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Dear Reader,

Welcome to the 5th edition, Issue 2 Volume 1 of the Uganda National Institute Public Health (UNIPH) Quarterly Epidemiological Bulletin.

This bulletin aims to inform the district, national, and global stakeholders on the public health interventions, evaluation of surveillance systems and outbreak investigations undertaken in disease prevention and control by Ministry of Health.

In this issue, we present highlights on evaluation of surveillance system in emergence setting, chemical poisoning due to consumption of a dead pig, chemical poisoning in a flower farm and Typhoid misdiagnosis among others. These studies generated evidence and results which will be used to inform planning and interventions in the country and beyond.

For any further information regarding the articles, feel free to contact us at: *jbbaale_musph.ac.ug* **OR** *lkwagonza_musph.ac.ug*

We will appreciate any feedback regarding the content and general outlook of this issue and look forward to hearing from you. We hope this will be both an informative and enjoyable reading for you.

Thank You

Inside this issue:

HIGHLIGHTS

The 2nd National Field Epidemiology Conference:

From left: Gen. Katumba Wamala, Hon. Jane Ruth Aceng, HE. Deborah Malac, Prof. David Serwadda and Assoc. Prof. Rhoda Wanyenze

The 2nd National Field Epidemiology Conference (NFEC) with the theme "Enhancing Global Health Security through the Field Epidemiology Program" took place on 14th November 2016 at the Sheraton Kampala Hotel. The NFEC was combined with the 1st Regional Biosafety Biosecurity Conference .The Guest of Honor was the Minister of Health, Hon. Dr. Jane Ruth Aceng. The 2nd Epidemiology Conference which had over 200 delegates attracted the media, dignitaries from government, academia and international guests.

Invited guests also included the United States Ambassador to Uganda, Hon. Deborah R. Malac and the former Chief of Defense Forces, General Katumba Wamala. In their speeches, both the Guest of Honor and US Ambassador appreciated the Uganda Public Health Fellowship Program (PHFP) – Field Epidemiology Track for its contribution to the response and control of disease outbreaks in Uganda. The environment at the 2nd NFEC gave an indication that the conference has moved to greater heights since it was first implemented in 2015.The presentations by PHFP fellows covered topics on surveillance in areas such as Maternal and Child Health and Cancer. Health Assessments in Refugee Settlements and completed outbreak investigations for Measles, Typhoid, Cholera and others were also presented. The NFEC was informative and full of activity. It is indeed a memorable event!

Highlights from National Tuberculosis and Leprosy Program (NTLP)

Uganda like most of Sub-Saharan Africa is battling the dual Tuberculosis (TB) and HIV/AIDS epidemic. This dual epidemic has resulted in a fourfold increase in the notification numbers of TB cases in the region. Furthermore TB stands as the number one single killer of HIV/AIDS patients.

The clinical presentation of TB among the dually infected persons changed and this has a bearing on the clinical management and design of the public health interventions to effectively respond to the dual epidemic.

On 24 March, 2017, Uganda joined the rest of the World in commemorating the World TB Day; cerebrations were held at Atiri Primary School Playgrounds, Mukuju Sub-county, Tororo District. The Theme was 'Unite to end TB' and the slogan was 'Find the Missing Patients with TB'. All partners pledged to scale up efforts towards finding missing TB patients.

Scaling up of trainings and mentorships for pediatric TB in lower level facilities countrywide was emphasised. This follows documented low capacity among health care workers to diagnose TB in children. Currently NTLP notifies about 7.0% TB among children against the expected 15 – 20% of all TB case notification.

Bravo to Uganda Cancer Institute!!

In November 2016, The Uganda Cancer Institute received autonomy as an institution of the Ministry of Health to oversee and monitor cancer control activities in the country. Given this power and authority, the institute gained momentum and plans to implement the following:

1) Improve access to cancer services in the country by establishing four regional cancer treatment centers in Gulu, Mbarara, Arua and Mbale Regional Referral Hospitals.
2) Improve cancer registration in the country through establishment of population based cancer registries in different parts of the county. The first registry to be established is Mayuge Cancer Registry (MCR) at Kigandalo HC IV which will serve as a model project for all cancer registries.
3) Conduct the International Atomic Energy Impact Assessment. This is planned to be done in April 2017.
4) Organize periodic national cancer conferences to showcase the progress and challenges in cancer control efforts in the country.
5) Establish a fully functional Radiotherapy Unit.
6) Oversee activities of the East African Oncology Center of Excellence funded by African Development Bank.

Uganda Cancer Institute has now become a Regional Centre of Excellence

Continued from page 2

Investigation of Suspected Guinea Worm Outbreak, Isingiro district, 2016

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Background

On 30th May 2016, a suspected case of guinea worm was reported from Nakivale HCIII in Isingiro district. The suspected case was reported to have come from Nakivale refugee settlement in Isingiro district. It was believed that many more cases could be within the community. Two residents of the Uganda Public Health Fellowship Program –Field Epidemiology Track supervised by the Field Coordinator set out to conduct an epidemiological investigation to confirm the outbreak, determine the extent of the outbreak; establish the source and risk factors for transmission. Findings from the study would inform evidence based interventions.

Meeting DHT and Health Facility Staff

The team met the District Health Officer, District Surveillance Focal Person and the Vector Control Officer of Isingiro District and obtained the following information: The initial suspected case, a male, had an incision performed to remove the 'worm' suspected to be in the position of the lesion but no worm was seen; the second suspected case was a female whose worm-like lesion on the foot was noted to shift in position (1-2cm). The Nakivale HC III clinicians corroborated the report by DHO.

The initial suspected case reported to Nakivale HCIII on 30th May. Incision was done but no worm seen. Albendazole was prescribed and administered. The Clinical Officer reported having seen 4 cases within the past 2 months with similar skin lesions mainly on the lower foot. Incisions were done on all 4 cases and no worms seen. All 4 cases did not report other related symptoms.

Case Investigation

We interviewed two suspected cases (adults) and the parent of the third suspected case (9month baby) at Nakivale Refugee Settlement where all the reported cases were. First suspected case: a 21yr old male farmer living in Kabazana village; was not wearing shoes at the time prior to when he developed the skin lesion, now wears gumboots. Prior to the lesion appearing, he experienced a jigger like itch on the lower leg on 25th May which made him scratch the area affected. The 'worm-like' lesion appeared on 27th May and as he continued to scratch the area, the lesion moved in position by about 1-2cm. He had no other symptoms such as diarrhea, nausea and abdominal pain. He visited Nakivale HCIII on 30th May, three days after the appearance of the lesion. The clinical staff made an incision on the affected area and failed to identify any worm. He was given albendazole at the facility, skin lesion dried up 3days after visiting the facility. A scar remains in the area that previously had the lesion.

Skin lesion before treatment

Scar after treatment where skin lesion existed

Second suspected case: a 38yr old female peasant living in Kabazana Village, was not consistently wearing shoes at the time prior to when she developed the skin lesion, itching on the toes of the right leg started about 3 months ago soon after a 'worm-like' lesion appeared on the toes along with an ulcer, the lesion kept migrating from the toes to an area close to the ankle, itching persisted. She had no other symptoms such as nausea, diarrhea and abdominal pain. She made an incision on the lesion but did not see anything. A scar remains in the area that previously had the lesion. Third suspected case: a 9 month old female living in Kankingi village; usually left to sit and play on the bare ground (sandy soils), lesion developed on the buttocks about 2 months ago, itching of the affected area reported. No other symptoms such as nausea, diarrhea and abdominal pain reported. The child was put on albendazole on the day of investigations.

