perspectives on treating asymptomatic infections for malaria elimination in The Gambia | Malaria Journal | Full Text. Available at: https://malariajournal.biomedcentral.com/articles/10.1186/s12936-019-2672-7. (Accessed: 6th September 2019)

10. Kateera, F. *et al.* Malaria parasite carriage and risk determinants in a rural population: a malariometric survey in Rwanda. *Malaria journal* **14**, 16 (2015).

Malaria Outbreak Propagated by Rain Water Harvesting and Increased Vector Breeding Sites, Butambala District, Uganda, August 2018-February 2019

Gerald Rukundo[1], Daniel Kadobera[1], Phoebe Nabunya[1], Dativa Aliddeki[1] , Alex Riolexus Ario[1]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda

Summary

In early February 2019, the Butambala District Health Office reported an upsurge of malaria cases through the National Malaria Control Program (NMCP). Preliminary analysis of District Health Information Sys-

Continues to page 8

Continued from Page 7

tem (DHIS2) malaria data showed that the cases exceeded the action threshold from Epidemic week 1 to 6 of 2019. The most affected sub-counties were Kibibi and Budde. We investigated to assess the outbreak's magnitude, identify transmission risk factors, and recommend evidence-based control measures. We defined a confirmed case as malaria positive by rapid diagnostic test (mRDT) or microscopy from 1 August 2018 to 25 February 2019 in a resident or visitor of Kibibi and Budde sub-counties, Butambala District, Uganda. A total of 6,718 case-patients were identified (Attack rate (AR) =6.6%) and no fatalities). Females (AR=7.1%) were slightly more affected than males (AR=6.2%). The most affected age-group was 5-18 years (AR=10%). In the case-control study, 73% (87/120) of case-patients and 62% (74/120) of controls had water harvesting containers (OR_{M-H}=1.6 ,95% CI=1.0-2.0) two weeks before symptom onset; 80% (96/120) of case-patients and 58% (69/120) of controls carried out late outdoor activities (OR_{M-H}=3, 95% CI 1.6-5.2) two weeks before symptom onset; 63%(76/120) of case-patients and 71% (85/120) of controls had used Long Lasting Insecticide Nets (LLINS) the previous night (OR_{M-H}=0.7 95% C.I 0.4-1.2). Environment assessment revealed extensive use of drums and pots to harvest rain water due to lack of piped water and limited boreholes which was favorable for mosquito breeding. In addition, there were stone quarries which led to stagnation of rain water. Entomological assessment of the water in the harvesting containers showed presence of mosquito larvae. Prolonged vector breeding in water harvesting containers and stone quarries was sustained by the intermittent heavy rains; these coupled with inadequate malaria preventive measures caused this outbreak. We recommended frequent draining of the water harvesting containers, increasing coverage for LLINs, and larviciding of vector breeding sites.

Introduction

In Uganda, clinically diagnosed malaria is the leading cause of morbidity and mortality, accounting for 30-50% of outpatient visits at health facilities, 15-20% of all hospital admissions, and up to 20% of all hospital deaths. Twenty seven percent (27%) of inpatient deaths among children under five years of age are due to malaria. Uganda has one of the highest malaria transmission rates in the world and is third in malaria mortality in Africa. Temperature and rainfall are two climatic factors previously used to forecast malaria outbreaks in East Africa. The transmission intensity of malaria depends on vector population or density which also depends on the presence of breeding sites and favorable temperatures; parasite-carrying individuals from whom mosquitoes pick the parasites; and presence of a malaria susceptible populations, especially people with low immunity The influence of climatic factors on malaria infection may differ from place to place based on many local contexts like availability of good public health system for malaria prevention and treatment, socio-economic factors, and local land use. Comprehensive intervention policies and strategies have been adopted to control malaria in Uganda. In early February 2019, the Butambala District Health Office reported an upsurge of malaria cases through the National Malaria Control Program (NMCP). Preliminary analysis of District Health Information System (DHIS2) malaria data showed that the cases exceeded the action thresholds from Epidemic week 1 to 6 of 2019. The most affected sub-counties were Kibibi and Budde. We investigated to assess the outbreak's magnitude, identify transmission risk factors, 7720 and recommend evidence-based control measures.

Methods

We defined a confirmed case as a positive malaria test result by mRDT or microscopy from 1 August 2018 to 25 February 2019 in a resident or visitor of Kibibi and Budde sub-counties, Butambala District, Uganda. We reviewed health records in health facilities of the two most affected sub-counties. We systematically searched for malaria cases by reviewing outpatient health records in health facilities of the two most affected sub-counties. We abstracted data from the registers, including age, sex, village, parish and sub-county of residence, type of confirmatory test done and described cases by person, place, and time. We conducted environmental and entomological assessments in the most affected villages in the two sub-counties. We generated hypotheses and conducted a case control study to compare exposures among cases and controls, frequency matched by age and village with a ratio of 1:1.

Results

We line listed 6,718 confirmed case-patients with median age 13 years (Interquartile Range [IQR]: 7-24 years) and no fatalities. Females (AR=7.1%) were more affected than males (AR=62%). The most affected age-group was 5-18 years (AR=10%). Mabanda parish (AR=41%) in Kibibi sub-county and Kibugga parish (AR=38%) in Budde sub-county, were most affected. The epidemic curve showed a steady increase in malaria cases from August 2018, with peaks in December 2018 and February 2019 following intermittent heavy rainfall.

