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Contact Tracing Following Outbreak of Ebola Virus Disease in Urban Settings in Nigeria

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African Case Studies in Public Health

Participants' Guide

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Contact Tracing Following Outbreak of Ebola Virus Disease in Urban Settings in Nigeria

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Abstract

An outbreak of Ebola virus disease occurred in Nigeria between July and September 2014. Contact tracing commenced in Lagos, and extended to Port Harcourt and Enugu as the outbreak continued to spread. A total of 899 contacts were traced. Contact tracing enhanced immediate identification of symptomatic contacts, some of whom eventually became cases. Contact tracing could be challenging in urban cities. However, use of electronic technology, adequate logistics, and highly skilled personnel enhanced the tracing of contacts to facilitate the successful containment of the outbreak. Nigeria was certified to be Ebola free on 21st October 2014. Ebola virus surveillance needs to be maintained to ensure the disease has been contained and to prevent future outbreaks. This case study aims to help trainees to review concepts, apply skills, and address challenges for contact tracing based on the experience of the Nigerian Field Epidemiology Training Network during the 2014 Ebola virus disease outbreak.

How to Use the Case Study

General instructions: This case study in applied epidemiology allows students to practice applying epidemiologic skills in the classroom setting to address real-world public health problems. The case study is used as a vital component of an applied epidemiology curriculum, rather than as a stand-alone tool. It is suited to reinforcing principles and skills already covered in a lecture or in background reading.

Ideally, 1 to 2 instructors facilitate the case study for 10 to 15 students in a classroom or conference room setting. The instructor should direct participants to read aloud a paragraph or two, going around the room and giving each participant a chance to read. When a participant reads a question, the instructor directs participants to engage in discussions or exercises as recommended in the note for the instructor in the instructor's guide. Questions are answered by participants serially based on how they are seated to ensure active participation. Sometimes, the instructor's guide may recommend splitting the class into groups to play different roles or assume different sides of the discussion when answering the question. All questions involve group discussion and reflection of the answer. As a result, participants learn from each other, not just from the instructors.

Audience: The primary audience includes residents in Field Epidemiology Training Programs (FETPs) and Field Epidemiology and Laboratory Training Programs (FELTPs). The secondary audience includes health professionals (such as disease surveillance and notification officers and other field officers) working in the African region in government and non-governmental health organisations who are interested in this topic.

Prerequisites: Before using this case study, case study participants should have received lectures or other instructions on contact tracing or read the guidelines on contact tracing.

Materials needed: A white board or flip chart is recommended for recording responses. A projector will also be required to project to the class a flow diagram.

Level of training and associated public health activity: Basic – contact tracing, i.e. this case study is for participants who may not or may already have an understanding of how to conduct an outbreak investigation such as tier 1 and 2 of the CDC Applied Epidemiology Competencies (http://www.cdc.gov/AppliedEpiCompetencies/).

Time required: Approximately 2-3 hours

Language: English

Participant's Guide

Goal of Case Study: To review concepts, apply skills, and address challenges for contact tracing based on the experience of the Nigerian Field Epidemiology Training Network during the 2014 Ebola virus disease (EVD) outbreak.

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

1. Identify and characterise types of EVD contacts
2. Explain the contact tracing process and the importance of its role in stopping the chain of transmission of EVD
3. Discuss how to manage contact tracing after its initiation
4. Interpret data on contacts and contact tracing process
5. Describe potential solutions to challenges in contact tracing including data management, socio-cultural context (stigma) and special cases

Introduction

The West Africa Ebola Virus Disease (EVD) epidemic began in Guinea in December 2013 and spread to Liberia and Sierra Leone, affecting 27,965 people and resulting in 6,476 deaths as of 12th August, 2015 [1]. EVD is a dangerous disease with a high case fatality rate. Early symptoms of EVD usually are nonspecific and may not be immediately recognised as EVD, such as fever, severe headache, muscle pain, fatigue, or weakness.

Figure 1. Map of Nigeria with a black circle marking the general area of Lagos [6]. Lagos is the economic center of the country. It is the second fastest growing city in Africa and the seventh in the world [7]. The population of Lagos is about 20 million [4,8].

On 20th July, 2014, an individual was admitted to Hospital A in Lagos, Lagos State, Nigeria with a resulting diagnosis of EVD (Figure 1). This individual, Index Case A, was the first case of EVD in Nigeria since the start of the West African epidemic.

