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An Investigation of Pyrexia of Unknown Origin in Shamva District, Zimbabwe, September 2015

Participant Guide

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An Investigation of Pyrexia of Unknown Origin in Shamva District, Zimbabwe, September 2015

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Abstract

Outbreak investigation is a key component of public health training. A good outbreak investigation can go beyond determining the causative agent by recommending policies to be formulated by policy makers. This case study simulates a real-life investigation of pyrexia of unknown origin in Shamva District, Zimbabwe, during the period of September to October 2015. It aims at reinforcing principles and skills taught in class on outbreak investigation, study design and policy initiation. The target audience for the case study is Field Epidemiologists at their advanced level of training. It is expected to be completed in approximately 2 hours.

How to use the case study

General instructions: Ideally, 1 to 2 facilitator(s) is/are required to facilitate the case study for 10 to 20 participants. The facilitator should request 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 facilitator encourages all participants to engage in discussions, perform calculations, and draw graphs among other tasks. The facilitators request the participants to play different roles or take different sides in answering a question. As a result, participants learn from each other, not just from the facilitators.

Audience: Field Epidemiologist and other person(s) interested in the case study

Pre-requisite: Before using this case study, case study participants should have received lectures or other instruction in outbreak investigation, use of Epi info 7 visual dashboard to run aberration algorithm, study design, measures of association, and policy formulation and analysis

Materials needed: Flipchart or whiteboard with markers

Level of training: Advanced Outbreak investigation

Time required: Approximately 2 hours

Language: English

Participant Guide

Goal of case study: To simulate an outbreak investigation of pyrexia of unknown origin

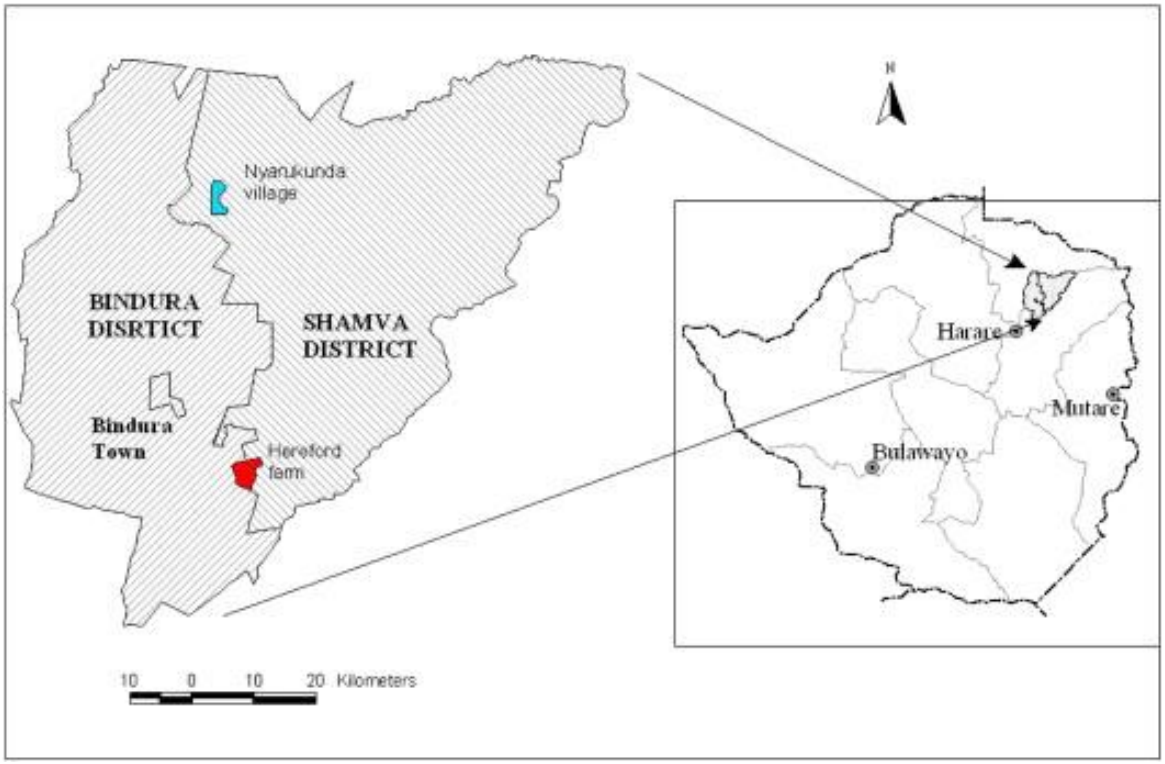
Learning objectives: At the end of the case study, the participants should be able to: -

1. Describe how to prepare for an outbreak investigation
2. Establish existence of an outbreak
3. Formulate and test hypothesis from descriptive epidemiology
4. Recommend appropriate control measures based on outbreak investigation findings
5. Assess the readiness for policy development

Introduction

Shamva district is one of the seven districts located in Mashonaland Central Province in Zimbabwe. It is located 60 km northwest of the capital city of Harare. Location of Shamva District is presented in Figure 1.