Lesion on buttocks of third case (9 month baby girl)

Possible cause and risk factors

Based on clinical presentation of the third case and description of the first two cases the probable cause was thought to be a soil helminth. A number of dogs and cats, risk factors for the transmission of parasitic worm infestations mentioned above, were seen around the villages of the suspected cases.

Blood samples were obtained from a random sample of 30 persons from the affected villages including the three suspected cases for a full blood count test. The results showed basophilia in 80% of samples, about 50% samples showed lymphocytosis and less than 10% showed eosinophilia.

Stool samples were obtained from the same 30 persons that provided blood in order to identify and confirm the causative agent. The results did not yield any soil helminthes. Additional 20 fresh stool samples that were taken from residents of Nakivale Camp who reported to the health facility all turned out negative for parasites at the reference microbiology laboratories.

Conclusion

Guinea Worm Disease was ruled out. The causative agent was not identified and no further studies were conducted to establish the risk factors. However, from the description of the signs and laboratory results, the following are still probable: Larva currens - More samples need to be taken from those who will be spotted with the lesions still evident. The parasite load in stronyloidiasis is very low and they are very erratic in shedding larva hence very difficult to get in stool; Loa Loa - common in Western Uganda and Congo Border with Bundibugyo - blood needs to be taken and microfilaria looked for inpatients with skin lesions; Cutaneous Larva Migrans – need to take stool samples from dogs and cats from Nakivale Refugee Settlement and look for all parasites known in literature. It could be the first documented case in Uganda since epidemiology does not support it's occurrence.

Strengthening Disease Surveillance in Rhino Camp Refugee Settlement - Arua District, Sept 2016

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Summary: *On 29 August 2016, we visited Rhino Camp Refugee Settlement in Arua District to ascertain capacity for timely detection and response to disease outbreaks and strengthen the surveillance system to ensure early warning and response to epidemic threats. This followed a looming threat of a cholera epidemic due to the sudden influx of refugees from South Sudan who had increased the settlement population by 50%. We interviewed staff from 4 Health Centres serving the Settlement and reviewed facility records. All Health Centres were adequately staffed. Two parallel Surveillance Systems were in place i.e. the National Health Management Information (HMIS) and Health Information (HIS) for United Nations High Commission for Refugees (UNCHR). The latter system was more active than the former despite deficiencies in case definitions and action thresholds. This coupled with lack of knowledge on and use of Integrated Disease Surveillance and Response (IDSR) guidelines, led to skewed data capture, irregular reporting and weak alert system. The District Health Team immediately intervened with training and mentorship of facility staff on case detection and reporting. We recommended training of Facility staff on IDSR implementation and harmonization of guidance on disease surveillance in Rhino Camp Refugee Settlement.*

Introduction: By 28th August 2016 in a period of just one month, over 11,800 refugees from had reached Rhino Camp Refugee Settlement in Arua District following fresh political clashes in neighboring South Sudan. The new arrivals accounted for over 50% increase in the existing refugee population. At least 500 people were received on a daily basis at Ocea Refugee Reception Centre in Rhino Camp, majority of them being women and children. With this influx, there was a high risk of epidemic prone diseases such as cholera etc. due to challenges of inadequate and unsafe water, poor sanitation facilities, overcrowding and lack of shelter. At the time of this influx, cholera outbreaks were confirmed in Pagirinya Refugee Camp in neighboring Adjumani District as well as Nebbi District. Thus there was urgent need for early detection and prompt response to disease outbreaks in Rhino Camp Refugee Settlement. At the invitation of the District Health Officer, we visited Rhino Camp Refugee Settlement on 29 Aug 2016, to ascertain capacity for timely detection and response to disease outbreaks and strengthen the surveillance system to ensure early warning and response to epidemic threats.

Methods: We visited 4 health centers and one refugee reception centre within 3 sub-counties housing the refugee settlement (See map below).
At the Health Centres we interviewed staff including HMIS/surveillance focal persons, nurses, clinicians and laboratory personnel and reviewed records to obtain information on the existing surveillance system. We collected data on the core and support functions of the existing disease surveillance system including availability of human resource, staff training on IDSR, capacity for detection/identification of epidemic prone diseases, case definitions used, data capture and reporting, analysis and interpretation of surveillance data, capacity to investigate and confirm outbreaks, epidemic preparedness and feedback mechanisms.

Findings:

Health Service Availability
All Health Centres are well staffed above the MoH recommended standard. However, majority of the staff are not supported by Government of Uganda.

Health Facility	#Staff	MoH Staffing Norms	Staff Ratio: Gov't : Partner
Siripi HC III	31	19	4:27
Olujobo HC III	30	19	3:27
Odoubu HC II	27	9	1:26
Ocea HC II	27	9	2:25

Surveillance systems in place
Parallel surveillance systems were in place: the National Health Management Information System (HMIS) and Health Information System (HIS) for the UNHCR. These parallel systems provide different data capture, reporting tools and structures with varying timelines and requirements. There were different case definitions and thresholds for alert and action to guide detection and response to outbreaks. The HIS was more active, although deficient in case definitions and action thresholds, leading to skewed data capture and irregular reporting.

Strengths	Gaps
- HMIS tools available - Weekly and monthly reports were compiled & submitted - Some level of data analysis occurred - Feedback mechanisms exist, i.e. CMEs, performance review meetings and support supervision	- Irregular and inconsistent reporting - Staff lacked knowledge on standard case definitions as per Integrated Disease Surveillance (IDSR) guidelines - Weak alert system - Staff lacked knowledge on notifiable diseases and action thresholds - Absence of standard case definition guidelines for use in case patient diagnosis - Lack of case based investigation forms for immediate reporting - Weak laboratory support, referral system for lab specimens

Conclusion: Our review found 2 parallel surveillance systems being used in Rhino Camp Refugee Settlement, non-availability of guidelines on IDSR and lack of training on the same. There were several weaknesses in the core functions of IDSR system.

Public Health Actions
We disseminated our findings to the DHT and partners and immediate actions for improving early detection and response to alerts and outbreaks were agreed upon. We conducted a training of the District Frontline FETP team on IDSR after which they trained health facility staff on prompt case detection and reporting.

Continued from page 4

Strengths and Gaps identified in the existing Surveillance Systems
Mentorship visits to the facilities by the Frontline FETP team were conducted to reinforce the skills passed on in the training. A meeting was planned to strengthen the district coordination role in regard to Implementing Partner activities

Recommendations: We recommend training of health facility staff on IDSR guidelines and implementation. Ministry of Health should urgently work with UNHCR to harmonize guidance on disease surveillance in Rhino Camp Refugee Settlement and other refugee settings. Arua District Local Government should coordinate the activities of the different partners to maximize efficient use of resource.