The doctor at Hospital A suspected the possibility of EVD and collected a sample the next day. When the result was confirmed on 23rd July, Hospital A immediately informed the State Ministry of Health of the EVD diagnosis, which in turn notified the Federal Ministry of Health (FMOH). The FMOH declared an EVD outbreak on the same day and commenced contact tracing on 24th July, 2014. An Emergency Operations Centre (EOC) was constituted with five working group units: 1) co-ordination, 2) epidemiology/surveillance and laboratory, 3) social mobilisation and communication, 4) points of entry, and 5) case management. An epidemiologist (a graduate of the Nigerian Field Epidemiology and Training Program [NFELTP]) in the Epidemiology/Surveillance and Laboratory Unit was given the responsibility of overseeing the contact tracing process as Team Lead.

Question 1: What is the purpose of EVD contact tracing?

Question 2: Who would be considered an EVD contact?

Because the EVD outbreak could spread quickly and put many people at risk, time to act was limited. The head of the EOC was given three days to establish processes for all activities associated with contact tracing: contact identification, contact listing, and contact follow-up. The EOC adapted the U.S. Centers for Disease Control (CDC) Standard Operating Procedure (SOP) (Figure 2) to ensure it was relevant within the context of the Nigeria and the outbreak location namely urban settings [2].

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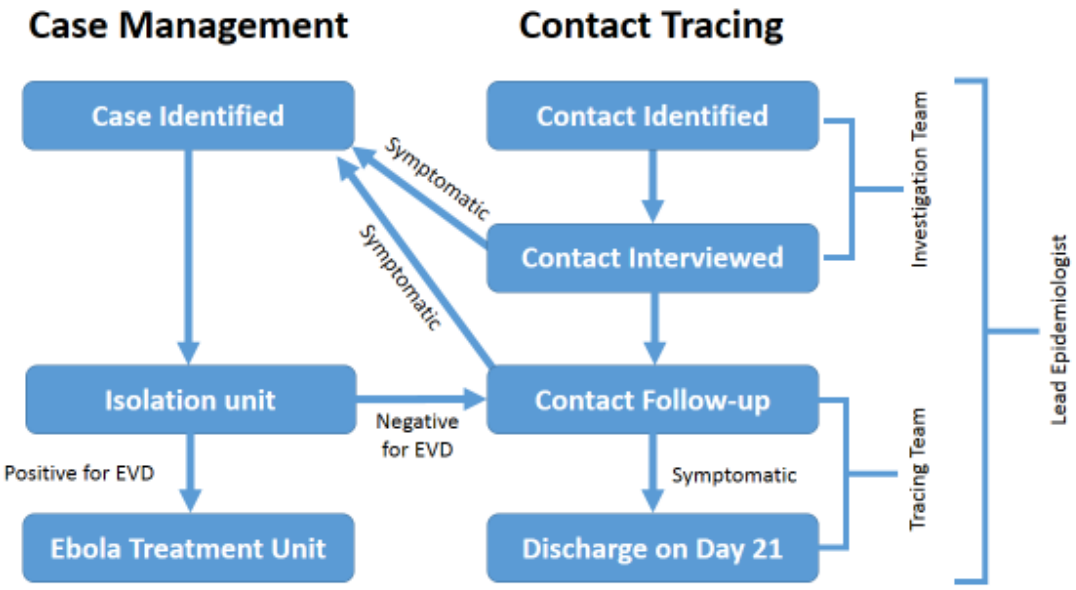
Figure 2. Flow diagram for Ebola virus disease response [2]



Question 3. Describe 1) who should be included in contact identification, 2) information that listed contacts should receive, and 3) activities and materials needed for contact follow-up.

Contact identification and listing was managed by epidemiologists and surveillance officers from the NFELTP, World Health Organisation, university/tertiary hospitals, Red Cross, and the State Ministry of Health. In addition, community health workers from the local health department, community leaders, and other volunteers – as well as the Nigerian Army, Air force, and Navy – also participated in contact follow-up. Characteristics used in selection of the volunteer contact tracers included: confidence, tact, and previous experience as a health worker and with field investigations. Before the supervisors and contact tracers teams commenced their activities, a one-day training programme was implemented to prepare them for the field work.

Question 4: What topics would you suggest for a one-day contact tracing training programme for EVD?

Question 5: What human, financial, and logistical resources were required for contact tracing?

Contact tracing began with Index Case A. Contacts were grouped into 4 categories defined by their level of risk of EVD transmission [3].

Table 1: Categorisation of EVD contacts

Level of Risk	Potential Exposure-related Activity
1	Touched the body fluid of the case
2	Direct physical contact with the body of the case
3	Touched or shared the linens, clothes, dishes, or eating utensils of the case
4	Slept, ate, or spent time in the same household or room as the case

Several contacts had more than one type of exposure, but only the more dangerous contact type was applied.