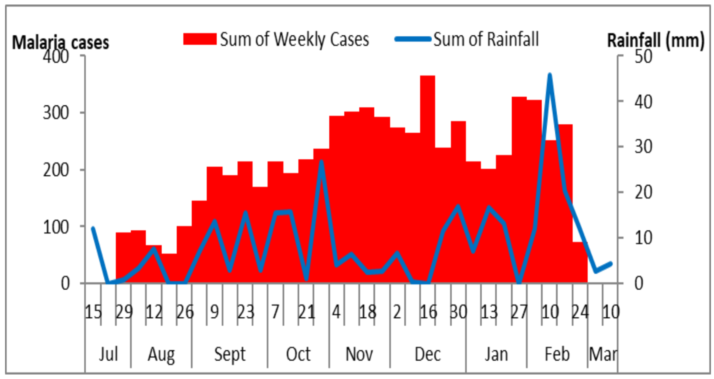

Figure 1: Epidemic curve of confirmed malaria cases in Budde and Kibibi sub-counties, August 2018 to February 2019

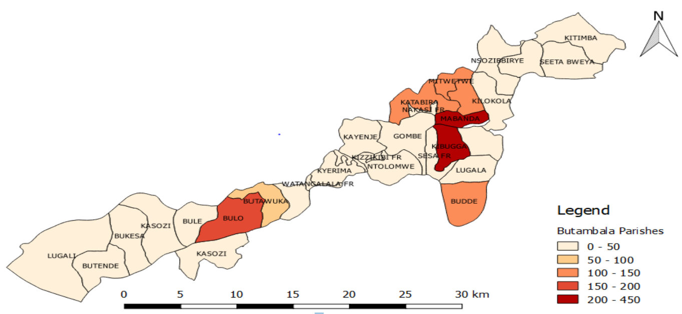

Figure 2: Malaria attack rates by parish in Budde and Kibibi sub-counties August 2018 – February 2019

Environmental assessment and Entomological findings

The most affected villages were characterized with many spots of standing water following heavy rainfall. There was accumulation of rain water in the large pits and stone quarry created by road con-

Continued to page 9

Continued from page 8

tractors and these became breeding sites for mosquitoes. Increased human activities around flowing streams such as ginger growing and cultivation led to their blockage hence acted as extra bleeding site for mosquitoes. The pyrethrum spray catch (PSC) yielded Anopheles gambiae.

Case-control findings

In the case-control study, 73% (87/120) of case-patients and 62% (74/120) of controls had water harvesting containers (OR_{M-H}=1.6 ,95% CI 1.0-2.0) two weeks before symptom onset; 80% (96/120) of case-patients and 58% (69/120) of controls carried out late outdoor activities (OR_{M-H}=3, 95% CI 1.6-5.2) two weeks before symptom onset ; 63% (76/120) of case-patients and 71% (85/120) of controls had used LLINs previous night (OR_{M-H}=0.7 95% C.I 0.4-1.2).

Discussion

This investigation revealed that presence of rain water harvesting containers facilitated this outbreak. The two most affected parishes lacked piped or borehole water for the population. During the environment assessment, it was evident that during the rainy season, most people harvested water. The containers used in harvesting water were drums, fixed pots, jerry cans, and saucepans. The rain water harvesting containers permanently stayed out-doors and many always had water residues. During the rainy season of October to December, the rains were prolonged and the containers retained water for longer periods than previously. This led to increased breeding sites for mosquitoes around the homesteads. A study carried out in India shows that water harvesting containers such as over-head tanks were potential breeding habitat for mosquitoes (3).

Our investigation also revealed that males were more affected than males. This could be because women do more activities that expose them to mosquito breeding sites, such as fetching water from various water sources and late night cooking outside the main house. A study carried out in Tanzania found that females were more susceptible to malaria attacks than men because they perform activities that predispose them to mosquito bites. Most activities done by women included late night outdoor cooking, fetching water from the water bodies, cultivation [4].

The environmental assessment revealed that human activities conducted along running streams such as ginger washing and road construction could have propagated this outbreak. In January 2018, the road contractors started mining stones for road construction. However, in October 2018, they suspended the road construction leading to the accumulation of rain water in the stone quarry. This acted as breeding sites for mosquitoes.

Conclusions

Prolonged vector breeding in water harvesting containers sustained by the heavy rains, together with inadequate malaria preventive measures caused facilitated this outbreak. We recommended frequent draining of the water harvesting containers, increased coverage for LLINs, and larviciding breeding sites.