A Cluster of Deaths due to Consumption of a Dead Pig, Kagadi District, Western Uganda, Nov 2016

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Summary: *On 3 November №02, three mysterious deaths occurred in the same household after consumption of a dead pig for lunch. We investigated this cluster of deaths to identify the cause of death and recommend prevention measures. We defined a suspect case as sudden onset of abdominal pain or vomiting from 1 November 2016 in a resident or visitor of Kisegu village and any one of the following symptoms: diarrhea, headache, body weakness and perceived fever. We identified 8 case-persons all from the same household. The attack rate was 80% and case fatality rate of 38%. The main symptoms included: Abdominal pain (100%), body weakness (75%) headache (50%), vomiting (25%), and (48%) diarrhea (50%) among others. All 8 cases shared a meal of meat from the dead pig and the first deaths occurred within 48 hours. The toxicology testing from the remains of the pig intestines showed traces of carbaryl and chlorfenvinphos. This cluster of deaths was caused by consumption of a dead pig intoxicated with a carbamate and organophosphate. We recommended stricter control of pesticides in the district and countrywide.*

Introduction: On 7th /11/2016, Ministry of Health through EOC received an alert from the surveillance focal person of Kagadi District of two mysterious deaths from the same family. The family had butchered and feasted on a dead pig one day before symptom onset in the index and fatal case. The two brothers and their mother (fatal cases) had complained of severe abdominal pain, diarrhea, headache, general body pain, weakness and vomiting. Three other family members developed similar symptoms on 8th November 2016 except vomiting.

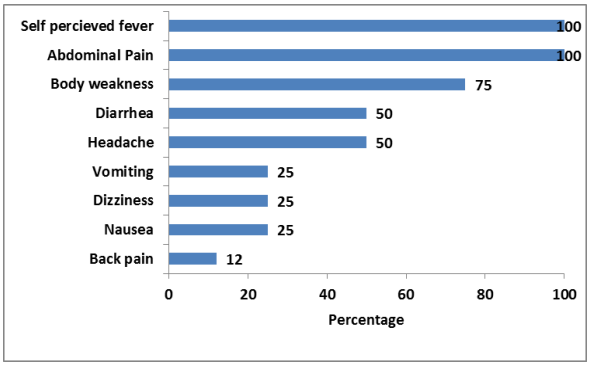
Five samples from the isolated suspects tested PCR Negative for Viral hemorrhagic fevers. Based on the above information; a team comprising of MoH (ESD, CPHL and PHFP), WHO, CDC and Kagadi DHT set out to conduct an epidemiologic investigation to identify the cause, mode of transmission and recommend control measures for this outbreak.

Methods: Kagadi District is located in mid-western Uganda. We defined a suspected Case as sudden onset of abdominal pain or vomiting from 1 November 2016 in a resident or visitor of Kisegu village and any one of the following symptoms: diarrhea, headache, body weakness and perceived fever. The team visited the hospital where the survivors were admitted, the affected village and health facilities which managed the affected persons. We interviewed the survivors, persons at the home where the death occurred and village residents with vital information on the meat consumed by the case persons.
The team reviewed records in the health facilities and line listed the cases. We held discussions with the village local leaders and village health teams in search of other cases and exhumed the pig's intestines. Soil samples from the spot where the pig was slaughtered and underneath the spot where the intestines were buried were submitted to Government analytical research laboratory for toxicology investigations. The team also searched for evidence of pesticides, in and around the home including their farmland and neighborhood. An assessment of the general wellbeing of the other pigs in the household and in the neighborhood was also done.

Results: Person distribution
A total of 8 cases from the same household with 3 deaths were identified, Case Fatality Rate = 37% (3/8). Apparently all the 10 household members consumed the pork though 8 were affected, attack rate 80% (8/10). Among females, the attack rate was 100%, while among males it was 75%.

Distribution of symptoms
All the case patients presented with abdominal pain and self-perceived fever. However, no fever was documented in any of the survivors on admission to hospital.

Figure 1.0 Distribution of symptoms

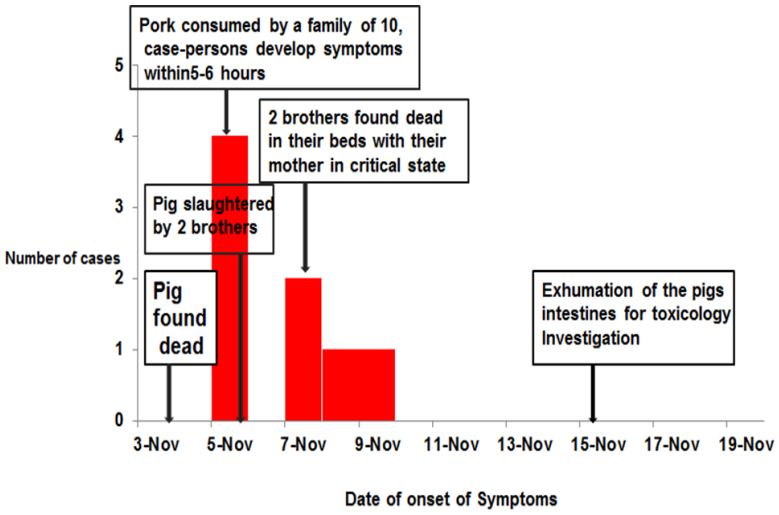


Timeline of events: The suspected pig died on 3rd and was slaughtered by the deceased brothers (26 yrs and 12 yrs) and roasted a pig on 4th November 2016. They roasted and ate the liver/lungs of the pig. A neighbor (actual owner of the pig) noted that the liver/lungs were "black" and the meat looked funny, hence declined taking a share of the meat. On 5th November 2016, with the help of their mother, the brothers completed the process of roasting and preparation of the meat for the family lunch. Nine of the family members consumed the pork for lunch between 12-2pm.

Continues to page 10

The 10th family member missed lunch as he was not available at the time of serving; however he ate his share in the evening. He later felt abdominal discomfort also fell ill. By dinner time (5-6 hours later), the two deceased brothers, their father and mother had started feeling unwell with abdominal pain, vomiting followed by diarrhea through 7th Nov 2016. They were discovered dead in their beds by their younger brother about 6am on Monday 8th Nov 2016. Their mother was found delirious by that time. The 3rd victim (mother) was admitted in a comatose state at a nearby clinic.

The epidemic curve showing onset of symptoms



Environmental Assessment: The family reported no use of pesticides and there was no evidence of use of such products in the household. However, a nine year old boy reported having seen the family members use unknown rat poison in the recent past.

Laboratory findings: Five samples from the isolated suspects tested PCR Negative VHFs, Anthrax, the toxicology report indicated presence of 0.0867 ppm Carbaryl and 0.1097ppm Chlorfenvinphos.

Discussion: This cluster of deaths was due to unintentional chemical poisoning from consumption of a dead pig contaminated with carbonates and organophosphates. The sudden deaths of the two brothers, their mother and symptom onset from the family members clearly demonstrate a dose response relationship. The two brothers who died had a high exposure from slaughtering, and roasting and preparing the lunch meal as well as consumed the liver which we highly suspect to be toxic. They went ahead to have lunch thereby increasing on the exposure amounts. Usually, the household takes a bigger share of the plate compared to other members of the household and in addition he ate some liver.