Investigation of Index Case A found that he was reportedly ill during a flight from Monrovia, Liberia. This flight stopped in Accra, Ghana, and Lome, Togo, before reaching Lagos, Nigeria (Figure 3). Index Case A could not leave the airplane by himself, so he was helped out of the airplane into the airport by airport crew in Lagos and was transported directly to Hospital A.

Figure 3. This map shows the flight pattern of Index Case A from Roberts International Airport (ROB) in Monrovia to Kotoka International Airport (ACC) in Accra to Lome-Toikin Airport (LFW) in Lome and finally to Murtala Muhammed International Airport (LOS), 2014 [6]

Question 6. List the possible contacts of Index Case A sorted by risk level in the table below.

Level 1	Level 2
Level 3	Level 4

Through interviewing Index Case A, possible contacts that may have been exposed to EVD were identified and sorted by their level of risk. Additionally, Liberia identified a number of contacts (n= 8) who interacted with Index Case A before he departed on this flight. To ensure the capacity to follow all contacts in Lagos, 23 contact tracer teams were dispatched as follows (Table 2). Additionally, daily routine activities were followed to guarantee that appropriate communication between field and headquarter teams was maintained.

Table 2: Dates and number of contact tracing teams dispatched, Nigeria, July – September 2014

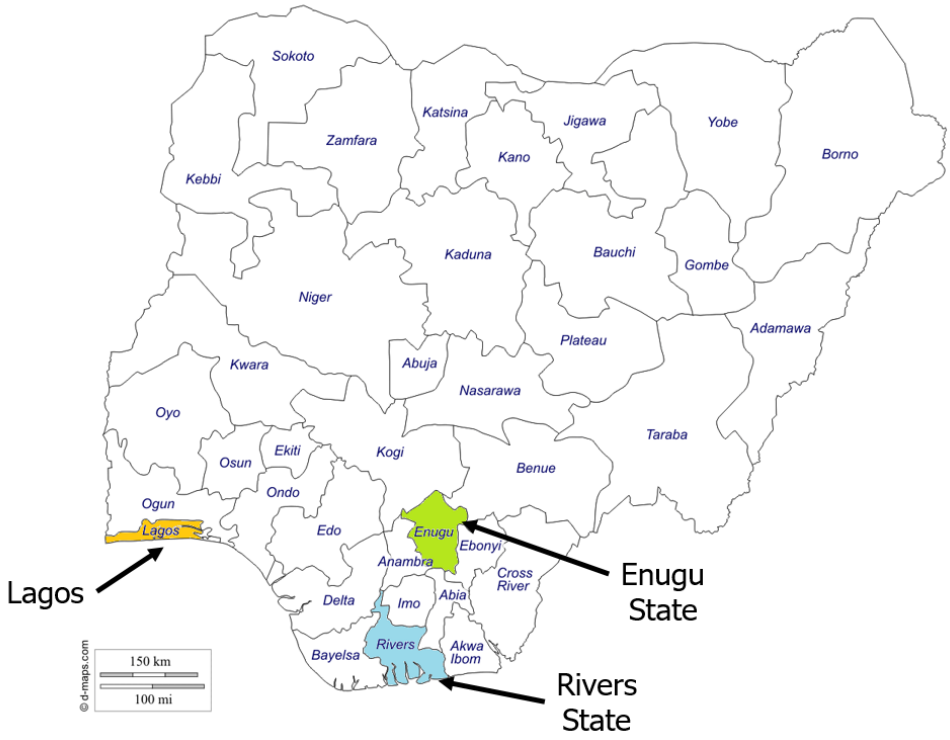
Date	Number of Teams
24th July, 2014	3
30th July, 2014	18
9th September, 2014	21

Question 7. Identify daily management and reporting procedures of the 1) Team Lead (chief epidemiologist), 2) supervisory team, and 3) contact tracer teams when following up with contacts.

Part 1: Contact Follow-up

On 6th August, 2014, the national EOC received a report of a health care worker who became ill (Case B) with suspected EVD in Enugu, Enugu State (Figure 4). Enugu is the largest city in the south eastern part of Nigeria with an estimated population of 723,000 [4]. Case B was initially being monitored in Lagos as a contact of Case A but fled to Enugu. A team was immediately dispatched to Enugu to evacuate Case B back to Lagos by ambulance in the early hours of 8th August.

Figure 4. This map highlights Lagos State, Enugu State, and Rivers State in Nigeria [5]



Question 8: Why do you think Case B was evacuated? What are the advantages and disadvantages of this approach?