References

1. MOH (2015) *Health Sector Development Plan №1/№2 - 2019/20*. doi: 10.1093/intimm/dxu005.

2.World Malaria Report 2013 https://www.who.int/malaria/publications/world_malaria_report_2013/en/

3.Shalu Thomas, Sangamithra Ravishankaran, Johnson A. Justin, Aswin Asokan, Manu T. Mathai, Neena Valecha, Matthew B. Thomas and Alex Eapen. Overhead tank is the potential breeding habitat of Anopheles stephensi in an urban transmission setting of Chennai, India .Malaria Journal201615:274https://doi.org/10.1186/s12936-016-1321-7

4.Chiruvu RT, Kanengoni B, Mungati M, et al. Malaria Outbreak investigation in Chitulipasi, Beitbridge District, Matabeleland South Province, 2015. IJRDO-Journal of Health Sciences and Nursing. 2017; 2 (5): 104–120

Animal bite patterns and delays in initiating post exposure prophylaxis associated with vaccine stock outs at Arua Regional Referral Hospital, Arua District, Uganda: 2014-2018

Fred Monje[1], Daniel Kadobera[1], and Alex Riolexus Ario[1]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda

Summary

Although Northern Uganda had the highest incidence of animal bites at 76 per 100,000, among all the regions in 2001-2015 rabies surveillance data analysis, rabies Post Exposure Prophylaxis (PEP) usage was not indicated – whether timely or not. We described patterns of animal bite victims seeking PEP at Arua Regional Referral Hospital (ARRH), established proportions of timely initiation of PEP and predictors of delayed PEP initiation in Arua District. We identified 1,411 animal bites in Arua District during the period 2014-2018; with an overall incidence of 17/ 10,000population. Of 1,411 animal bites, 21% (294) had timely initiation of PEP at ARRH. 29% (275/952) of animal bite victims received timely PEP when there was availability of rabies vaccine compared to 4% (19/459) who received timely PEP when there was a stock out of rabies vaccine (AOR=8.8; 95%CI:5.4-14). There was low timely initiation of PEP among animal bite victims in Arua District associated with stock-outs of rabies vaccine at ARRH. We recommended increasing availability of rabies vaccine at ARRH guided by animal bites data from the veterinary department; and sensitization of the public about PEP to minimize the dangers of animal bites/rabies in humans.

Background

In Uganda, research indicate that 41% of patients exposed to rabies virus through animal bites do not complete their course of PEP (1). It is also possible that more animal bite victims do not initiate or delay to initiate PEP after an animal bite injury in Uganda. Furthermore, descriptive rabies surveillance data analysis conducted from 2001-2015 in Uganda based on data routinely collected at health facilities revealed that Northern region in Uganda had the highest incidence (/100,000) of animal bites at 76, among all other regions, with significant increase in suspected deaths associated with rabies (2). Within Northern region, Arua District consistently reported high numbers of animal bites from 2014 - 2018 but without information regarding adherence and delays of PEP and associated factors at health facilities. We described patterns of animal bite victims seeking PEP at Arua Regional Referral Hospital (ARRH), established proportions of timely initiation of PEP and predictors of delayed PEP initiation in Arua District to guide control interven-

Continued to page 10

Continued from page 9

tions.

Methods

We conducted a retrospective cohort study at ARRH located in Arua District, Northern Uganda. We reviewed Outpatient registers (HMIS 031) and extracted animal bites data at ARRH from 2014-2018. We also conducted Key informant interviews (KII) with the Outpatient Department head, Hospital Pharmacist, and the head of the Medicine stores at the Hospital. We abstracted data on timely initiation of PEP (Vaccine initiation < 48 hours) or delayed initiation of PEP (Vaccine initiation ≥ 48 hours or not receiving vaccine at all) as our dependent variable. The independent variables were date of initiating PEP, residence, age, sex, diagnosis, knowledge gap of the patients, rabies vaccines stock-out cost of the vaccine, and technical capacity. We described animal bite patterns by person, place, and time. Using QGIS, we drew a map of Arua District to show the spatial distribution of animal bites victims at ARRH based on their recorded areas of residences. Proportions of animal bite cases was generated and subjected to a Chi-Square test to test significant differences. We used logistic regression to identify predictors of delayed initiation of PEP. Qualitative data was summarized as themes and sub-themes.

Results

We identified 1,411 animal bites in Arua District during the period 2014-2018; with an overall incidence of 17 /10,000 population. Of 1,411 animal bites, 21% (294) had timely initiation of PEP. Among 294 animal bite victims who received timely PEP at ARRH, the majority were children aged 6-17 (Incidence/10,000=5.3). Dadamu sub-county was the most affected (Incidence/10,000=11) (Figure 1).
PEP initiation at ARRH showed variations in different years with the peaks occurring between March-October during the study period, 2014-2018. For instance, PEP initiation was highest in the month of July in 2014; highest in the month of April in 2015; highest in the month of August in 2016; highest in the months of March and October in 2017; and highest in the month of June in 2018 (Figure 2).