Discussion: This could explain why the four case–persons just described developed symptoms on the same day at different hours (first the 2 brothers, followed by their mother and then their father in that order). In addition to this, the 9 year old boy who reportedly declined to eat the meat and the 3 year old who ate very little meat apparently did not develop any sign or symptom as exhibited by the rest of the household members. Exposure to organophosphate or carbonates can occur through inhalation, skin contact, or ingestion. When this occurs, inhibition of Acetyl cholinesterase takes place resulting in disruption of the activities of the Central Nervous System at Neuromuscular junctions. This leads to accumulation of Acetyl choline hence overstimulation of muscles (Chaudhry, 1988).

Conclusion: This was a localised cluster of deaths was due to unintentional chemical poisoning from consumption of a dead pig contaminated with carbamates and organophosphates. All the affected people ate the pork and developed symptoms and signs consistent with organophosphate and carbamate poisoning soon afterwards.

Recommendations: We recommended stricter control of pesticides in the district and countrywide. We also recommended training of the District Health Teams on the importance of collecting adequate samples from the deceased for further investigations. The district Health officials should sensitize people about the importance of seeking early treatment in the event of unusual signs and symptoms appear to an individual.

Reference

1. Chaudhry, R., et al.,. (1988). A foodborne outbreak of organophosphate poisoning. . *BMJ, #º3(3º1#): p. №4-9.*

HIV prophylactic treatment of HIV positive mothers and risk of infants' HIV positivity

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Summary: *The Early Infant Diagnosis (EID) program of the Uganda Ministry of Health is mandated to diagnose HIV in infants and children at the earliest possible opportunity, usually at 6 weeks from birth. Diagnosis of HIV in infants and mothers is followed by prompt ART initiation under the policy of Elimination of Mother to Child Transmission (eMTCT) of HIV. We analyzed EID -data from the national database at the Central Public health Laboratories (CPHL) from Jan – Dec 2015. Infant positivity rates were higher earlier in the year at 5.5% and declined progressively to 4% by December. . The highest positivity rates were in East Central (7%) and Mid-Eastern (8%) regions while other regions ranged from 4% to 5%. A total of 65,233 infants were tested for HIV by PCR1 between January and December 2015, of which 3,121 (4.78%) were positive. Risk factors for HIV positivity in exposed infants were lack of maternal ARV use, breastfeeding infant whose mother is ARV naive, and lack of ARV prophylaxis for the infant. As the EID program expands, more infants and mothers should be tested followed by prompt ART initiation*

Continues on page 7

Continued from page 6

Introduction: A pregnant woman who is HIV positive can transmit the virus to the baby during pregnancy, labour, birth, and breastfeeding; the likelihood ranging from 15% to 45% without antiretroviral treatment and highest in breastfeeding situations [1, 2]. Most mother to child transmission of HIV-1 is believed to occur in the third trimester of pregnancy, during labor and delivery (3,4). Postnatal transmission of HIV through breastfeeding is thought to cause about one-third to one-half of HIV-1 infections in children worldwide (5,6). Measures must be taken to prevent HIV transmission. However, antiretroviral treatment, elective caesarian delivery, and other effective eMTCT interventions can reduce this risk to below 5% (7)

In Uganda the Ministry of Health has made efforts to improve the health of mothers and their infants by strengthening laboratory diagnosis of HIV. The laboratory method employs PCR of viral RNA from dried blood spot samples (8). Diagnosis is followed by prompt initiation of anti-retroviral prophylaxis or treatment under the Early Infant Diagnosis (EID) program initiated in 2006.We described the epidemiologic characteristics of infants under the EID program, assessed the risk factors for infant positivity rate and made recommendations for future improvements in EID services.

Method: We obtained data from the central EID database at CPHL. Infant variables included location (residence), age, sex, specimen collection date, specimen testing date, ARV prophylaxis/treatment status for mother and child, breastfeeding status of child, and infant HIV test results. Positivity rates and risk factors for the positivity were calculated. Risk factors were obtained using logistic regression.

Results: 65,233 infants were tested for HIV by PCR1 between January and December 2015, of which 3,121 (4.78%) were positive.

Table 1: Profile of infants tested for HIV for the first time by PCR1, Uganda, 2015

Result	Frequency	Percent
Negative	62,078	95.16
Positive	3,121	4.78
Invalid	30	0.05
Samples rejected	4	0.01
Total	65,233	100

Positivity rates varied between 4 and 5.5% and rates are lower towards the end of the year. (Specimens varied from 8,000 to 10,000 per month, each specimen represents a child).

Figure1: Percentage Monthly HIV Positivity rates by PCR1 .

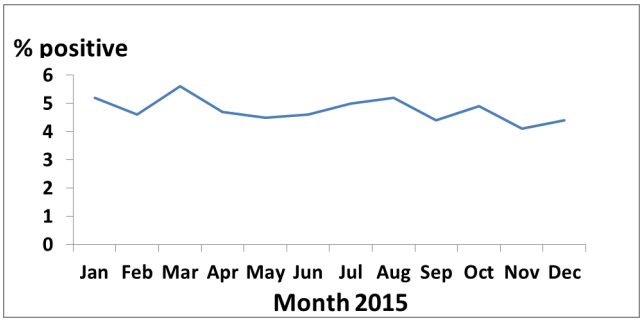
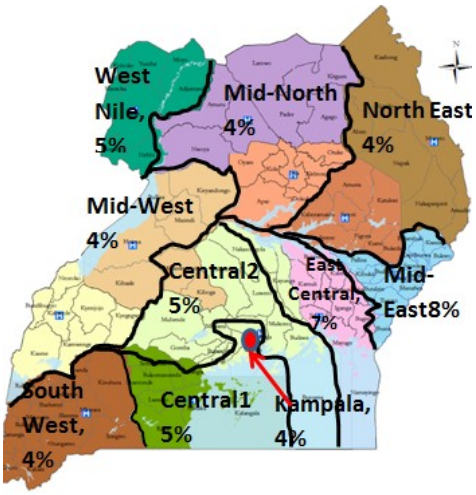


Figure 2: Infant HIV positivity rates by region;



Variable	HIV+ child (n)	HIV- child (n)	AOR*	95% CI Lower	95% CI Upper
Mother not on ART life long	420	2,358	6.58	5.81	7.44
Infant not on ART	428	2,399	6.18	5.46	6.99
No daily Nevirapine	869	6,031	7.62	6.89	8.44
Breastfed infant	1,236	24,140	2.71	2.39	3.09

**AOR = adjusted odds ratio.*

At antenatal, the odds of HIV transmission from ARV naïve mothers (during pregnancy) to their infants is 7.0(AOR = 6.58 and 95% CI 5.81 -7.44). At delivery, the odds of HIV transmission from ARV naïve mothers to their infants is 6 (AOR = 6.18 and 95% CI 5.46-6.99). An infant ARV naïve is up to 8 times more likely to get HIV infection from the mother (AOR 7.62, 95% CI = 6.89-8.44).Where the mother is ARV naïve, an infant is up to 3 times as likely to get HIV infection from breast milk, (AOR =2.71, 95% CI 2.39-3.09). Lack of ARV use mean the HIV positive person was not initiated on ARV for various reasons.