Figure 1. Location of Shamva District Zimbabwe



The population of Shamva district is approximately 123,650. [1] The district has 29 administrative wards. Health services are provided through one government district hospital, a mine hospital, 13 health centres, and, some private surgeries. Shamva district is known to have some of the richest gold deposits in Zimbabwe. Farming, formal and informal mining are the major economic activities in the district.

On 28th September 2015, the District Medical Officer (DMO) was notified of 15 cases of pyrexia of unknown origin (PUO). The cases were reported by Mtili and Shamva health facilities. The index case reported on the 26th September 2015 at a private surgery. PUO had never been reported in the affected communities. The diagnosis was made when cases tested negative to the common causes of pyrexia in Mtili and Shamva health centre catchment areas (malaria and typhoid). The population of the affected area was approximately 3812 with 887 households [1].

Part 1

Question 1. What actions would you take as a manager in preparation for a field response with regards to:

1. Rapid Response Team composition?
2. Supplies and equipment?
3. Administrative issues?
4. The epidemiological aspects of the investigation?

Question 2. How would you establish whether the cases of POU in Mtili and Shamva catchment area constitute an outbreak?

A rapid response team was deployed to the area on 29th September 2015. After analysis of the line lists, a case definition was developed as *"Any person who resides in Mushambanyama area, Ward 28, of Shamva District, who developed pyrexia, or diarrhoea or headache or vomiting or cough from 11th September 2015."*

Question 3a. In epidemiology, what is the purpose of developing a case definition?

Question 3b. What are the characteristics of a case definition in epidemiology?

A search for further cases was conducted using the case definition. By 12th October 2015, fifty-six (56) cases of POU had been reported with three deaths. Of these documented cases, 27 were females and 29 were males. The population of the area was approximately 3812. Among the populace, 52% were females. The number of households in the area was 887. [1] The age distribution of the cases and the age specific population are shown in Table 1.

Table 1. Shamva POU Cases by Age Group 2015

Age Category	No of Cases	Population in the Age Group
Less than 5 years	2	561
5 years to 14 years	18	1072
15 years and above	33	2179
Total	56	3812

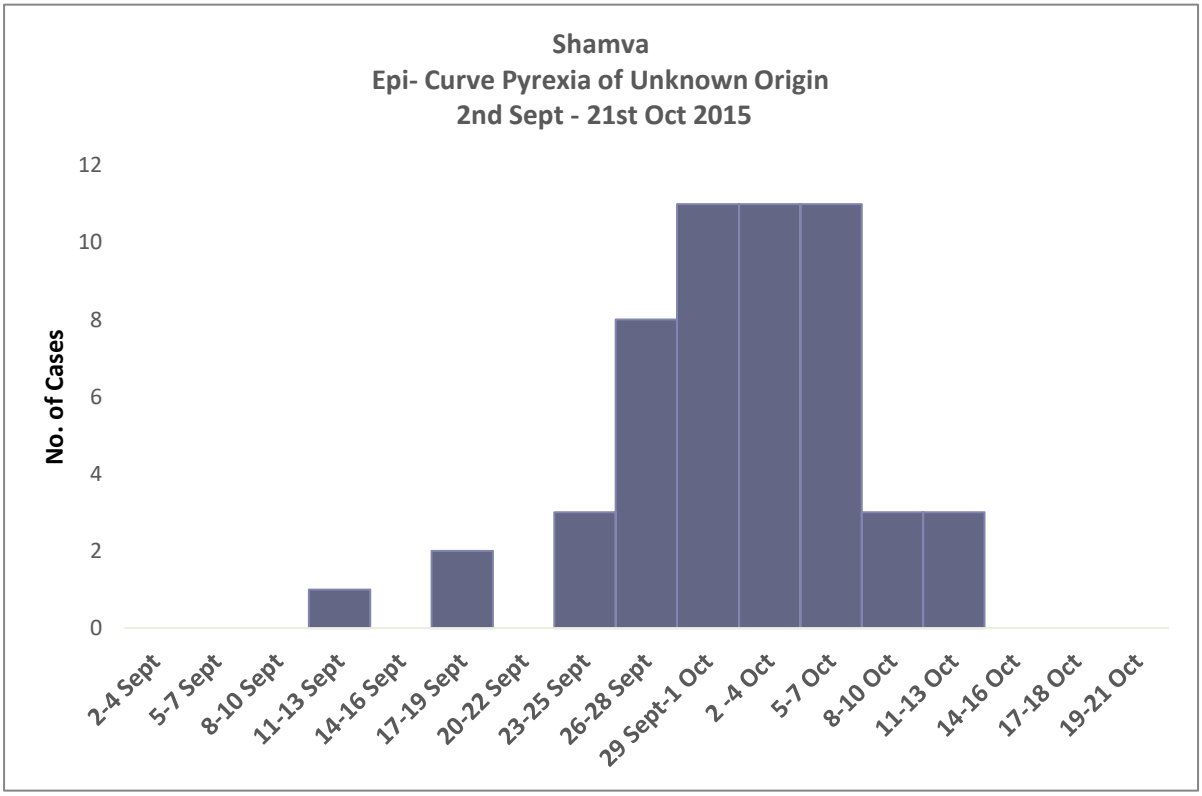
Question 4. Based on information provided in Table 1, what was the magnitude of the POU on the affected community?