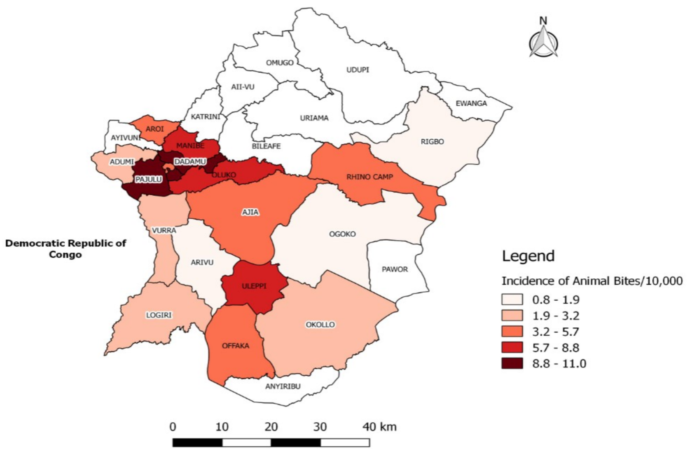

Figure 1: Map of Arua District showing incidence of animal bites among victims who sought healthcare at Arua Regional Referral Hospital, 2014-2018

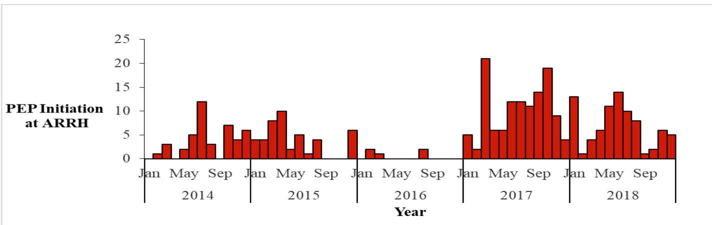

Figure 2: PEP initiation among animal bite victims at Arua Regional Referral Hospital, Arua District: 2014-2018

Factors associated with timely initiation of PEP among animal bite victims

In logistic regression, 29% (275/952) of animal bite victims received timely PEP when there was availability of rabies vaccine compared to 4% (19/459) of animal bite victims who received timely PEP when there was a stock-out of rabies vaccine (AOR=8.8; 95%CI:5.4-14). Besides, 28% (106/375) of animal bite victims staying ≤ 20km away from ARHRH received timely PEP compared to 18% (188/1036) of animal bite victims staying > 20km away from ARRH (AOR=1.4, 95%CI: 1.1-2.0). Furthermore, one Key informant at ARRH said, "As a referral hospital, we could be having enough rabies vaccines all the time, but many times, patients for dog bites come here and don't find vaccines".

Discussion

Our epidemiologic investigation demonstrated that there was low timely initiation of PEP associated with stock-outs of rabies vaccine at ARRH and long distance of patient residence away from ARRH. Besides, most patients who sought for PEP at ARRH were Children aged 6-17 years during the study period.
The WHO recommends that all animal bite victims be given immediate PEP after rabies exposure (3). However, in our study, there was delayed initiation of PEP associated with stock-outs of rabies vaccine and long distance of patients away from ARRH. Previous studies have also pointed out that rabies vaccine stock-outs was associated with low uptake of rabies vaccine at health facilities among animal bite victims (4). Rabies vaccine stock- outs at health facilities may discourage animal bite victims seeking for PEP services from returning to health facilities for PEP due to the long distances and transport costs incurred by the poor farmers.

Past studies have indicated that following an animal bite, the majority of animal bite victims who received PEP services were children (5). In our study, most animal bite victims accessing rabies vaccine were children probably because this was a school going age-group who could have been bitten by stray dogs when going to school- hence prompting them to seek for PEP services.

Our study also showed that PEP initiation had peaks occurring between March-October during the study period, 2014-2018. The period March – October in the study period corresponds to the rainy season in Arua District and Uganda in general. Rainy seasons are associated with mating and breeding in dogs as indicated by a study in Kenya (6). Rainy seasons are usually associated with abundance of resources such as food possibly that's why mating and breeding occurs in this season. In mating season, dogs' instincts to multiply are at their sharpest and often lead to behavioral changes- including the urge to bite in an attempt to protect the female dogs. Thus, any human who approaches or moves near such a pack is perceived to be a threat and bitten. The year 2016 was characterized by few people or the least number of people accessing PEP. However, it is not clear why few persons accessed during 2016.

Conclusion and Recommendations

Our investigation demonstrated that there was low timely initiation of PEP among animal bite victims in Arua District associated with stock-outs of rabies vaccine at ARRH. We recommended increasing availability of rabies vaccine at ARRH guided by animal bites data from the veterinary department; and sensitization of the public about PEP usage to minimize the dangers of animal bites/ rabies in humans.

References

1. Fèvre EM, Kaboyo RW, Persson V, Edelsten M, Coleman PG, Cleaveland S. The epidemiology of animal bite injuries in Uganda and projections of the burden of rabies. Trop Med Int Health. 2005 Aug;10(8):790–8.

2. Masiira B, Makumbi I, Matovu JKB, Ario AR, Nabukenya I, Kihembo C, et al. Long term trends and spatial distribution of

Continues to page 11

Continued from page 11

animal bite injuries and deaths due to human rabies infection in Uganda, 2001-2015. PLOS ONE. 2018 Aug 21;13(8):e0198568.

3. Crowcroft NS, Thampi N. The prevention and management of rabies. BMJ. 2015 Jan 14;350:g7827.

4. Changalucha J, Steenson R, Grieve E, Cleaveland S, Lembo T, Lushasi K, et al. The need to improve access to rabies post-exposure vaccines: Lessons from Tanzania. Vaccine [Internet]. 2018 Oct 8 [cited 2019 Aug 21]; Available from: http://www.sciencedirect.com/science/article/pii/S0264410X1831243X

5. Penjor K, Tenzin T, Jamtsho RK. Determinants of health seeking behavior of animal bite victims in rabies endemic South Bhutan: a community-based contact-tracing survey. BMC Public Health. 2019 Feb 27;19(1):237.

