CDC METHODS FOR IMPLEMENTING AND MANAGING CONTACT TRACING FOR EBOLA VIRUS DISEASE IN LESS-AFFECTED COUNTRIES

CENTERS FOR DISEASE CONTROL AND PREVENTION

December 2014

CONTENTS

OBJECTIVES

1. Describe the contact tracing process and the importance of its role in stopping the chain of transmission of Ebola virus disease (EVD).
2. Describe how to do contact tracing.
3. Describe how to manage contact tracing after its initiation.
4. Describe potential solutions to challenges in contact tracing.

INTRODUCTION

Ebola virus disease (EVD) is a dangerous disease with a high case fatality rate. Early symptoms of EVD are usually nonspecific and may not be immediately recognized as EVD, such as fever, severe headache, muscle pain, fatigue, or weakness. A person with EVD can spread the disease to others as soon as he or she begins to have symptoms, therefore it is critically important to identify and isolate symptomatic persons immediately to stop the disease from spreading.

Contact tracing is the process of identifying, assessing, and managing people who have been exposed to a disease to eliminate transmission. People who may have been exposed to EVD are systematically followed during the maximum incubation period of 21 days from the date of most recent exposure. This process allows for the immediate identification of people who become symptomatic. Rapid identification of symptoms and prompt isolation prevents further transmission. However, contact tracing can stop EVD transmission only if it is properly prepared for, implemented, and managed. It is important to prepare ahead of time.

This document focuses on contact tracing implementation and management in areas where there are currently no EVD cases, although it can be considered for use in any country. This document provides CDC teams with guidance for helping ministries of health to 1) prepare a country for the introduction of EVD and 2) develop standard methods to help halt EVD transmission. While this document is written to provide guidance to CDC staff, it is important to remember to adjust language to match local language and competency if used externally.

DEFINITIONS

Effective contact tracing requires the rigorous application of contact and case definitions to identify contact-persons and case-patients. Failure to apply these definitions strictly can allow ongoing transmission. The following definitions are based on the World Health Organization (WHO) contact/case definitions[7, 8]. Note that these are the *minimum* criteria. Countries can further expand the definitions based on the current context.

CONTACT DEFINITIONS

A **contact** is any person who has been exposed to a suspect, probable, or confirmed case of EVD in at least one of the following ways:

- Has slept in the same household as a case
- Has had direct physical contact with the case (alive or dead) during the illness
- Has had direct physical contact with the (deceased) case at a funeral or during burial preparation rituals
- Has touched the blood or body fluids of a case during their illness
- Has touched the clothes or linens of a case
- A baby who has been breastfed by the patient

ALERT AND CASE DEFINITIONS

These definitions are modified based on the Integrated Disease Surveillance and Response (IDSR) alert definition (definition 1, see reference 9), as well as WHO's case definitions (definitions 2-5, see reference 7 & 8).

1. **IDSR Alert:** Illness with onset of fever and no response to treatment of usual cases of fever in the area, **OR** at least one of the following signs:
    - Bleeding, bloody diarrhea, bleeding into urine

    OR
    - Any sudden death

2. **Case Under Investigation (CUI):** Any person who has **travelled to or stayed in a country** that has reported at least one confirmed case of EVD, within a period of 21 days before the onset of symptoms, and who presents with:
    - Sudden onset of high fever and any of the following symptoms: headache, vomiting, diarrhea, anorexia/loss of appetite, lethargy, stomach pain, aching muscles or joints, difficulty swallowing, breathing difficulties, hiccups

    OR
    - Inexplicable bleeding/hemorrhaging

    OR
    - Who died suddenly and inexplicably

3. **Suspect Case:** Any person **having had contact with a suspected, probable or confirmed Ebola case**, within a period of 21 days before the onset of symptoms, and who presents with:
    - Sudden onset of high fever and any of the following symptoms: headache, vomiting, diarrhea, anorexia/loss of appetite, lethargy, stomach pain, aching muscles or joints, difficulty swallowing, breathing difficulties, hiccups

    OR
    - Inexplicable bleeding/hemorrhaging

4. **Probable Case**: Any deceased suspected case having an epidemiological link with a confirmed Ebola case, where it has not been possible to test specimens for laboratory confirmation.

