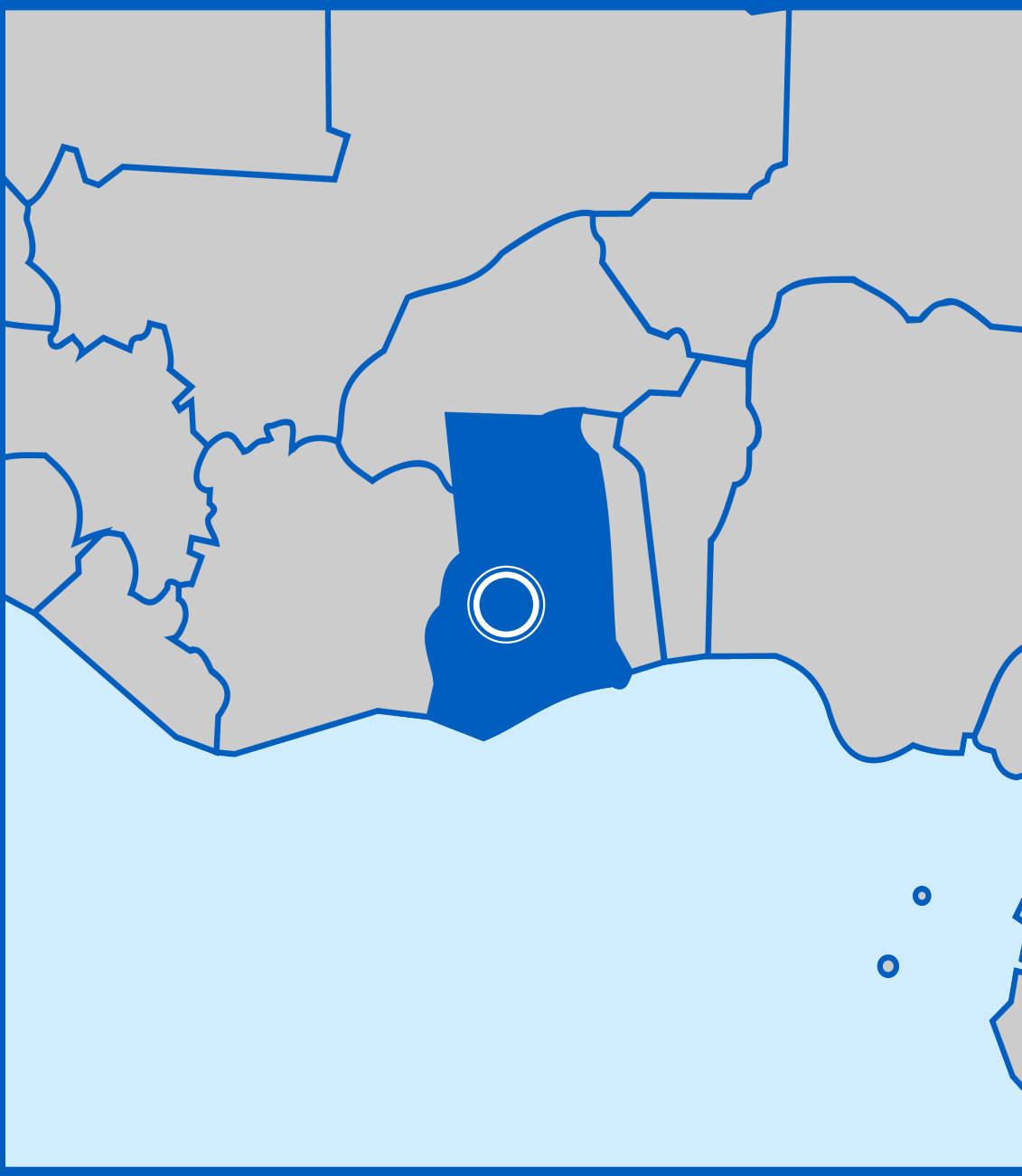
The Pan African Medical Journal

Meningitis Outbreak Investigation in Nkoranza South Municipality in Brong Ahafo Region, Ghana, February, 2016

Participant Guide



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Meningitis Outbreak Investigation in Nkoranza South Municipality in Brong Ahafo Region, Ghana, February, 2016

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Abstract

The occurrence of communicable diseases highlights the need to have well-trained field epidemiologists at the forefront in the fight against these diseases, especially during an outbreak. Training for outbreak investigation is most effective when participants can develop their competencies in a practical exercise. This is a simulation of the steps in meningitis outbreak investigation conducted in Ghana in February 2016 by Ghana Field Epidemiology Training Programme (FELTP) residents and the public health technical team of the Nkoranza South Municipality as a field epidemiologist.

This case study is ideally suited to reinforce principles and skills already covered in a classroom lecture or in background reading by providing a practical training beyond the scope of theoretical learning. It is primarily intended for training novice public health practitioners who should be able to complete the exercises in approximately 3 hours.

How to Use the Case Study

General instructions: Ideally, 1 to 2 instructors facilitate the case study for 13 to 20 students in a classroom or conference room. The instructor should direct participants to read a paragraph out loud, going around the room to give each participant a chance to read. When the participant reads a question, the instructor directs all participants to perform calculations, construct graphs, or engage in discussions. The instructor may split the class to play different roles or take different sides in answering a question. As a result, participants learn from each other, not just from the instructors. Specific instructor's notes are included with each question in the instructor's version of this case study.