6. Digital S. Why dogs bite during the rainy seasons | Smart Farmer [Internet]. [cited 2019 Aug 22]. Available from: https://smartfarmerkenya.com/why-dogs-bite-during-the-rainy-seasons/

Trends and Treatment Outcomes of Pediatric Tuberculosis, Mbale Regional Referral Hospital, Uganda, 2013-2017

Fred Monje[1], Daniel Kadobera[1], Lilian Bulage[1], Alex Riolexus Ario[1]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda;

Summary

Neglected or missed Childhood TB often leads to missed opportunities for diagnosis, treatment, and prevention of transmission. We assessed trends in TB case notification rates, TB spatial distribution, TB treatment outcomes, and factors associated with completion of TB treatment in Children at Mbale Regional Referral Hospital (MRRH), Eastern Uganda. We identified 344 TB case notifications aged 0-14 years at MRRH; overall prevalence of 12 TB cases/100,000 population. The trend of TB case notification rates decreased from 3.9/100,000 in 2013 to 1.5/100,000 in 2017 (OR=0.83, p < 0.001). TB patients originated from 11 districts in Eastern Uganda. TB treatment completion was at 52% (179/344). In logistic regression, 67% (118/175) TB patients who resided ≤20km away from the hospital completed TB treatment compared to 36% (61/169) of TB patients who resided > 20km away from the hospital (AOR =3.3; 95%CI: 2.1-5.2). Childhood TB treatment completion rate was below the WHO recommendation of 85%. Better TB completion rate was associated with TB patients residing < 20km from the Hospital. To improve completion of TB treatment, MRRH should consider designing a means of follow up of TB patients who transfer out due to long distance to ensure they complete TB treatment in the scheduled period. Ministry of Health may open up more treatment facilities at lower levels closer to communities. Ministry of Health should consider educating communities on the importance of completing TB treatment.

Introduction

According to the Uganda National Tuberculosis and Leprosy Program (NTLP), children (0-14 years) are among the high risk groups for TB. Tuberculosis in children is often neglected by various professionals because children are hardly infectious and rarely develop severe TB disease (1). Unavailability of resources makes accurate diagnosis of childhood TB cases even more difficult, which leads to both undiagnosed and underreporting of childhood TB (1). This dilemma of childhood TB will continuously provide a source for new TB infections in the population (1). Each missed TB case spreads TB to 10-15 people. Even the children who are correctly diagnosed as having TB, their treatment outcomes vary from region to region in Uganda (2). We assessed the trends in TB case notification rates, TB spatial distribution, TB treatment outcomes, and factors associated with completion of TB treatment in children at Mbale Regional Referral Hospital (MRRH), Eastern Uganda to guide control interventions.

Methods

We conducted a retrospective cohort study at MRRH. We reviewed secondary TB data that's routinely collected within the catchment area of MRRH in Eastern Uganda. We enrolled and reviewed records of all patients aged 0-14 years in the TB register at MRRH whose place of residence was among the Eastern districts of Uganda during the period 2013-2017. We excluded pediatric patients whose outcome of interest was missing.
We captured variables of TB patients from the TB registers such as patient residence (≤ 20km from MRRH or ≥20km away from MRRH), age (0<5; 5< 10; and 10< 15 years), sex, type of patient (patient continuing with TB treatment or patient newly initiated on TB treatment), TB classification (PCD, EP and PBC), HIV status (positive or negative), treatment model (facility based treatment model or not), and treatment outcome (completed TB treatment or not). We computed the TB case notification rate (/100,000) for the period 2013 - 2017; performed a trend analysis of childhood TB and used QGIS to draw an area map to show the spatial distribution of childhood TB cases based on their recorded areas of residence. We used the estimated population of children from the hospital records of the catchment districts in Eastern Uganda to calculate the TB notification rate. We used logistic regression to identify predictors of completion of childhood TB treatment.

Results

We identified 344 TB case notifications aged 0-14 years at MRRH, 2013-2017; overall prevalence of 12 TB cases per 100,000 population. The trend of TB case notification rates decreased from 3.9/100,000 in 2013 to 1.5/100,000 in 2017 (OR=0.83, P < 0.001) (Figure 1).
Fifty three percent (181/344) of the pediatric patients were females. The mean age of TB patients was 6.3 years (Range = 0.17-14years). With regard to classification, 55% (188/344) of the TB patients were clinically diagnosed with pulmonary TB; 34% (119/344) diagnosed with extra pulmonary TB, and 11% (37/344) bacteriologically confirmed with pulmonary TB.