Discussion and conclusions

The EID indices analyzed vary in time, place and person in ways that provide opportunities for intervention to treat, prevent, or control HIV. HIV positivity rates dropped towards the end of the year. This could be due to intensification of the eMTCT campaign in which more mothers may have started lifelong ART (Option B+) towards the end of the year and reducing the mother to child transmission of HIV. The Eastern registered higher HIV positivity rates (Figure 1) and this calls for increased interventions to control HIV spread in mothers through whom the children acquire the infection perinatally. Identifiable risk factors for HIV positivity in exposed infants were lack of maternal ARV use, the breastfeeding infant whose mother is ARV naive, and lack of ARV prophylaxis for the infant. Lack of life-long ART use by HIV positive mothers promotes HIV transmission to infants during pregnancy, birth & breastfeeding. Infants and mothers should be tested followed by prompt ART initiation if HIV positive.

References

Bulterys, M., et al., *Advances in the prevention of mother-to-child HIV-1 transmission: current issues, future challenges.* AID Science, 2002. 2(4).

Continued from Page 7

A False Reported Typhoid Outbreak due to Inadequacies in Typhoid Surveillance

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Summary: *The Health Management Information System reported 1549 cases of typhoid fever in 2015 and 1743 in 2016 in Nakaseke District. The Uganda Ministry of Health has provided surveillance case definitions on typhoid fever to districts; however, adherence is unknown. We investigated to confirm presence of an outbreak and evaluated adherence to the surveillance guidelines. . We extracted patient medical records to assess adherence to surveillance guidelines, especially in regard to standard surveillance case definitions, and to identify any cases of perforations. We also examined freshly admitted typhoid in-patients and reviewed laboratory and data collection procedures. We collected blood specimens from 5 freshly diagnosed typhoid patients for culture confirmation. Nakaseke District reported 560 typhoid cases during January to June 2016, compared to 291 reported cases during the same time -period in 2015. Of the admitted patients reviewed, 28% (5/18) met the surveillance case definition. Of the 1025 records reviewed in 2016, 81% (829/1025) of diagnoses were clinical only, and 19% (192/1025) had a positive Widal test as the supporting laboratory evidence. All 5 samples from the freshly diagnosed patients cultured negative for typhoid at the reference laboratory. No cases of perforations were identified in area hospitals during the time periods under review. In conclusion, there was no evidence of typhoid outbreak in the district. The increase in reported typhoid cases was likely due to inadequate use of standard surveillance case definitions and use of unreliable laboratory diagnostic tests. We recommend enforcing the use of surveillance case definitions for typhoid reporting, and developing laboratory capacity for typhoid diagnosis.*

Introduction: In 2000,the WHO estimated about 21 million cases of typhoid cases and 210,0000 deaths [1]. These infections are highest in developing countries mainly due to poor sanitation. The burden of typhoid in sub-Saharan Africa has not been well described given the poor surveillance systems in the region; however population based studies have estimated typhoid incidence to range from 13-845 cases per 100,000 populations [2, 3]. However a recent systematic analysis reported 11·9 million (95% CI 9·9–14·7) new cases and 129 000 (75 000–208 000) deaths in 2010 [4]

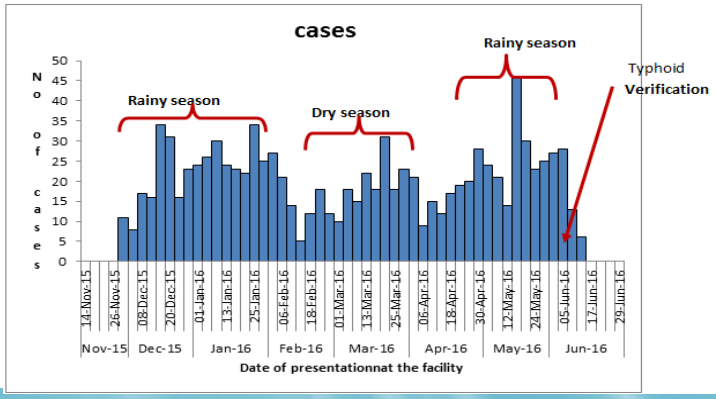
Typhoid is a systematic infection transmitted via the oral faecal route; it has an average incubation period of 8-14days [5]. The clinical presentation varies from a mild illness with low-grade fever, malaise, slight dry cough to a severe clinical picture with abdominal discomfort and multiple complications. Typhoid case -fatality rate is estimated at 1% with prompt, appropriate antimicrobial therapy but approaches 30%–40% after intestinal perforation (IP) which may occur in 1%–3% of hospitalized patients [5]. Clinically, typhoid fever resembles other febrile illnesses (eg, malaria) and thus the need for laboratory confirmation[6].The gold standard diagnostic test is bone marrow culture [7] however, routine bone marrow aspirates are not feasible in many settings. Therefore, the second test that is recommended is blood culture[5]. Most of the countries in developing countries lack the laboratory capacity to confirm typhoid. This is likely to result into misdiagnosis, under diagnosis or over diagnosis. Data from the Health Management Information System .(HMIS) shows a steady increase in typhoid cases from 3,470 in 2012 to 100,869 in 2015 but it is unclear whether all these are true cases or not.

On 11th June 2016, Ministry of Health was notified of a suspected typhoid outbreak in Nakaseke district. This followed analysis of surveillance data from 12 health facilities where 342 new cases were reported for week 15-21. Likewise analysis of district records in the MOH weekly surveillance system for week 18,19,20,21 estimated about 134 typhoid cases per 50,000 which is above the recommended community threshold (20 /50,000 persons)[8]. A similar threat was reported in the district in 2015, and it was found to be a false alarm[9]. We investigated these claims to confirm presence of outbreak and evaluate adherence to standard case definition guidelines.

Methods: We conducted this study in Nakaseke district between the 14th and 18th June 2016, in four health facilities which were selected purposively based on patient load and coverage. These included the two hospitals (Kiwoko and Nakaseke), Semuto HC IV and Kapeeka HC (III). We extracted medical records of all patients who had a diagnosis of typhoid/enteric fever from 1st December 2015 to 14th June 2016 from OPD, IPD and laboratory registers. We reviewed laboratory testing procedures and use of protocol guidelines. Blood samples were drawn from case-patients who had high positive Widal test for surface antigen O (>1:160) for culture and sensitivity tests. The team also examined case-patients who were sent to the laboratory for typhoid screening and those who were currently admitted on the ward with a typhoid diagnosis. We defined a **suspected case** as a resident of Nakaseke district with history of fever (38°C and above) that had lasted more than three days, tested negative for malaria and had at least one of the following symptoms: chills, malaise, headache, sore throat, cough, abdominal pain, constipation, diarrhea; a **probable case** as a patient with fever (38°C and above) that had lasted for at least three days, with a positive serodiagnosis or antigen detection test (Widal test); and a **confirmed case** as a suspected case confirmed by isolation of salmonella typhi from blood or stool by culture.

Results: Of the 1025 case patients records extracted from the registers, 1007(98.2%) were outpatients, 829(81.2%) were clinically diagnosed. Of the18 patients admitted with typhoid diagnosis 5/18(27.8%) records adhered to the surveillance case definitions. More people were diagnosed with typhoid during the rainy season compared to the dry season as shown in figure 1 below.