Audience: Residents in Ghana Field Epidemiology Training Programs (Ghana-FELTP) and other Field Epidemiology and Laboratory Training Programs (FELTPs) and Field Epidemiology Training Programs (FETPs) who are interested in this topic.

Prerequisites: Before using this case study, case study participants should have received lectures or other instructions in outbreak investigations, including case definition development, line listing, passive and active case search to populate a line list, construction of an epi-curve and its interpretation, and report writing and information dissemination.

Materials needed: Laptop with Microsoft Excel, Epi Info™, or graph paper; calculator; flipchart or whiteboard with markers; A4 sheets; pens; pencils; and erasers.

Level of training and associated public health activity: Novice - Outbreak investigation

Time required: 2-3 hours

Language: English

Participant Guide

Goal of Case Study: Simulate a real-life meningitis outbreak investigation in Ghana

Learning Objectives – After completion of this case study, the participants should be able to:

1. Establish that an outbreak has occurred
2. Describe the steps in outbreak investigation
3. Develop a working case definition for meningitis
4. Develop a line list for the outbreak investigation and describe its value
5. Interpret and describe the value of an epidemic curve
6. Calculate the basic risks and case fatality rate associated with outbreak investigations
7. Communicate findings and make recommendations to stakeholders

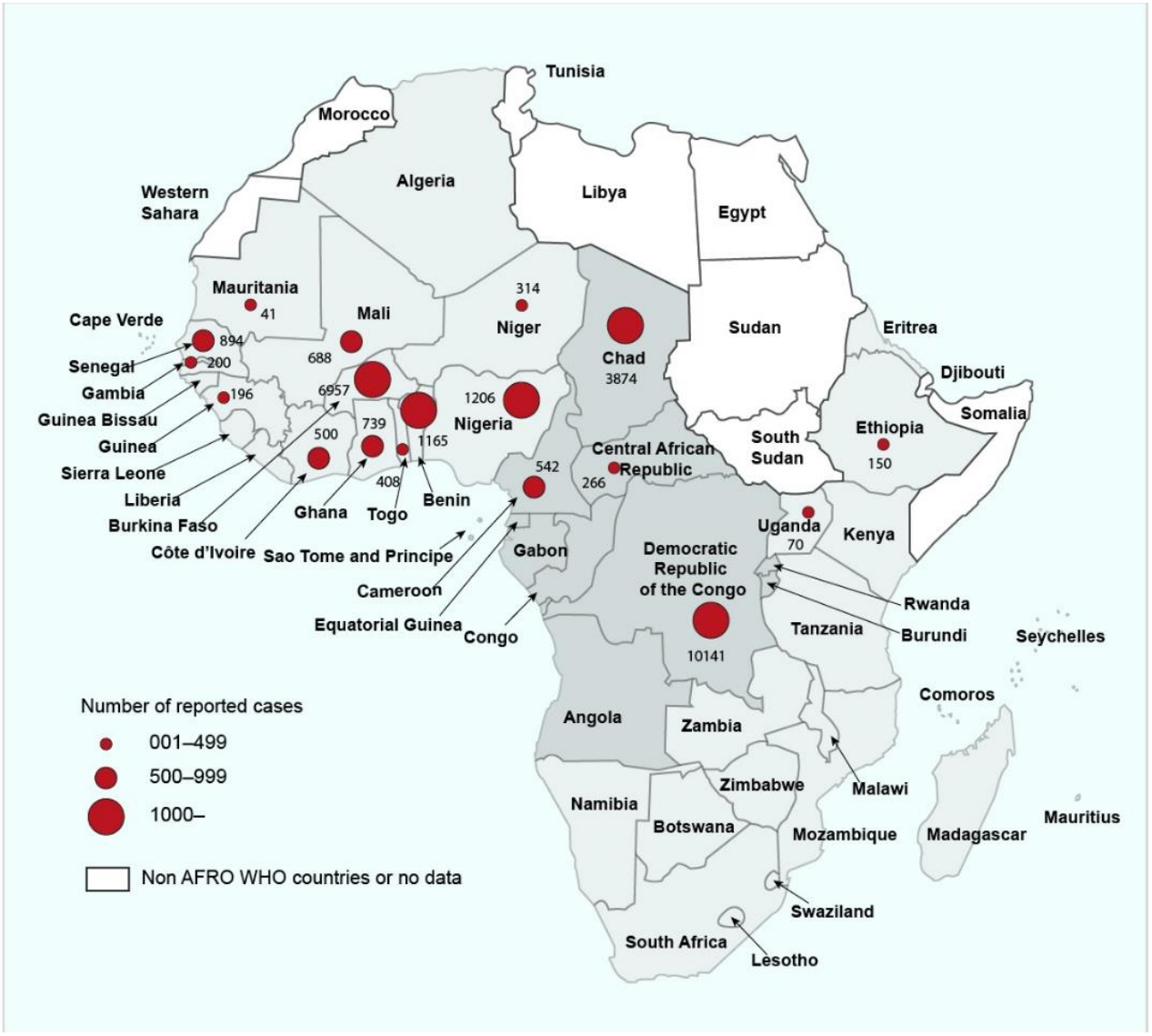
Introduction

Meningitis is described as inflammation of the meninges and/or infection of the cerebrospinal fluid (CSF) that surrounds and protects the brain and spinal cord [1]. Meningitis can result from many causes, both infectious and non-infectious. Bacterial meningitis is a life-threatening condition that requires prompt recognition and treatment. Beyond the newborn period, the most common causes of bacterial meningitis are *Neisseria meningitides*, *Streptococcus pneumonia*, and *Haemophilus influenza*. All three of these organisms are respiratory pathogens. They are spread from person-to-person by close contact with respiratory secretions [2].