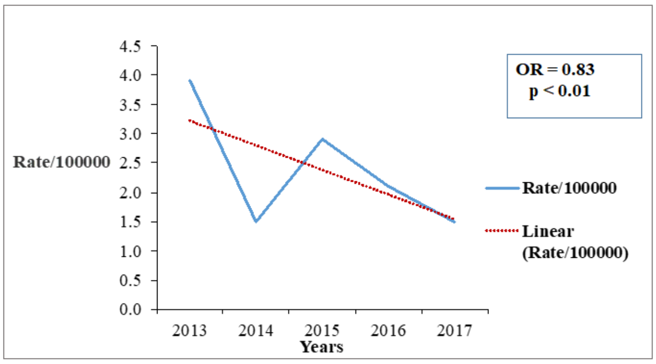

Figure 1: Trends of TB case notification rates among children at Mbale Regional Referral Hospital, 2013-2017

Tuberculosis patients originated from 11 districts with Mbale District showing the highest TB case notification rate (73/100,000) and Kapchorwa District showing the lowest TB case notification rate (3.8/100,000) (Figure 2).

Continues to page 12

Continued from page 11

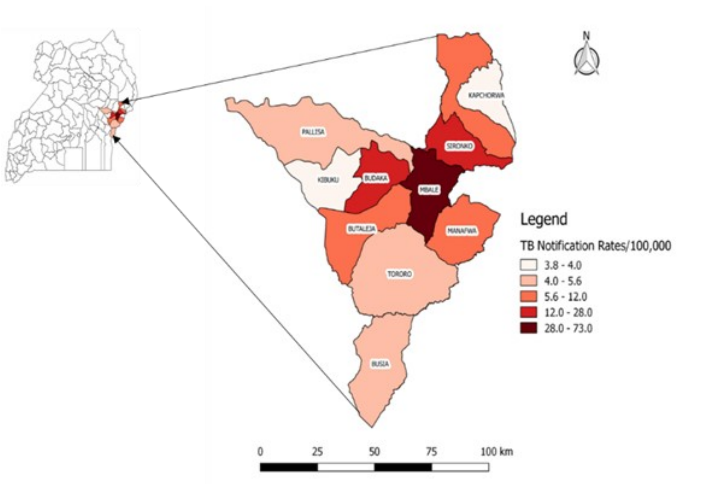

Figure 2: Tuberculosis case notification rates among children at Mbale Regional Referral Hospital, 2013-2017

One hundred seventy nine (52%) of the TB patients completed TB treatment. In logistic regression, 67% (118/175) TB patients who resided ≤ 20km away from the hospital completed TB treatment compared to 36% (61/169) of TB patients who resided > 20km away from the Hospital (AOR=3.3, 95% CI=2.1-5.2).

Discussion

Our investigation demonstrated that completion of TB treatment among children aged 0-14 years at MRRH in Uganda was associated with staying closer to the hospital (i.e. < 20km). Staying closer to MRRH /TB treatment centre (<20km away from MRRH) may have made it easy for the pediatric TB patients to access medication and complete the 6 months course of TB treatment. This agrees with a qualitative study conducted at selected health facilities in Asmara, Eritrea that indicated that access to health facility for TB treatment enabled them complete TB treatment because distance from their homes to the health facility was manageable (3). Other studies among TB patients in a TB treatment health facility in Ethiopia also indicated that completion of TB treatment was compromised if the distance from the patients home to the health facility was far (4,5). We also found that the completion rate of childhood TB treatment was 52%. This TB treatment completion rate was lower than the targeted completion rate of 85% by WHO (6). This demonstrates that a good number of patients are unable to complete treatment which leads to increased transmission and possibly of multi drug resistant TB among the population.

There was a decline in the TB case notification rates at MRRH, from 2013 - 2017. The decline may be due to a scale up of Anti-Retroviral Therapy (ART) at MRRH. Since HIV is a major risk factor for developing TB, the scale up of ART could have reduced the TB case notifications. ART reduces the risk of TB infection in people living with HIV thereby reducing the TB transmissions and hence TB case notifications. This is consistent with other findings in Zimbabwe that pointed out that the declining TB case notifications was due to the scale up of ART(7).

However, our investigation had some limitations. The names of the health facilities to which the TB patients from MRRH transferred to were not indicated and therefore we could not tell if they eventually completed TB treatment or not. Failure to account for the TB treatment completion of the patients who transferred out from MRRH may have led to underestimation of the TB treatment completion rates among children.

Conclusions and recommendations

The TB treatment completion rate was below the WHO recommendation of 85%. Better TB completion rate was associated with TB patients residing ≤ 20km from the Hospital. To improve completion of TB treatment, MRRH should consider designing a means of follow up of TB patients who transfer out due to long distance to ensure they complete TB treatment in the scheduled period. Ministry of Health may open up more treatment facilities at lower levels closer to communities. Ministry of Health should consider educating communities on the importance of completing TB treatment.

References

1. Hamzaoui A, Yaalaoui S, Cherif FT, Saidi LS, Berraies A. Childhood tuberculosis: a concern of the modern world. European Respiratory Review. 2014 Sep 1;23(133):278–91.

2. National Tuberculosis and Leprosy Control Programme Revised National Strategic Plan 2015/16 - 2019/20 | Ministry of Health [Internet]. [cited 2018 Nov 25]. Available from: http://health.go.ug/content/national-tuberculosis-and-leprosy-control-programme-revised-national-strategic-plan-201516

3. Gebreweld FH, Kifle MM, Gebremicheal FE, Simel LL, Gezae MM, Ghebreyesus SS, et al. Factors influencing adherence to tuberculosis treatment in Asmara, Eritrea: a qualitative study. J Health Popul Nutr [Internet]. 2018 Jan 5 [cited 2019 Sep 21];37. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5756387/

4. Demissie M, Lindtjorn B, Berhane Y. Patient and health service delay in the diagnosis of pulmonary tuberculosis in Ethiopia. BMC Public Health. 2002 Sep 25;2:23.