Figure 1: Epicurve of typhoid patients , Dec 2015—Jun 2016



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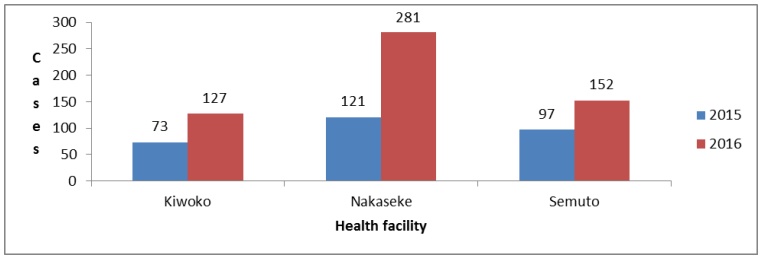
A similar typhoid verification exercise was conducted in the district in May 2015, and records for the period Jan –April 2015 were reviewed for three health facilities (Kiwoko, Nakaseke and Semuto). The number of people diagnosed with typhoid in the three health facilities in 2016 was twice that reported in 2015.

Figure 2: Comparison of suspected typhoid cases between two time periods: Jan –April (2015 and 2016)



Blood Culture: All five samples taken to the Central Public Health Laboratory for culture and sensitivity were negative for salmonella typhi. At the district level, none of the hospitals were sufficiently equipped to confirm typhoid by culture.

Discussion

Although Nakaseke district reported typhoid cases in the Health Management Information system (HMIS), none of these cases reported in the weekly epidemiological bulletin had been confirmed using the recommended diagnostic test (blood culture), diagnosis was based on clinical symptoms. In the hospitals, the clinicians used both clinical symptoms and high surface O antigen titers (>1:160) to make a diagnosis of typhoid however, the presence of clinical symptoms characteristic of typhoid fever or the detection of a specific antibody response may only be suggestive of typhoid fever but not definitive[5]. Therefore, there was insufficient evidence to confirm the presence of an outbreak in this district. One of the key challenges the district faces is inability to confirm the presence of salmonella typhi using culture as none of the facilities had the capacity to do so.

The Ministry of Health has instituted a hub system that facilitates transportation of blood samples from the peripheral centers to the Central Public Health Laboratory. However, this system does not favor appropriate transportation of samples for culture and sensitivity since samples from facilities are picked on designated days, yet samples for culture should be fresh and transported to the reference lab as fast as possible in a recommended transport media and temperature.

Conclusion and Recommendations: In conclusion, there was no evidence of typhoid outbreak in the district. The increase in reported typhoid cases was likely due to inadequate use of standard surveillance case definitions and use of unreliable laboratory diagnostic tests. We recommend enforcing the use of surveillance case definitions for typhoid reporting, and developing laboratory capacity for typhoid diagnosis we recommend training of clinicians in typhoid surveillance and strengthening the district laboratories to perform culture.

References

John A Crump, S.P.L., Eric D. Mintz, *The global burden or typhoid fever.* Bulletin of World Health Organization, 2004. **82**: p. 346-353.

Breiman, R.F., et al., *Population-Based Incidence of Typhoid Fever in an Urban Informal Settlement and a Rural Area in Kenya: Implications for Typhoid Vaccine Use in Africa.* PLoS ONE, 2012. 7(1): p. e29119.

Outbreak of metam sodium poisoning at a flower farm: Central Uganda, October 2016

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Summary: *In October, 2016, an out of a mysterious disease, presenting with fainting and vomiting, affected 80 workers at flower farm X in Central Uganda. We investigated to identify the disease's nature and recommend evidence-based prevention measures. We defined a probable case as sudden onset in a flower farm X worker of ≥1 of the following in October: shortness of breath, dizziness, fainting, vomiting. We identified cases through record review and in-person interviews. We conducted a retrospective cohort study to compare risks between 197 workers working in Green House 7 (GH7, suspected exposure place) and 403 workers not working at GH7 during the outbreak days.*

Cases increased sharply and peaked on 14 October, and gradually declined but remained high until 20 October. During 14-20 October, 56% (110/197) of workers working at GH7 compared with 13% (54/403) of workers working elsewhere developed a case (RR=4.2; 95%CI=3.2-5.5). The soil in GH7 was reportedly fumigated the night of 13 October by mixing metam sodium with soil and covering the ground with plastic sheeting afterwards. However, in violation of protocol, workers poorly covered the ground, potentially allowing metam sodium fumes to escape into GH7 for several days; also, no post-fumigation checking was done. No workers wore masks while working because masks were not provided. In conclusion, this outbreak was caused by inhalation of metam sodium fumes, which escaped from the soil due to protocol violation. We recommended training employees on strict adherence to protocol, and providing masks to workers and enforcing their use.

Introduction: On 25 October 2016, a mysterious disease outbreak, presenting with symptoms of vomiting, sudden onset of diarrhea and fainting reportedly affected 80 workers at a flower farm in Nsangi sub-county, Wakiso District in Central Uganda. Reports indicated that the affected workers entered a greenhouse which had been recently fumigated and the chemical used was metam sodium (sodium N-Methyldithiocarbamate), a non-selective soil fumigant commonly used in flower farms. Metam sodium is in liquid form and one of the major hazards associated with its use is that it has a degradation product called Methyl isothiocyanate (MITC) which turns into a gas. MITC may cause a chemically induced asthma-like condition known as reactive airways dysfunction syndrome [1]. We conducted investigation to identify cause, determine the magnitude of the problem, establish the source of the outbreak and recommend evidence-based prevention measures for future outbreaks.

Methods: We defined a **suspected case** as sudden onset in a flower farm worker of ≥1 of the following in October

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Continued from page 9

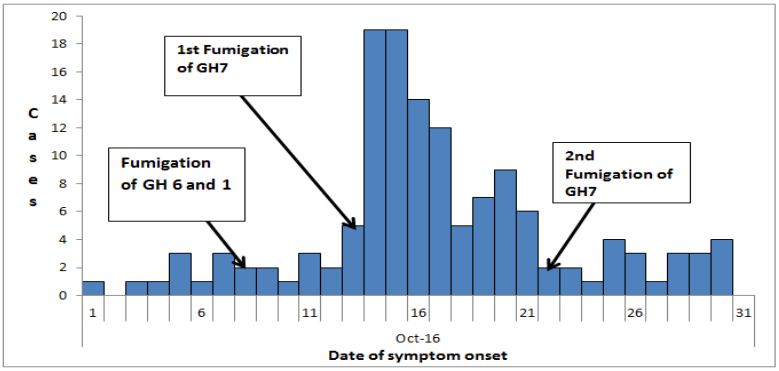
Shortness of breath, dizziness, fainting, vomiting, headache, itching eyes, itching throat, itching nose, wheezing, diarrhea; and a **probable case** as sudden onset in a flower farm worker of ≥1 of the following in October 2016: Shortness of breath, dizziness, fainting, vomiting. We reviewed medical records and actively searched for cases using face-to-face interviews. We conducted a retrospective cohort study to compare risks between exposed and non-exposed workers which included flower pickers, packers and supervisors. The exposed category worked at Greenhouse No 7 during the exposure period (10th to 23rd October, 2016); meanwhile the non-exposed controls did not. An assessment of the fumigation store and procedures was also done.

Results

Attack rates were 41% among sprayers, 34% among pickers and 30.8% among growing support ladies workers. Of the 9 greenhouses, 58% (81/139) of the case persons reported having worked in Greenhouse 7 (GH7) in October 2016.

The epicurve suggests continuous common source exposure. Cases with features suggestive of poisoning started on the 14th October, a day after GH7 was fumigated and peaked around 14th and 15th October but steadily reduced.