Contact identification for Case B commenced immediately. Investigation findings are described in Table 3 below.

Table 3. Dates of investigation and activity of case D, 1st – 6th August, 2014

Date	Description
1st August, 2014	Case B travelled to Enugu by bus. Case B was said to be completely well.
2nd August, 2014	Case B attended a wedding at a church and a reception at a hotel. Case B was said to be completely well.
3rd August, 2014	Case B attended church service at the same church as the wedding location. Case B was said to be completely well.
4th August, 2014	Case B visited with her husband's family in the morning and returned home after she began to feel sick. Her fever noticeably began in the evening. Her husband would not reveal the identity, address, and phone numbers of his family members, even after much probing.
5th August, 2014	Case B stayed home with vomiting and diarrhea.
6th August, 2014	Case B traveled by cab to a church for private prayer with the church pastor and reportedly vomited during travel. The husband would not reveal contact details of the cab driver, despite much probing, because he feared for the safety of his own family as the cab driver knew the location of his family's house.

Possible contacts of Case B included the husband, Case B's family members, the husband's family members, church pastor, and cab drivers (only those she came into contact with when she was unwell). Teams of contact tracers working in Enugu State were able to complete between 81% and 100% of daily follow-ups. Overall, 96% of the contacts were visited through 21 days; a few contacts were lost to follow-up, and a few travelled elsewhere against recommendations.

On 25th August, 2014, the EOC received a report of a suspected EVD death of a physician (Case D) in Port Harcourt, Rivers State. Port Harcourt is a major industrial city with a large number of multinational firms, particularly petro-chemical industries. It has an estimated population of 3.3 million [4].

Question 9: How should the EOC respond to this report?

Question 10: Describe the challenges of conducting contact tracing and controlling the outbreak considering Case D reported on August 25th.

Question 11: What are possible explanations for the physician contracting EVD?

Investigations revealed that the physician who died in Port Harcourt, Case D, had treated Case C, who visited Index Case A in the hospital in Lagos on 21st July. After visiting Index Case A, Case C flew from Lagos to Port Harcourt on 1st August because he was ill and wanted treatment while avoiding the contact tracers. Case D treated Case C in a hotel in the city from 1st-5th August before Case C returned by flight to Lagos. The timeline of the Case D's illness is shown in Table 4 below.

Table 4: Date and description of illness of case D, 10th- 22nd August, 2014

Date	Description
10th August, 2014	Case D became ill
18th August, 2014	Case D was admitted to a private health facility
22nd August, 2014	Case D was diagnosed with EVD

Contacts of Cases C and D included fellow passengers; hotel staff and guests; hospital staff, patients and guests in Port Harcourt; and friends, family, and community members in Lagos and Port Harcourt.

Question 12: Draw a full transmission chain that includes details about Cases A-D. Discuss the purpose of reviewing a transmission chain.

From 23rd July to 31st August 2014, the number of EVD cases increased to 20. The increasing number of cases led to a corresponding increase in the number of contacts. Therefore, it was necessary to consider using software to manage the growing list of contacts and their information.

Question 13: What types of software are available that can be used to manage data on the cases and their corresponding contacts?

Part 2: National Contact Tracing

As the outbreak continued to spread to different regions of the country, a total of 899 contacts were identified over the seven weeks (23rd July to 9th September, 2014) of the outbreak (Table 5).

Table 5: Socio-demographic characteristics of contacts (as of 9th September, 2014)

Variables	Frequency (n=899)	Percent (%)
Location		
Lagos	362	40.6
Port-Harcourt	530	58.6
Enugu	7	0.8
Age group (years)		
0 – 9	54	6.0
10 – 19	43	4.8
20 – 29	230	25.6
30 – 39	219	24.4
40 – 49	149	16.6
50 – 59	78	8.7
≥60	40	4.4
No response	86	9.6
Sex		
Male	390	43.4
Female	509	56.6
Occupation		
Health care workers	200	33.3
Non health care workers	599	66.6

Question 14: Using the table above, describe new criteria/strategies that could be applied to contact tracing activities to ensure the teams achieve the highest follow-up rates.

Question 15: Considering how Cases B and C were discovered, how can you ensure movement restriction and reduce loss to follow-up?

As of 1st August, 2014, there were 18 contact tracer teams. By 6th August, that number had increased to 35, and by 9th September, 2014 there were a total of 51 teams.

The percentage of contact-persons traced daily ranged approximately from 72.1% - 98.1% with a mean of 96.1%. The percentage of contact-persons followed for all 21 days was 99.3 %, while the percentage of cases that had contact-person tracing implemented within 24 hours of case identification was 90.9% of case-patients [5].