5. Tadesse T, Demissie M, Berhane Y, Kebede Y, Abebe M. Long distance travelling and financial burdens discourage tuberculosis DOTs treatment initiation and compliance in Ethiopia: a qualitative study. BMC Public Health. 2013 May 1;13:424.

6. End_TB_Strategy.pdf [Internet]. [cited 2018 Nov 26]. Available from: https://www.who.int/tb/strategy/End_TB_Strategy.pdf

7. Takarinda KC, Harries AD, Sandy C, Mutasa-Apollo T, Zishiri C. Declining tuberculosis case notification rates with the scale-up of antiretroviral therapy in Zimbabwe. Public Health Action. 2016 Sep;6(3):164–8.

Outbreak of yellow fever among unvaccinated children, Masaka District, Uganda, March-May 2019

Maureen Nabatanzi[1], Gloria Bahizi[1], Benon Kwesiga[1], Alex Riolexus Ario[1], Bernard Lubwama[2]

[1]Uganda Public Health Fellowship Program, Ministry of Health, Kampala, Uganda

[2]Epidemiology and Surveillance Department, Ministry of Health, Uganda

Summary

Yellow fever remains a public health threat in Uganda. Despite the availability of a vaccine, Uganda has had several outbreaks; the most recent was in 2016 in the central and south western region. On 8th May 2019, the Uganda Virus Research Institute (UVRI) identified one yellow fever confirmed case in Masaka District through their sentinel surveillance system and laboratory sub-network. We investigated to determine the scope of the outbreak, identify possible exposures, and recommend evidence-based control measures. We reviewed medical records and conducted community case finding in Bukakata sub-county, Masaka District. We identified a total of 5 case-persons (1 confirmed, 2 probable, and 2 suspect). All case-persons were children, the average age was 11 (SD=5), ranging from 3 to 17 years. Case-persons reported fever (100%), headache (100%),

Continues to page 13

and abdominal pain (85%). The index case developed symptoms on 19 March 2019, and the outbreak ended in May 2019. All case-persons were residents of Bukakata sub-county in Masaka District. None had received yellow fever vaccination. Most (2/5, 80%) lived near forests and reported seeing monkeys at their home or family farmland; *60% lived near stagnant water and swampy areas (60%). Aedes mosquitoes and larvae were isolated at homes and farmlands in Bukakata. This yellow fever outbreak affected unvaccinated children. Likely risk factors for transmission were being unvaccinated and living close to swampy and forested areas inhabited by monkeys. We recommended a vaccination campaign in Bukakata* and surrounding areas.

Introduction

Yellow fever is an acute viral hemorrhagic disease. It is transmitted from human to human by *Aedes* mosquitoes. Mosquitoes acquire the virus by feeding on infected primates (human or non-human) and then transmit the virus from human to human in areas with high mosquito density and where most people are unvaccinated (1). The incubation period of yellow fever infection is 3 to 6 days. According to the World Health Organization, severe symptoms include high fever, jaundice, unexplained bleeding, and eventually organ failure. Among the severe cases, the case fatality rate is 20-50% (2). There is no known treatment for yellow fever and emphasis is put on vaccination.

Uganda has a history of yellow fever outbreaks; the most recent one in 2016 affected Masaka, Rukungiri, and Kalangala districts (3, 4). Following the 2016 outbreak, a mass vaccination campaign was conducted in the affected districts with the aim of preventing further outbreaks.

On 8 May 2019, the Ministry of Health received notification of one confirmed case of yellow fever in Masaka District. The case was identified at Bukakata Health Centre III in Masaka which is one of 6 sentinel sites set up by UVRI for the surveillance of arbovirology infections. We investigated to determine the scope of the outbreak, identify possible exposures in order to recommend evidence-based control measures.

Methods

We defined a suspected case as any person from Bukakata sub-county with fever of acute onset (negative for malaria test, unresponsive to fever management and not explained by any other reasons) from March-May 2019, and any two of the following symptoms: joint pain, headache, diarrhea, vomiting, abdominal pain, and back pain. A probable case was a suspected case with liver function abnormalities or with post mortem liver histopathology or with jaundice (yellowing of the skin and eyes) or with unexplained bleeding. A confirmed case was a suspected or probable case with a laboratory positive result (serology, PCR or other tests) for yellow fever virus.

We reviewed Bukakata health center III patient records and engaged health workers to refer any cases that fit the case definition. We also actively searched for cases in the affected communities. We shared the case definition with community leaders and worked alongside them to identify case patients. We assessed the affected community to establish environmental factors that could explain the onset of the outbreak. In addition, we assessed for the presence of *Aedes* mosquitoes in the affected community. Dry ice was used as bait for the adult mosquitoes while larvae were collected from stagnant water on site.