Once acquired, each species can colonize the mucosa of the nose and throat, which is known as pharyngeal carriage. From there, they may cross the mucosa and enter the blood. Once in the blood, they can reach the meninges (covering of the brain and spinal cord), causing meningitis, or reach other body sites causing other syndromes [2]. Without treatment, the case-fatality rate can be as high as 70%, and one in five survivors of bacterial meningitis may be left with permanent sequelae including hearing loss, neurologic disability, or loss of a limb function [2].

Over 1.2 million cases of bacterial meningitis were estimated to occur worldwide each year. The incidence and case-fatality rates for bacterial meningitis vary by region, country, pathogen, and age group [3]. The three regions of the north and the northern part of Brong Ahafo region of Ghana are within the “meningitis belt,” a popular term for a region of sub-Saharan Africa where epidemics of group A meningococcal infection have occurred in cycles of approximately 10 years or where large epidemics of meningococcal meningitis have occurred in the last century [4] (Figure 1).

Figure 1. Meningitis belt in sub-Saharan Africa, Adapted from WHO Regional Office for Africa Outbreak Bulletin Vol. 3 Issue 11, 31 January 2014



Part 1

In 2015, Ghana recorded 349 suspected cases throughout the country, with 44 deaths. The Municipal Director of Health Service in Nkoranza South confirmed pneumococcus meningitis in a patient who was fortunate to survive. Beginning in January 2016, some of the districts and municipalities in Brong Ahafo Region, Ghana reported outbreaks of meningitis, including the Nkoranza South Municipality located in the northeast of the region (Figure 2). The Disease Surveillance Department of the Ghana Health Service, in partnership with the Ghana Field Epidemiology and Laboratory Training Programme (GFELTP), started some investigations to control the outbreak.

Figure 2. Map of Nkoranza South Municipality in the Brong Ahafo Region, Ghana

In the notification report that led to the outbreak investigations, it was noted that by 30th January, 2016, the municipality had recorded 31 cases with no mortality. Between 31st January and 1st February, 2016, the municipality lost three suspected meningitis patients. All three cases were later laboratory-confirmed as bacterial meningitis.

Question 1. What is a disease outbreak?

Question 2. What is an alert and epidemic threshold? Define them in terms of meningitis.

On 3rd February, 2016, the Disease Surveillance Department of the Ghana Health Service notified the GFELTP of the outbreak. The GFELTP subsequently constituted a team of residents and alumni to work with the public health unit of the municipality to investigate the outbreak in Nkoranza South Municipality. As part of the preparation, the lead epidemiologist assigned team members to roles and responsibilities. The team also reviewed literature on the disease and made the necessary administrative, personnel and logistical arrangements. After engaging the local partners (municipal health directorate) and other agencies/stakeholders, the team embarked on a journey to Nkoranza South Municipality on 5th February, 2016.

Question 3. What are the steps in an outbreak investigation?

Question 4. Does every outbreak need to be investigated? Justify your answer.

Question 5. Assuming the position of a team lead/lead epidemiologist, who will you add to your investigation and why? Indicate roles and responsibilities.

Part 2

Upon arrival in the field, the team met with members of the Municipal Health Directorate who briefed them on their preliminary findings. The index case was an 11-year-old female from Kyiradeso Community in the Donkro-Nkwanta Sub-district of the Nkoranza South Municipality. She reported to the hospital on 2nd December, 2015 with complaints of headache and a fever lasting 3 days, neck pain, stiffness lasting the past day, and sensitivity to light (photophobia). Her CSF tested positive for pneumococcal meningitis. Subsequently, two cases were suspected of meningitis on 14th and 19th of January, 2016 but Gram staining was negative. The team requested to review the case definition used to classify cases.

Question 6: What is a case definition?

Question 7: What are the three classifications of a case definition? Describe each in terms of typical types of criteria and levels of sensitivity and specificity.

Based on information gathered so far, the team noticed that all the patients who reported to the hospital had complaints of fever of sudden onset. Headache, neck pain, neck stiffness, blurred vision, and photophobia were present in some patients. All patients originated from Nkoranza South or its neighbouring districts, including Nkoranza North and Ejura-Sekyere-Dumasi. The first case was seen in the hospital on 2nd December, 2015. During the investigation, the team did not find any epidemiological linkage between the first case and cases from neighbouring districts.