Figure I: Distribution of cases by time



Retrospective cohort study findings

During 14-20 October, 56% (110/197) of workers working at GH7 compared with 13% (54/403) of workers working elsewhere developed a case (RR=4.2; 95%CI=3.2-5.5). Further investigations revealed that, the ground was poorly covered with plastic sheeting after the fumigation process thus allowing the gaseous fumes of metam sodium to escape into the air overnight and for several additional days inside GH7. In addition, it was also likely that post fumigation double checking was not well done.

Risk of developing symptoms by date worked in GH7*

Workday	Time fumigation Time	% Exposed	% Non-exposed	Risk Ratio (95% CI)
14-10-6	14	70%	11%	6.3(2.9-13.8)
15-10-16	34	54%	8.8%	6.1(2.5-14.9)
16-10-16	58	57%	17%	3.4(1.8-6.4)
17–10-16	82	44%	12%	3.6(1.5-9.0)
18t-10-16	106	64%	15%	4.4(2.1-8.9)
19-10-16	130	36%	15%	2.4(1.0-6.0)
20-10-16	154	43%	15%	2.6(1.0-8.1)

The higher the total scores for symptom severity, the more severe symptoms the case persons experienced. All (100%) who were in the highest category of total scores (6-10) based on symptom severity were exposed to GH7. Three of the 4 case persons who got the full total score of 10 were from team 12, a working team which was exposed to GH7 less than 24 hours after fumigation. Overall, the findings from the investigation revealed that there was a strong association between developing symptoms of poisoning and being exposed to GH7 as shown in the table below.

Conclusions: The likely source of the outbreak was inhalation of metam sodium fumes, which escaped from the soil due to protocol violation. The violated protocol was not following the SOPs of carefully sealing off the ground with plastic sheeting after fumigation. Also, there was no evidence to show that the post fumigation double checking was well conducted. Finally, none of the case persons had nasal or mouth protection as part of Personal Protective Equipment. The public health actions taken include: Presentation of the findings at the National Task Force; and generation of a policy brief to inform policy decisions. The recommendations to the Farm Management was amending Standard Operating Procedures (SOPs) to provide more detailed guidance on pre, actual and post fumigation protocols and identify forms of nasal and mouth protection for the pickers of flower cuttings for example masks.

Total scores (Symptom severity) N=65	Percentage exposed to GH7	Percentage non-exposed to GH7
1-5	80(43/54)	21(11/54)
6-10	100(11/11)	0

References

1. Agency, C.E.P., *Metam Sodium (Sodium N-Methyldithiocarbamate) RISK CHARACTERIZATION DOCUMENT Available at: http://www.cdpr.ca.gov/docs/risk/rcd/metam.pdf* 2004.
2. Pruett, S.B., L.P. Myers, and D.E. Keil, *Toxicology of metam sodium.* J Toxicol Environ Health B Crit Rev, 6445 8 (2): p. 207-22.
3. Rosemarie Bowler, G.A.a.D.S., James E. Cone, Lee Wugski, John R. Balmes, Rupali Das,, *Persistent Respiratory Health Effects After a Metam Sodium Pesticide Spill Available at: http://chestjournal.chestpubs.org/content/106/2/500*Chest, 5338.
4. Organization, W.H., *Sound Management of Pesticides and Diagnosis and Treatment of Pesticide Poisoning Available at: http://www.who.int/whopes/recommendations/IPCSPesticide_ok.pdf*. 2006.
5. Program, C.D.o.H.S.E.E.a.T., *Acute Heal th Effect s of the Cantara Metam Sodium Spill Available at: http://ehib.org/cehtp/cehtp.org/papers/Acute%20health%20effects%20of%20Cantara%20metam%20sodium%20spill%201992.pdf* 1992.

A measles outbreak propagated by children congregating at water collection points: Mayuge District, Uganda, October, 2016

Majwala Robert Kaos[1]*, Nakiire Lydia[1], Kadobera Daniel[1]

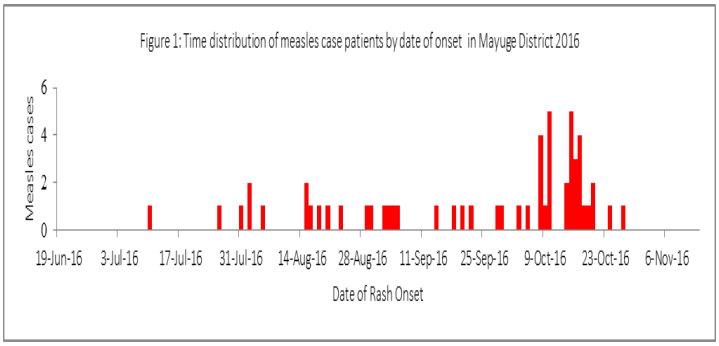
Summary: *On 12 October, 2016 a measles outbreak was reported in Mayuge district. We investigated the outbreak to determine its extent, risk factors, evaluate vaccination coverage and vaccine effectiveness, and recommend evidence-based control measures. Probable case was onset of fever (≥3 days) and generalized rash, plus ≥1 of the following: conjunctivitis, cough, runny nose in a resident of Mayuge. A confirmed case was a probable case with measles-specific IgM (+). We found cases by reviewing medical records and active community case-finding. A matched case-control was conducted to evaluated risk factors for transmission . We estimated vaccine effectiveness (VE) using the formula: VE≈100 (1-$OR_{protective}$) and calculated vaccination coverage using the percent of controls vaccinated. 62 probable cases were identified (attack rate [AR] = 4.0/10,000. Children <5 years (AR=14/10,000) were the most affected. 32% (13/41) of case-persons and 13% (21/161) of control-persons went to water-collection sites (by themselves or with parents) during the case-patients' likely exposure period (OR_{M-H}=5.0; 95% CI=1.5–17). Among those aged 9 – 59 months, the effectiveness of the single-dose measles vaccine was 69% (95% CI=25-88); vaccination coverage was 68% (95% CI=61-76). Exposures at water-collection sites might have contributed to propagation of this outbreak. Low vaccine effectiveness and vaccination coverage facilitated measles transmission. We recommended intensifying measles vaccination, advised residents with fever and rash to avoid going public gatherings including water-collection sites, and introducing a two-dose measles vaccine in routine vaccination schedule.*

Introduction: Measles is one of the top five causes of vaccine preventable morbidity and mortality in the world [1] despite the availability of a safe and effective vaccine. Measles is an epidemic prone disease that has been targeted for eradication [2]. Measles surveillance is part of the National Integrated Disease Surveillance and Response System, requiring immediate notification whenever measles is suspected [2] [3] . On 12 October, 2016, 3/10 samples from suspected measles case patients from Mayuge District tested positive for measles IgM antibodies. We investigated this outbreak to determine the extent, risk factors, vaccine effectiveness and coverage, and recommend evidence based control measures.