Results

From March to May 2019, we identified 5 case-persons (1 confirmed, 2 probable, and 2 suspect). The case-persons were children with a mean age of 11 (SD=5) and ranging from 3 to 17 years. All 5 case-persons were residents of Bukakata sub-county in the villages of Kabsese (2), Kaziru (2) and Bukakata (1). Case-persons presented with headache (5/5, 100%), abdominal pain (4/5, 80%), joint pain (3/5, 60%), vomiting (3/5, 60%), unexplained bleeding (2/5, 40%), and jaundice (2/5, 40%). None of the case-persons had received yellow fever vaccination. Most case-persons lived near forests (4/5, 80%), stagnant water (3/5, 60%), and swampy areas (3/5, 60%). Four case-persons (4/5, 80%) reported seeing monkeys at their home or family farmland. The main activities in the affected communities were farming and fishing. The farmlands were located in forested areas, recently deforested areas, and swamps. *Aedes* mosquitoes and larvae mosquitoes were observed at the homes, farmlands, and areas surrounding the outbreak site.

Figure 1: Yellow Fever Cases in Bukakata Sub-county, Masaka District, Uganda, March-May, 2019

The outbreak occurred between March and May 2019; the index case developed symptoms on 19 March (week beginning 18 March) while majority of cases (4) occurred in April (Figure 2).

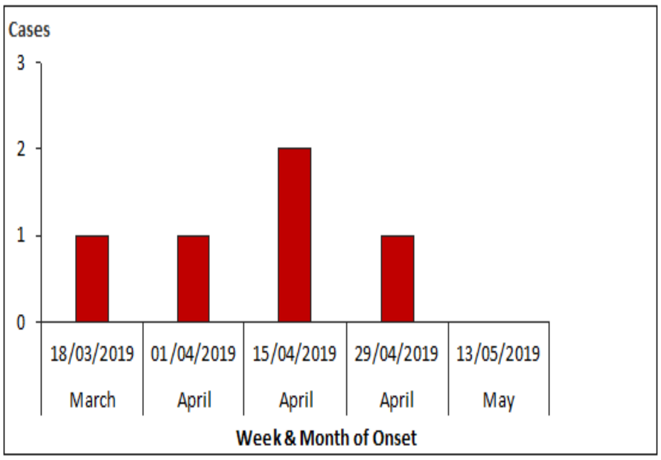

Figure 2: Epidemic curve of a Yellow Fever outbreak in Masaka District, March-May 2019

Continues to page 14

Continued from page 13

Discussion

Our investigation revealed that all the case-persons were residents of Bukakata sub-county Masaka District and living or farming in close proximity to forests or previously forested land inhabited by monkeys. Similarly, Kwagonza et al found an association between farming in monkey inhabited forest and swampy areas and yellow fever infection. (4). In the sylvatic (jungle) yellow fever transmission cycle, the virus is transmitted via mosquitoes from monkeys to humans when human activities encroach into the jungle (1).

It is recognized that presence of mosquito vectors and non-human primate hosts are involved in the YF virus transmission cycle (2). The environmental assessment revealed the presence of *Aedes* mosquitoes and larvae mosquitoes at the homes, farmlands, and areas surrounding the outbreak area. The rainy season months in this region are usually March, April, and May. These coincide with increased agricultural activities as farmers prepare their land for planting. During the investigation, it was raining heavily in the outbreak area which resulted in puddles of water around the homes of case-persons. It is likely that the heavy rains increased the stagnant water in the environment which encouraged the breeding of mosquitoes (4). This outbreak started in March and peaked in April; similarly, the 2016 yellow fever outbreak in Masaka District coincided with the rainy season and peaked in March and April (4).

The World Health Organization recommends vaccination as the most important intervention to prevent yellow fever [1]. After the 2016 outbreak, a yellow fever mass vaccination campaign was conducted in Masaka. However, from our discussions with community members, some people especially children did not receive the vaccine during the campaign. In addition, the yellow fever vaccine has not been incorporated into the routine immunization schedule, it is therefore possible that there were unvaccinated people in Bukakata sub-county. This outbreak affected children who had not been vaccinated against yellow fever. Our investigation implied that this outbreak was likely sylvatic in nature, spread by the *Aedes* mosquitoes to an unvaccinated population living in proximity to mosquito breeding sites.

Conclusions and recommendations

This yellow fever outbreak affected unvaccinated children living in close proximity to monkey inhabited forested and swampy areas. We recommended that the Ministry of Health and Masaka District Health Team be supported to conduct a vaccination campaign in Bukakata sub-county with a special focus on children.

References

1. CDC. CDC Yellow Book 2020. Mark D. Gershman JES, editor. USA: Centers for Disease Control and Prevention; 2019 August 02, 2019.
2. WHO. Background for the Consultation on Yellow Fever and International Travel. 2010.
3. Wamala JF, Malimbo M, Okot CL, Atai-Omoruto AD, Tenywa E, Miller JR, et al. Epidemiological and laboratory characterization of a yellow fever outbreak in northern Uganda, October 2010-January 2011. International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases. 2012;16(7):e536-42.
4. Kwagonza L, Masiira B, Kyobe-Bosa H, Kadobera D, Atuheire EB, Lubwama B, et al. Outbreak of yellow fever in central and south-western Uganda, February–may 2016. BMC Infectious Diseases. 2018;18(1):548.