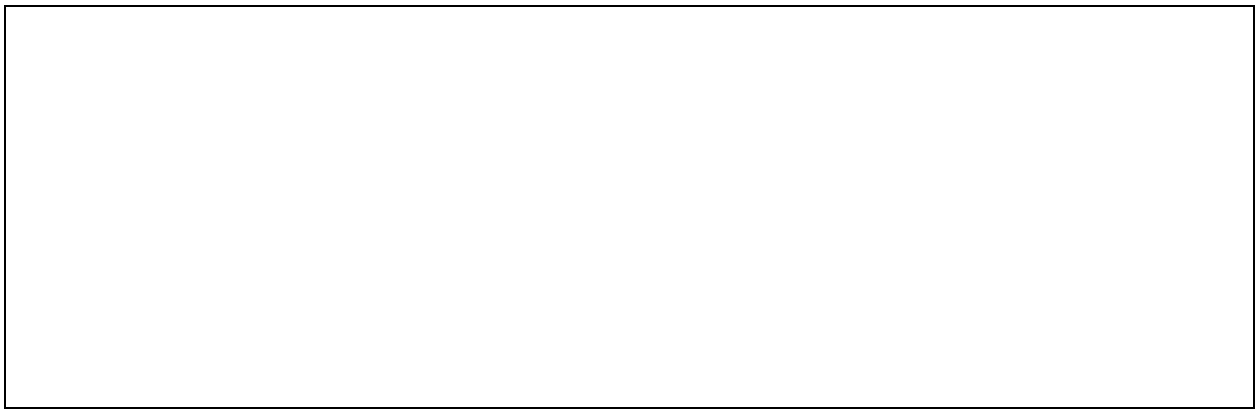
Question 8: Develop a working case definition for bacterial meningitis for each case classification based on this scenario.

Following the surge of meningitis cases in neighbouring Wenchi and Tain Districts (which had reported the highest cases in the region), in addition to reported cases in the Nkoranza South Municipality, the Municipal Director of Health Services and her team (Municipal Health management team-MHMT) at the directorate met on 20th January, 2016. She instructed disease control and surveillance officers to alert the community-based surveillance volunteers (CBSV) to engage communities to provide public health education on meningitis and to emphasize the importance of reporting to the nearest health facility should they notice any of the symptoms of a suspected case. The CBSVs also asked community members whether they experienced the symptoms pointing to meningitis. Community members who exhibited symptoms were referred to the Municipal Hospital. Some community members upon receiving the health education reported to the nearest health facility by themselves or accompanied by a relation who had heard about the public health education on meningitis, especially the symptoms. The MHMT embarked on an active case finding/search mission.

Within a few days, the Municipal Director was informed by the hospital disease control officer that many cases were reporting to the hospital. Thus, on 25th January 2016, she met with the hospital management and clinical staff to sensitize them to a possible increase in the suspected meningitis cases and to prepare logistics for clinical case management and heighten public health education on meningitis available in the out-patient waiting area. The clinical team also reviewed medical records using the working case definition to identify additional cases that were missed. They also reviewed patient folders for good history, examination, investigations requested and correct diagnosis for case management of meningitis. They assessed the laboratory for capacity and reagents for confirming meningitis and reviewed medications in the pharmacy needed for case management. One obvious challenge was the unavailability of adequate amounts of prescribed medications within the hospital to be used for managing the patients. This was a result of non-payment/re-imbursement of monies for services provided. As a result, the hospital ran out of prescribed medications for managing meningitis as the cases overwhelmed the usual projected stocks of medications needed for the stable influx of routine patients visiting the hospital. Thus, prescriptions were issued to patient relatives to purchase the medications from private pharmacies

outside the hospital. Where the relatives could not afford this, the patients missed their medications being administered to them. This was brought to the attention of the municipal health director who also forwarded the challenge to the national level through the regional directorate.

Question 9: What is the difference between passive and active case search/finding?