Methods: A Probable measles case-patient was someone presenting with fever of ≥3 *days* with a generalized muculopapular rash *plus* ≥1 of conjunctivitis, cough or running nose between 19th June and 17th November, 2016. A confirmed case was a probable case-patient with measles IgM (+). We reviewed health facility records and searched case-patients in the community, laboratory confirmation was done using WHO procedures [4]. Case control investigation involving participants from Kityerera and Malongo Sub-counties using face to face interviews with investigator administered questionnaires was conducted. One case-patient per household was interviewed, households with more than one case-patient; the first to develop a measles rash was interviewed. After interviewing a case-patient, 4 asymptomatic controls, matched by village and age were randomly selected and interviewed. District population estimates were extrapolated from the 2014 Uganda National Population census [5]. Vaccination coverage was computed from the vaccination coverage among controls and compared with district administrative coverage for a 3 year period (2014 – 2016). Monthly measles data elements for period (2014 – 2016) were downloaded from DHIS 2,cumulative measles monthly coverage was computed and compared against monthly targets using Mayuge District population estimates obtained from Uganda National Population Census report 2016 [5]. We estimated Vaccine effectiveness (VE) for children ≤ 59 months using formula ; VE= 1-RR where Relative Risk (RR) approximates to Odds Ratio (OR) in rare diseases, hence VE = 1 – OR.

Findings: We found 62 case patients; Attack rate [AR] = 1.3 per 10,000. The most affected age groups were 0 – 11 months (AR = 13/10,000) and 12 – 59 months (AR = 15/10,000). Males had AR = 4.3/10,000 while females had AR = 3.9/10,000. Two sub counties were affected by this measles outbreak, Kityerera AR = 4.1/10,000 and Malongo AR = 4.0/10,000. The most affected parish was Bumwena with AR = 79/10,000 followed by Kityerera with AR = 13/100,000.

The epidemic curve (Figure 1) indicated features of person to person transmission. The index case patient in this outbreak had a rash onset date of 10th July, 2016 and the last case patient had rash onset date of 27th October; hence this measles outbreak lasted 110 days. During interviews it was also found out that on 9th August, 2016 a lady travelled from a family that had recorded two measles case-patients of measles in Bumwena parish, Malongo sub-county to Kityerera Parish, Kityerera sub-county with two children aged 24 and 36 months, both non-vaccinated. After 7 days (16th August, 2016) the 36 months old baby developed a measles rash, and 11 days later (20th August, 2016) the younger sibling also developed a measles rash. A 9 year old child with whom they shared a homestead developed a measles rash on 23rd August, 2016 and was taken to the grandmother's place for care. The homestead where the grandmother stayed had 4 homes. This led to local transmission to 18 other children, with 83% of these aged between 0-59 months



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About 39% (12/31) case patients' aged 9 – 59 months were measles vaccine compared to 68% (82/121) controls of the same age group (odds ratio (OR_{MH}), 0.31; 95% confidence interval (CI), 0.12 – 0.75). We found out that in this community, mothers of infants less than 6 months do not usually fetch water. Mothers of infants aged between 6 months to two years tend to carry their babies along as they go to fetch water from water collection points. Children above 2 years escort their mothers, guardians or other siblings as they go to fetch water, often carrying age appropriate water collection vessels. We found that among children aged 6 – 59 months; approximately 32% (10/31) of case patients went to water collection points either alone, with their parents/guardians or with other children compared to 13% (16/121) of controls; OR_{MH} 5.0; 95% CI = 1.5-17.

The Vaccine Effectiveness for children aged 9 – 59 months was 69%; 95% CI: (25 – 88). The vaccination coverage using controls from the case control investigation was 68% (95% CI: 61 – 76). In 2014 administrative measles vaccination coverage in the district was 86%, 75% in 2015 and by end of September 2016 vaccination coverage was 52%; against a cumulative target of 75%. By extrapolation, if no catch up vaccination had been implemented, by December 2016 vaccination coverage would have been 69%.

Discussion: Our investigation documents a propagated community measles outbreak that lasted 110 days with 62 case-patients, we were unable to identify the primary case-patient however the index case-patient was in Bumwena Parish, Malongo sub-county.. It appears the index case patient transmitted the measles virus to the two other subsequent case patients since all of them developed disease within the incubation period for measles.

Similarly it appears two 2 children had exposure to measles from the household where they were staying in Bumwena Parish since this household had already recorded two measles case patients. Since the 36 month's old child developed a measles rash 7 days after leaving the measles affected family in Bumwena Parish, it appears he had exposure in Bumwena. However, the 24 month's old child could have contracted the measles from his older sibling through person to person contact since they were staying in the same household or from Bumwena parish since the onset of the measles rash was 18 days from the time they left the measles affected family in Bumwena parish. Measles transmission is through person to person, where a susceptible individual gets into contact with an infected individual, this may have been the case with the two siblings who had been staying in a measles affected family prior to moving to Kityerera Sub-county, additionally the 9 year old child who also got measles after staying in the same homestead with a measles case in Kityerera also supports this theory [6].

Vaccination coverage among controls in our investigation was estimated at 68%. This was nearly the same as the extrapolated administrative measles coverage of 69%. Low coverage creates a pool of susceptible individuals in the population, these susceptible individuals have been shown to cause outbreaks in populations with low measles vaccine coverage [7]. The coverage of 69% is far less than the 97% coverage that prevents measles outbreaks [8].

Vaccine effectiveness in our investigation was 75%. This was lower than the observed 85 – 94% in other settings studies for one dose measles vaccination [9]. Several factors affect vaccine effectiveness including age at vaccination, vaccine handling techniques, and quality of the cold chain. Our investigation did not access these factors. A single measles vaccine administered at 12 months increases the vaccination effectiveness to about 92% compared to 85% when the measles vaccine is given at 9 months [9]. A two dose measles vaccine with one given at 9 and the other at about 12 months has been shown to increase vaccine effectiveness to over 94% [9].

Our investigation further revealed that children congregating at water collection points were 5 times more likely to get measles than those who never went to collect water. When children get to water collection points, there is mixing between those with measles rash and health ones. Our findings are in agreement with studies done in The Republic the Marshall Islands and China that showed that congregate setting are associated with measles transmission [10] [11].

Conclusion: It appears exposures to infectious patients at water collection points propagated this measles outbreak. Low vaccination coverage coupled with low vaccine effectiveness facilitated community transmission of measles in Mayuge District.

Recommendations: We recommended supplementary measles vaccination for group of 0 – 59 months, introduction of a second measles vaccine, advised the community leaders and parents to discourage sick children from going to water collection points.

Public health actions: The district implemented daily vaccination at all health facilities, extra community outreaches and mobile vaccination teams were established and implemented under the 'periodic Intensified Immunizations (PIRI)' project. Sensitization of residents to avoid public gatherings when they develop fever or fever and rash was also carried out.

References

1. CDC: **Vaccine preventable deaths and the Global Immunization Vision and Strategy, 2006-2015.** *MMWR* 2006, 15(18):511-515.
2. Uganda MoH: **National Technical Guidelines for Integrated Disease Surveillance and Response**. In. Kampala: Ministry of Health Uganda; 2012:
3. WHO: **Technical guidelines for integrated disease surveillance and response in the African Region**. In., 2nd Edition edn: World Health Organization; 2010: 418.
4. WHO: **Manual for the Laboratory Diagnosis of Measles and Rubella Virus Infection**. In., Second edition edn. Geneva: World Health Organisation; 2007.
5. UBOS: **The National Population and Housing Census 2014 – Main Report, Kampala, Uganda**. In. Kampala: Uganda Bureau of Statistics; 2016;
6. Siegel JD, Rhinehart E, Jackson M, Chiarello L: **2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings**. *American Journal of Infection Control*, 35(10):S65-S164.