Part 3: Challenges in Contact Tracing

As the EVD outbreak continued, the FMOH received several concerning reports from contact tracers about safety concerns. The contact tracing team lead and the supervisors met daily to discuss how to respond to these situations.

In Port Harcourt, Mr. P, a contact under follow-up, chased away a contact tracing team as they approached his home for the daily physical examination. Additionally, the contact tracing team was verbally abused by four of Mr. P's neighbors, all hefty young men. One neighbor even physically assaulted a team member and promised to severely beat up the team member if he ever returned. On returning home, that team member noticed that his housemates avoided physical contact with him.

Question 16: What is the danger with this situation and how can the concerns be addressed?

The SWAT (SWift Action Team) developed a system that constantly reviewed and identified contacts that could have been missed and developed strategies of resolving them by involving their employers, families, community leaders, and, in some cases, additional security agents. About 31 contacts in Port Harcourt and 11 contacts in Lagos particularly presented challenges to the team and were placed in the SWAT work plan. Using community and state security operations, all contacts were reached and eventually resolved.

In Lagos, there was a report about Mrs. X, a 40-year-old mother of four children. When Mrs. X was identified as a Type 3 contact of Index Case A and began to be visited by a contact tracing team, her neighbours suddenly refused to talk to her or enter her home. Neighbours forbade their children to play with Mrs. X's children, refused to buy groceries from her shop, and persuaded other community members to do the same by telling them Mrs. X had Ebola. Additionally, the landlord gave Mrs. X's husband a notice to leave his house within two weeks when he went to pay monthly rent.

Question 17: What challenges do contacts face in their community? What do you think can be done to avoid/stop this situation?

On 12th of August, the rumour management team of the Epidemiology/Surveillance and Lab Units received a call through the toll-free line that a staff of the hospital where the Index Case A was treated had died at home, and his body was secretly removed from his home in the early hours of that morning. Immediately, a team of contact tracers were asked to investigate.

Question 18: Why was this case investigated?

Investigation revealed that Case E (deceased; was a doctor and staff at the hospital where index case A was treated) never had any form of physical contact with the index Case A. Therefore, Case E was never listed as a contact of Index Case A and was never monitored by contact tracing team. However, on 8th August, he developed symptoms and was taken by his wife and children to another private hospital for treatment. He was discharged on the same day with a diagnosis of a case of cerebro-vascular disease (stroke). He later died at home on 11th August. The alert came when a neighbor saw that a dead body was been carried out of the house. The contact tracing team got to the body in the mortuary on 13th August, but Case E had already been embalmed.

Question 19: Do you think Case E was a case of EVD or not? If yes, why?

As the team lead and supervisory team worked to ensure that contact tracers and communities stayed safe, it was noted that as the number of suspected cases increased, there were many reports of potential cases that were revealed to be untrue. As time, personnel, and supplies were limited, it was important to separate genuine cases from rumours.

For example, one questionable report was received on 1st September, 2014. The rumour management team requested a contact tracing team in Lagos to investigate a report of a 55-year-old with fever and vomiting over the previous three days.

Question 20: What would you do to determine if this is a genuine contact or a rumour?

Through investigation, the team determined that the reported suspect case was not a true case due to a lack of history of contact with a confirmed case. Therefore, a contact team was not dispatched to investigate the case. A total of 149 rumours were received during the period of the outbreak, 95% were investigated within 24 hours of the report and only two cases were confirmed to be cases.

As the outbreak continued into its seventh week in September 2014, contacts tracers from Lagos, Enugu, and Port Harcourt began consistently reporting to EOC team leads that all contacts traced remained symptom-free.

Question 21: How long would you wait before you declare the country Ebola-free? Why?

Conclusion

Contact tracing was crucial for outbreak containment. There was an effective physical monitoring of 899 contacts on a daily basis over the seven weeks of the outbreak (23rd July to 9th September 2014). Of these 366 were registered in Lagos, 526 in Port-Harcourt, Rivers state and 7 in Enugu. High contact daily coverage was achieved over the period of follow-up with coverage of 96.1%. Contact tracing enhanced immediate identification of symptomatic contacts, 19 (2.1%) of who eventually became cases. Case fatality rate was 40%. Nigeria was certified to be Ebola-free on the 21st of October 2104.

This experience highlights some of the challenges with contact tracing in urban and mega cities. Nevertheless, use of electronic technology, adequate logistics and highly skilled personnel enhanced tracing of contacts and therefore the successful containment of the outbreak. Ebola virus surveillance needs to be maintained to ensure disease has been contained and to prevent future outbreaks.

Background Reading

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