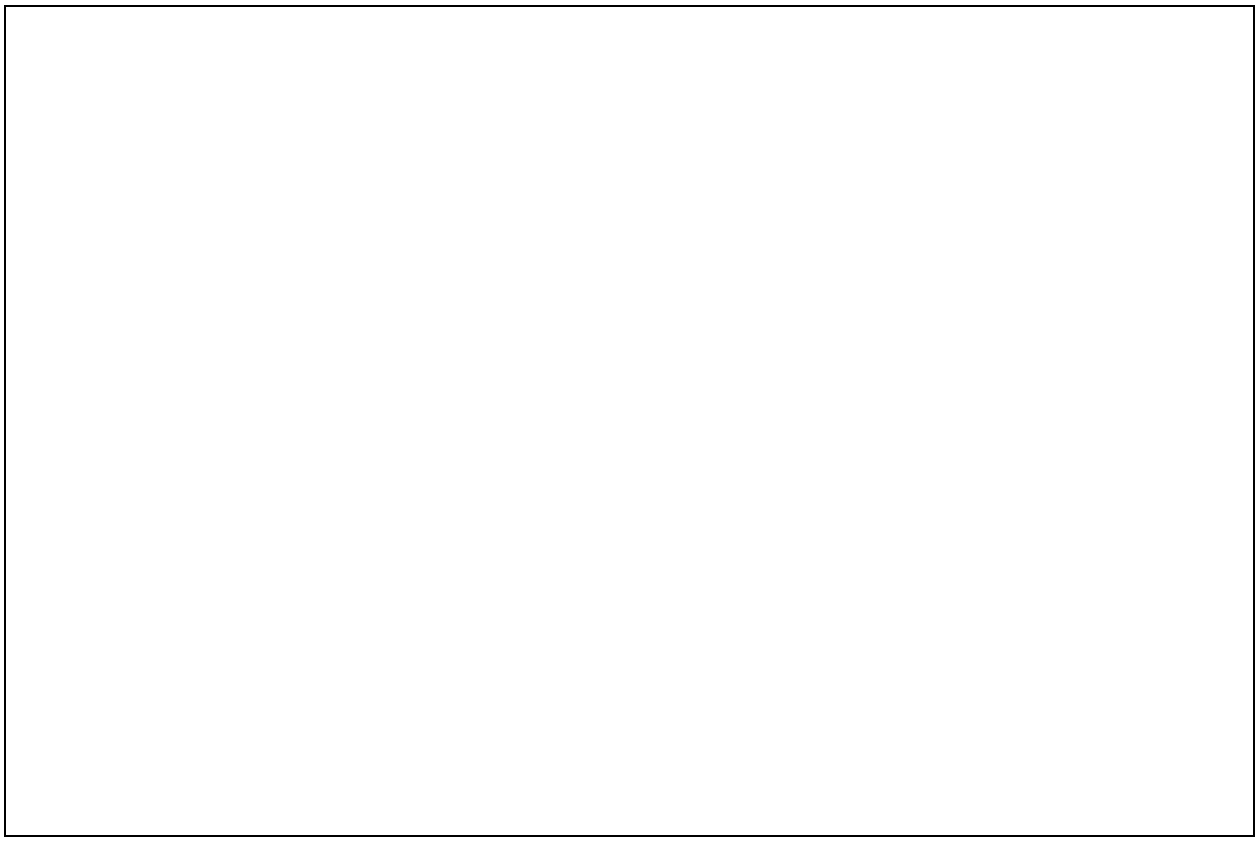


Part 3

After the meeting with the hospital management and clinical staff, the Health Director went to debrief the Municipal Chief Executive (MCE), the administrative head, and the chairperson of the Public Health Emergency Management Committee (PHEMC). The PHEMC subsequently called an emergency meeting on 26th January, 2016 to discuss educational strategies to sensitize the population, social mobilization, funding, and mobilization of logistics for case management. During the meeting, the meteorological agency manager provided crucial information regarding the harsh weather conditions in the last three years. This had been due to increased felling of trees exposing the bare ground to the direct scorching of the sun, and strong winds exposing the population to dust particles. The health director linked the dry dust particles hitting the mucus membranes of the nostrils to cracks allowing the bacteria in the pharynx to enter the tissue or blood stream.

By 5th February, 2016, the team recorded 35 cases, including 9 laboratory-confirmed (Gram-positive diplococci) cases and 3 deaths. There were eight patients on admission at the hospital. The next day, the team visited the hospital and reviewed the hospital records using the case definition to update the line list.

Question 10. What is a line list? List the variables that are needed as headers to construct a line list for the meningitis outbreak described thus far.



During the review, the team found additional cases to add to the line list (Figure 3). These cases were some of the ones that were picked from the source register from the emergency unit and consulting room.

Figure 3. Patient histories for cases 001, 015, and 031

Case 001

A.Z, an 11-year-old female pupil from Kyiradeso Community A in the Donko-Nkwanta Sub-district in the Nkoranza South Municipality, reported to the Hospital on 2nd December, 2015 with complaints of headache and fever of 3 days duration, neck pain and stiffness of a day's duration. This was associated with photophobia. On examination, she was ill-looking, febrile (38.9°C), and had a stiff neck. Kerning's sign was positive. The attending physician made an impression of meningitis. Blood sample was taken for a full blood count, blood film for malaria parasites and lumber puncture was done on the same day. The cerebrospinal fluid was cloudy/turbid and the samples were transported to the laboratory for confirmation. The results were as follows: *Hb – 11.3g/dL, mps was negative WBC- 26X10^9/L, Neutrophil - 87.1%, Lymphocytes- 7.3%, Mixed cells- 5.6*

CSF appeared cloudy and Gram-positive diplococci were identified. A confirmed diagnosis of Pneumococcal meningitis was made.

She was managed on IV Ceftriaxone 2g stat, then continued with 1g 12 hourly for 14 days. This was done without any break. She felt better and was finally discharged home. Unfortunately, she developed some neurological deficit and was referred to see a physiotherapist.

Case 015

H.Z, a 16-year-old female from Duromon community in the Sekyere-Dumas Sub-district in the Ejura- Sekyere-Dumase District in the Ashanti Region, reported to the hospital on 24th January, 2016 at 4:40 PM. She was apparently well and had complained of fever, ear pain, and vomiting of 2 days duration. She was taken to a health centre a day earlier where she was diagnosed with an ear infection. 4MU crystalline penicillin and Inj. Diclofenac was administered, and she was subsequently referred to the hospital for further management. Upon arrival at the hospital her complaints were neck stiffness, headache, and fever of 3 days duration. It was associated with photophobia, vomiting (single episode), rigidity of limbs, and history of contact with the meningitis epidemic zone (she had returned from Bole in the northern region a week ago).

On examination she was not febrile (37.1°C), SPO2 was 96%, pulse was 116 bpm, not jaundiced, and not pale. Neck was supple but Kerning's sign was positive, altered consciousness GCS 14/15. No abnormality detected on abdominal examination.

An impression of Meningitis was made.

Laboratory finding were: Hb- 10.5g/dL, WBC- 70.3x10 9/L, Neu and Mxd-???? Lymph- 83% PLT- 93, MCV-69%, No mps seen. CSF was cloudy, Gram-positive diplococci was identified (samples were taken on the same day).

Currently on admission

Case 031

A.B, a 59-year-old female who came from Nyinaase community in Nkoranza sub-municipality in Nkoranza South. was brought to the hospital on 31st January, 2016 at 12:05pm unconscious with earlier complaints of severe headache, fever, neck pain and general body weakness of a week's duration. She had a travel history from Kaleo in the Upper West Region (within the meningitis belt). She had been seen in a health centre earlier without improvement. On examination, she was unconscious, moderate pallor, stiff neck and Kerning's sign was positive. An impression of Meningitis was made. She was admitted to the isolation ward.