Question 5. What was the risk of contracting POU across sexes?

Question 6. What was the risk of contracting POU across each age groups?

The team constructed an epidemic curve using the line lists. The epi-curve is presented in Figure 2.

Figure 2. Epi-curve of Pyrexia of Unknown Origin-Shamva District, 2015



Question 7. What one assumption was used in the construction of this epi–curve?

Question 8. Describe the shape/ trend of the epi-curve.

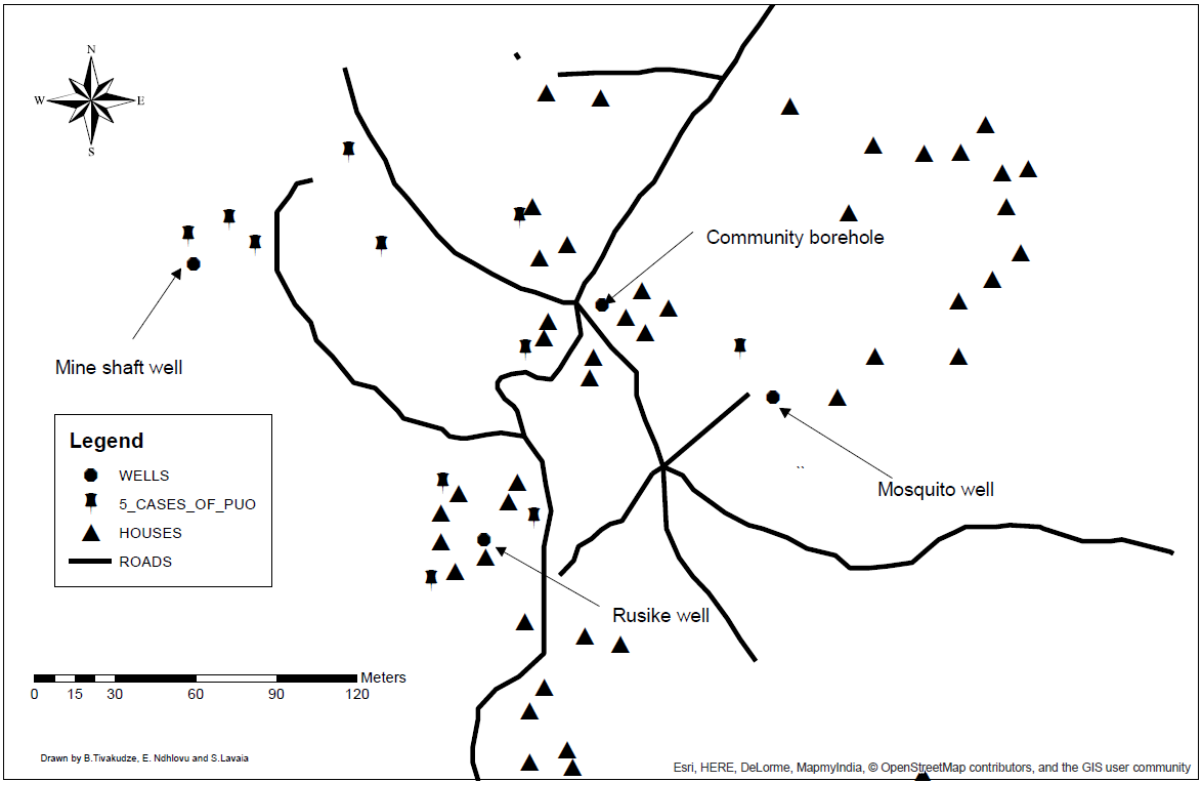
Question 9. What conclusion may you draw from the epi-curve to guide your investigation?