Laboratory investigation requested included FBC, mps, LP for CSF. IV Ceftriaxone 4g stat was given and some IVFs. The lab results came out as follows: CSF was cloudy and Gram-positive diplococci identified. Her condition did not improve and she died at 6:50 pm (6 hours of hospital stay)

Question 11. Use the information in Figure 3 to populate the line list (included in Appendix 1). What information can you derive from a line list?

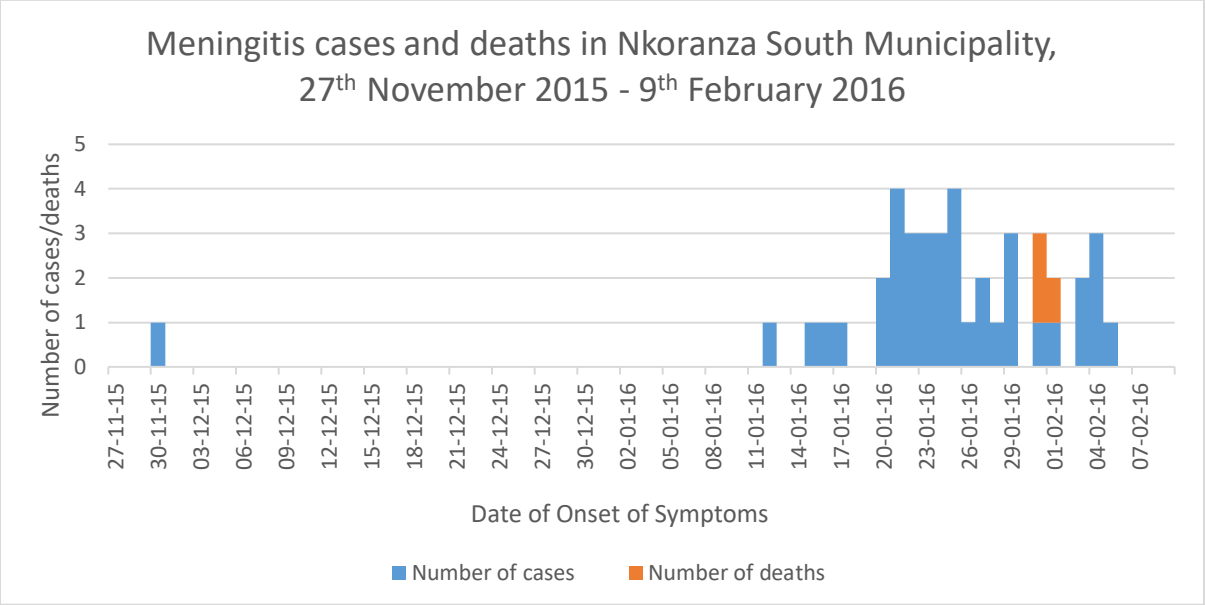
As of 8th February, 2016, the team had recorded 42 cases including nine confirmed as Gram-positive diplococci meningitis with three deaths on their line list. They also reviewed patient folders for good history, examination, investigations requested and correct diagnosis for case management of meningitis. They assessed the laboratory for capacity and reagents for confirming meningitis and reviewed medications in the pharmacy needed for case management.

A descriptive analysis was conducted to summarize their findings to give them a better understanding of the pattern of the disease. As part of the summaries, they constructed an epidemic curve (epi curve) (Figure 4) and spot map, and calculated measures of disease frequency and central tendency.

Hint: Note that this epi curve uses the date of onset of illness for the cases in blue, but for the purpose of demonstrating all the events on the line list in Figure 4, the date of death is also included and the deaths are in red.

Descriptive data analysis

Figure 4. Meningitis cases by date of disease onset and date of case deaths in Nkoranza South Municipality, 31st November 2015 – 5th February 2016



Question 12: Interpret the epi curve in Figure 4.

Table 1. Summary of population, cases, and deaths in affected sub-municipalities in Brong Ahafo Region, 2015 – 2016 (excluding Ejura-Sekyere-Odumase in Ashanti region)

No	Sub-municipality	Population	No. of communities	No. of cases	No. of deaths
1	Nkoranza	43,432	20	4	1
2	Nkwabeng	9,568	12	0	0
3	Bonsu	11,459	12	1	0
4	Donkro-Nkwanta	15,042	16	23	0
5	Akuma	23,432	20	2	0
6	Ahyiayem	7,521	9	0	0
7	Ayerede	5,240	9	1	1
8	Busunya sub-district in Nkoranza North*	n/a	n/a	10	1
9	Sekyere Dumase in Ashanti Region*	n/a	n/a	1	0
	Total	**115694**	**98**	**42**	**3**

*Note that Busunya sub-district is in Nkoranza North and Sekyere Dumase is a district in Ashanti region, which are districts outside of Nkoranza South. Thus, their populations have been excluded in the denominator of the calculations.

Question 13. Referring to Table 1, populate the blank cells using the questions below.

a. Calculate the sub-municipality specific attack rate
b. Calculate the overall attack rate
c. Calculate the sub-municipality specific case fatality rate
d. Then calculate the case fatality rate (overall)

Hint: Use only the populations provided for your calculations where applicable.

No	Sub-municipality	Attack Rate per 100000	Case Fatality Rate per 100
1	Nkoranza		
2	Nkwabeng		
3	Bonsu		
4	Donkro-Nkwanta		
5	Akuma		
6	Ahyiayem		
7	Ayerede		
8	Busunya sub-district in Nkoranza North		
9	Sekyere Dumase in Ashanti Region		
	Total		

Part 4

Based on the results so far, the team made recommendations to the Municipal Health Management Team (MHMT) to control and prevent meningitis from spreading person-to-person. While on the field, the joint team (the Nkoranza South municipal local team and that from the Ghana Field Epidemiology and Laboratory Training Programme (GFELTP) took some public health action to control and prevent meningitis from spreading from person to person. These actions were:

- Conduct contact tracing, update line list, and distribute prophylaxis
- Sensitize community on meningitis during the active case search
- Review of case management with clinicians to assess adherence to protocol
- Advocate for inclusion of meteorological agency manager in the municipal epidemic management committee
- Advocate for inclusion of private health facilties in public health activities
- Train MHMT on the use of GPS receiver to record longitude and latitude coordinates
- Conduct social mobilsation activities, including health education at places of gathering (e.g. funeral)
- Enhance surveillance activities and distribute case definitions, predesigned charts with alert and epidemic thresholds for plotting the number of cases and deaths per week to all health facilities in the municipality including the municipal hospital, health centres, community-based health planning services (CHPS) compound in the public service and the private sector.
- Conduct in-service training on IDSR and meningitis for all municipal staff, including at the hospital
- Train CBSV to identify and promptly refer suspected clients to the hospital for clinical care
- Intensify health education in the affected communities on signs and symptoms, mode of transmission, prevention, and early reporting of meningitis to the nearest health facility
- Ensure the availability of essential drugs at the hospital and the health directorate for prompt treatment and prophylaxis for contacts. This was achieved as information reaching the presidency and the MoH caused the Health Minister to come to the region and some selected districts to have a first-hand view of the outbreak situation.

Question 14: What recommendations will you make at the following health administrative levels?

a. National
b. Regional
c. Municipal (Directorate and Assembly)
d. Hospital

National, Ghana Health Service (Public Health Division)

Brong Ahafo Regional Health Directorate

Nkoranza Municipal Health Directorate

Hospital-Nkoranza

Municipal Assembly-Nkoranza

When the investigation was over, the team submitted their report.

Question 15. Who are the stakeholders to benefit from this investigation?

Question 16: How will you disseminate your findings?

Conclusion

The first case of the outbreak was reported on 19th October, 2015, in Makuma of the Bole District in the northern region. This outbreak was extensive, involving 9 out of 10 regions in Ghana. Only the Central Region was spared. The Brong Ahafo Region experienced the worst hit, with 19 out of 26 districts reporting cases.

In the case of Nkoranza South Municipality, a propagated outbreak of meningitis due to *S. pneumoniae* was established in about 3 of the 7 sub-municipalities in the Nkoranza South Municipality, affecting mostly women (32/42). The disease affected mostly adolescents between 10 and 20 years, typical of a *S. pneumoniae* outbreak. All 3 deaths were among the 9 confirmed cases for Gram-positive diplococci. The source of the outbreak could not be established. The changing rainfall patterns and unusually harsh dry and windy weather conditions experienced from October 2015 to February, 2016 were likely to have aided the quick spread of the causative organism to susceptible people in the communities. In the end, the outbreak was attributed to multiple different strains, with *S. pneumoniae* causing the most cases overall. Over 100 mortalities occurred in Ghana as a result of the outbreak; the case fatality rate was 16.9% as of February 2016. Later, with improved case management practices, no more deaths were reported after the first rain on 1st March, 2016.

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Acknowledgements

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Appendices

Appendix 1. Line List of meningitis cases in Nkoranza South Municipality as of 8th February, 2016

ID	Community/ Suburb/Town	Sub District	District of Residence	Sex	Age	Date of reporting	Date of onset of symptoms	Date specimen taken	Lab Results	Outcome	Date of outcome	Comments	Duration of outcome
001													
002	Asempanayre	Nkoranza	Nkoranza South	F	28	14-01-16	12-01-16	NA	NA	Alive	29-01-16	Discharged	15 days
003	Busunya	Bunsunya	Nkoranza North	F	14	19-01-16	15-01-16	19-01-16	GRAM +VE DIPLOCOCCI	Alive		on Admission	
004	Dimango	Ayerede	Nkoranza South	F	6	21-01-16	20/01/16	21/01/16	GRAM +VE DIPLOCOCCI	DEAD	31/1/16	DEAD	2hrs
005	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	12	23/01/16	21/01/16	23/1/16	GRAM +VE DIPLOCOCCI	Alive		on Admission	
006	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	13	23/1/16	21/1/16	23/1/16	GRAM +VE DIPLOCOCCI	Alive		on Admission	
007	Kyiradeso	Donkro Nkwanta	Nkoranza South	M	34	23/1/16	16/1/16	23/1/16	Negative	Alive		Discharged	
008	Subodom	Donkro Nkwanta	Nkoranza South	F	13	24/1/16	21/1/16	24/1/16	Negative	Alive		Discharged	