Environmental investigations began on 27th September 2015. The investigations revealed that the community borehole had broken down on 3rd September 2015. This had led to a search for alternative sources of water by the community. The alternative water sources for the community were the Mosquito spring well, Rusike well and the Mine-shaft water. Water vending was also prevalent during the period. Water samples were taken from the alternative sources for laboratory evaluation. All cases indicated they had used water from at least one of the alternative sources for domestic purposes including drinking.

Question 10. Based on the information you have so far, which water tests would you request the laboratory to perform on the samples? Justify your answers.

Spatial distribution of cases showed clustering in the Mushambanyama area, Ward 28 of Shamva District. The spot map is shown on figure 3. The area is a former commercial farm which was subdivided into small agricultural holdings. Small scale and informal mining was prevalent in the area.

Fig 3. Spot map of Mushambanyama area – Shamva District



Question 11. Based on the information provided at this point, what hypothesis would you formulate for the outbreak?

Part 2

As part of the field investigations, the team decided to conduct a case-control study to test the hypothesis. Forty-seven cases and 94 controls were recruited and assessed on their exposure to the alternative sources of water, as shown in Table 2.

Question 12. How would you select controls in this case-control study?

Table 2: Source of water for study participants, Shamva 2015

Water Source	Cases	Control	OR (95% CI)	p-value
Mineshaft Rusike Well Vended Water	32	35	3.6 (1.6-8.1)	0.00005
Other Sources	15	59		
Mine Shaft	18	23	3.07 (1.2-7.7)	0.007
Other Sources	15	59		
Rusike Well	5	8	2.45 (0.5-9.9)	0.15
Other Sources	15	59		
Mosquito Well	13	45	0.37 (0.45-0.96)	0.02
Mine Shaft	18	23		
Mosquito Well	13	45	0.4 (0.09-1.93)	0.16
Rusike Well	5	7		
Mosquito Well	13	45	0.1 (0.002-3.1)	0.08
Vended Water	2	1		

Logistic regression for independent factors associated with contracting PUO was also done. The results of the logistic regression are presented in Table 3.

Table 3. Independent factors associated with contracting PUO in Shamva, 2015

Covariate	Crude OR [95% CI]	OR [95%CI]	p-value
Household Member of Cases	2.6 [1.26-5.42]	3.97 [1.48-10.59]	*0.006
Age 20+ years	0.25[0.12-0.56]	0.20 [0.08-0.53]	*0.001
Mineshaft water	3.07 [1.33-7.11]	2.73 [1.07-6.95]	*0.001

Questions 13. Interpret the findings in Tables 2 and 3 and give plausible explanations for the observed association.

The government laboratory chemical analysis results showed excess cadmium (Cd) in the mineshaft water and zinc (Zn) in the mosquito spring well water. The levels exceeded acceptable levels for human consumption according to WHO Guidelines for Drinking Water Quality. [7] The team made recommendations based on these findings and proposed some policies to be formulated.

Question 14. What preventive control measures would you take to curtail the outbreak of PUO?

Question 15. As a public health manager, which policy(ies) would you recommend based on the findings from the investigation?

Question 16. How would you assess community readiness for policy development?

Question 17. How would you assess organizational readiness for policy development?

Conclusion

An outbreak of PUO occurred in Shamva district, Zimbabwe. The likely cause of the outbreak was water from a mine shaft and wells which were used as alternative sources of water by the community, as a result of breakdown of the main community borehole. Water from mine shafts is usually contaminated by heavy metals like zinc, cadmium, or lead. [13-15]

While public health practitioners may continue to investigate such public health emergencies, there is need for policy recommendation as a primordial measure. However, if the community is not involved in the process of policy formulation, the policy might not serve its purpose.

Background Reading

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Competing Interests

The authors declare no competing interests.

Authors' Contributions

All authors contributed to the design, drafting and critical revision of the intellectual content of this case. Every listed author approved the final version to be published.

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