ID	Community/ Suburb/Town	Sub District	District of Residence	Sex	Age	Date of reporting	Date of onset of symptoms	Date specimen taken	Lab Results	Outcome	Date of outcome	Comments	Duration of outcome
009	Nkoranza - Estate	Nkoranza	Nkoranza South	F	33	24/1/16	21/1/16	24/1/16	Negative	Alive		Discharged	
010	Subodom	Donkro Nkwanta	Nkoranza South	F	25	24/1/16	20/1/16	24/1/16	Negative	Alive		Discharged	
011	Subodom	Donkro Nkwanta	Nkoranza South	F	24	24/1/16	22/1/16	24/1/16	Negative	Alive		Discharged	
012	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	41	24/1/16	17/1/16	24/1/16	Negative	Alive		Discharged	
013	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	25	24/1/16	23/1/16	24/1/16	Negative	Alive		Discharged	
014	Subodom	Donkro Nkwanta	Nkoranza South	F	25	24/1/16	23/1/16	24/1/16	Negative	Alive		Discharged	
015													
016	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	35	24/1/16	22/1/16	24/1/16	Negative	Alive		on Admission	
017	Kyiradeso	Donkro Nkwanta	Nkoranza South	M	12	24/1/16	22-01-16	24/1/16	Negative	Alive		Discharged	
018	Pinihini	Busuya	Nkoranza North	F	36	26/1/16	24/1/16	26/1/16	Negative	Alive		Discharged	

ID	Community/ Suburb/Town	Sub District	District of Residence	Sex	Age	Date of reporting	Date of onset of symptoms	Date specimen taken	Lab Results	Outcome	Date of outcome	Comments	Duration of outcome
019	Donkro Nkwanta	Donkro Nkwanta	Nkoranza South	M	10	26/1/16	24/1/16	26/1/16	Negative	Alive		Discharged	
020	Kyiradeso	Donkro Nkwanta	Nkoranza South	M	11	26/1/16	24/1/16	26/1/16	Negative	Alive		Discharged	
021	Kyiradeso	Donkro Nkwanta	Nkoranza South	M	35	26/1/16	25/1/16	26/1/16	Negative	Alive		Discharged	
022	Subodom	Donkro Nkwanta	Nkoranza South	F	13	26/1/16	25/1/16	26/1/16	Negative	Alive		Discharged	
023	Subodom	Donkro Nkwanta	Nkoranza South	F	11	26/1/16	25/1/16	26/1/16	Negative	Alive		Discharged	
024	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	14	27/1/16	26/1/16	27/1/16		Alive		Discharged	
025	Fiema	Busuya	Nkoranza North	F	15	27/1/16	23/1/16	27/1/16	GRAM +VE DIPLOCOCCI	DEAD	02-01-16	DEAD	4 days
026	Kyiradeso	Donkro Nkwanta	Nkoranza South	F	37	27/1/16	25/1/16	27/1/16	Negative	Alive		Discharged	
027	Fiema	Busuya	Nkoranza North	F	55	28/1/16	26/1/16	28/1/16	Negative	Alive		Discharged	
028	Fiema	Busuya	Nkoranza North	M	9	29/1/16	27/1/16	29/1/16	Negative	Alive		Discharged	

ID	Community/ Suburb/Town	Sub District	District of Residence	Sex	Age	Date of reporting	Date of onset of symptoms	Date specimen taken	Lab Results	Outcome	Date of outcome	Comments	Duration of outcome
029	Fiema	Busuya	Nkoranza North	F	45	29/1/16	27/1/16	29/1/16	Negative	Alive		Discharged	
030	Bonsu	Bonsu	Nkoranza South	M	45	31/1/16	29/1/16	31-01-16	GRAM +VE DIPLOCOCCI	Alive		on Admission	
031													
032	Nkoranza - Estate	Nkoranza	Nkoranza South	M	7	31/1/16	28/1/16	31-1-16	Negative	Alive		on Admission	
33	Donkro Nkwanta	Donkro Nkwanta	Nkoranza South	F	31	02-02-16	31/1/16	02-03-16	Negative	Alive		on Admission	
34	Brahoho	Akuma	Nkoranza South	F	67	02-02-16	29/1/16	02-02-16	Negative	Alive		on Admission	
35	Donkro Nkwanta	Donkro Nkwanta	Nkoranza South	F	74	02-02-16	29/1/16	02-03-16	Negative	Alive		on Admission	
36	Appiesua	Akuma	Nkoranza South	F	32	02-05-16	02-01-16	02-05-16	Negative	Alive		on Admission	
37	Busunya	Busuya	Nkoranza South	F	21	02-05-16	02-03-16	02-05-16	Negative	Alive		on Admission	
38	Timiabu	Busuya	Nkoranza South	F	29	02-05-16	02-04-16	02-05-16	Negative	Alive		on Admission	

ID	Community/ Suburb/Town	Sub District	District of Residence	Sex	Age	Date of reporting	Date of onset of symptoms	Date specimen taken	Lab Results	Outcome	Date of outcome	Comments	Duration of outcome
39	Donkro Nkwanta	Donkro Nkwanta	Nkoranza South	M	15	02-05-16	02-03-16	02-05-16	Negative	Alive		on Admission	
40	Donkro Nkwanta	Donkro Nkwanta	Nkoranza South	M	15	02-05-16	02-04-16	02-05-16	Negative	Alive		on Admission	
41	Boana	Busuya	Nkoranza North	F	38	02-06-16	02-04-16	02-06-16	Negative	Alive		on Admission	
42	Timiabu	Busuya	Nkoranza South	F	15	02-06-16	02-05-16	02-06-16	Negative	Alive		on Admission	