5. **Confirmed Case:**
    - Any CUI or suspect case with a positive laboratory result.
        - Laboratory-confirmed cases must test positive for the virus antigen, either by detection of virus RNA by reverse transcriptase-polymerase chain reaction (RT- PCR), or by detection of IgM antibodies directed against EVD.
        - The RT-PCR assay for EVD does not always detect EVD during the first three days that a patient is symptomatic. For this reason, a negative lab test (RT-PCR assay) for EVD from a blood specimen collected less than 72 hours after the onset of symptoms **does not rule out EVD.** If the patient is still symptomatic 72 hours after symptom onset, the test should be repeated. If the patient has recovered within 72 hours from the illness that brought them to medical attention, a repeat test is not required.

PREPARATION

Contact tracing can only break the chain of EVD transmission if it is implemented immediately when a case of EVD is found. Any delay can lead to a rapid spread of EVD. Therefore, preparation is essential and should include identifying and allocating the required infrastructure, personnel, funding, resources, and training before the first case of EVD is detected.

INFRASTRUCTURE

Alert system

An alert system should be in place at health facilities nationwide, particularly in districts that border EVD-affected countries and in capital cities. Healthcare providers at the health facilities need to (a) know the definition of a CUI or suspect case-patient; (b) have the capacity to detect signs and symptoms of EVD to determine if someone is a CUI or suspect case-patient; and (c) know how to activate the alert system when they encounter a person who meets the definition of a CUI or suspect case-patient. Once activated, the alert system should result in specially trained staff being sent to assess the CUI or suspect case-patient and ensure safe specimen collection and patient transport if required. The contact tracing team will also need to be able to activate the alert system if contact-persons become symptomatic. The alert system includes staff trained in case definitions and able to detect signs and symptoms of EVD.

Holding/isolation unit

These areas should be designated for the isolation of a person meeting the definition of a CUI or suspect case-patient. Although separate facilities can be created, existing infrastructure can be used. Common locations to consider include airports, border posts, and healthcare facilities. Food and basic necessities will be needed for CUI or suspect case-patients awaiting confirmation. In some settings, CUI/ suspect case-patients may have blood drawn for EVD testing in the isolation unit and have to wait there until results are received. If a CUI/suspect case-patient has a negative laboratory result before 72 hours of illness onset, a second test is needed 72 hours after symptom onset to confirm the absence of EVD. In other settings, CUI/ suspect case-patients will be transferred to Ebola treatment units for holding and testing.

Incident management framework

Includes organized teams of people who are designated to lead the response (see Figure 1). Ideally, the staff of the incident management framework would have a representative from each ministerial stakeholder. An incident manager leads the incident management framework and must have the authority to make immediate decisions, allocate resources and funds, and coordinate each involved ministry. Review Federal Emergency Management Agency (FEMA) materials on the incident management framework at http://www.fema.gov/national-incident-management-system/nims-doctrine-supporting-guides-tools. These guidelines are for use in the United States and should be adapted to fit the needs of the other countries.

Ebola treatment unit (ETU)

This is the facility where probable or confirmed case-patients of EVD go for treatment. In some settings, CUI/suspect case-patients will be taken immediately to ETUs where they will have their blood drawn and await their test results. ETUs are specifically designed to prevent transmission of EVD to others and should be set up

according to WHO and MSF guidelines. At least one ETU should be established before the first case-patient is detected in the country.

Laboratory

Having a laboratory capable of EVD testing in-country is preferred, but if that is not possible, it is important to identify a laboratory nearby that can provide rapid results. Planners should consider the equipment available (including reagents), biosafety level, and the availability of properly trained staff. WHO recommendations are available at http://www.who.int/csr/resources/publications/ebola/laboratory-guidance/en/. Standard operating procedures for proper specimen packaging and shipment need to be identified and provided to all hospitals/healthcare facilities[1,3].

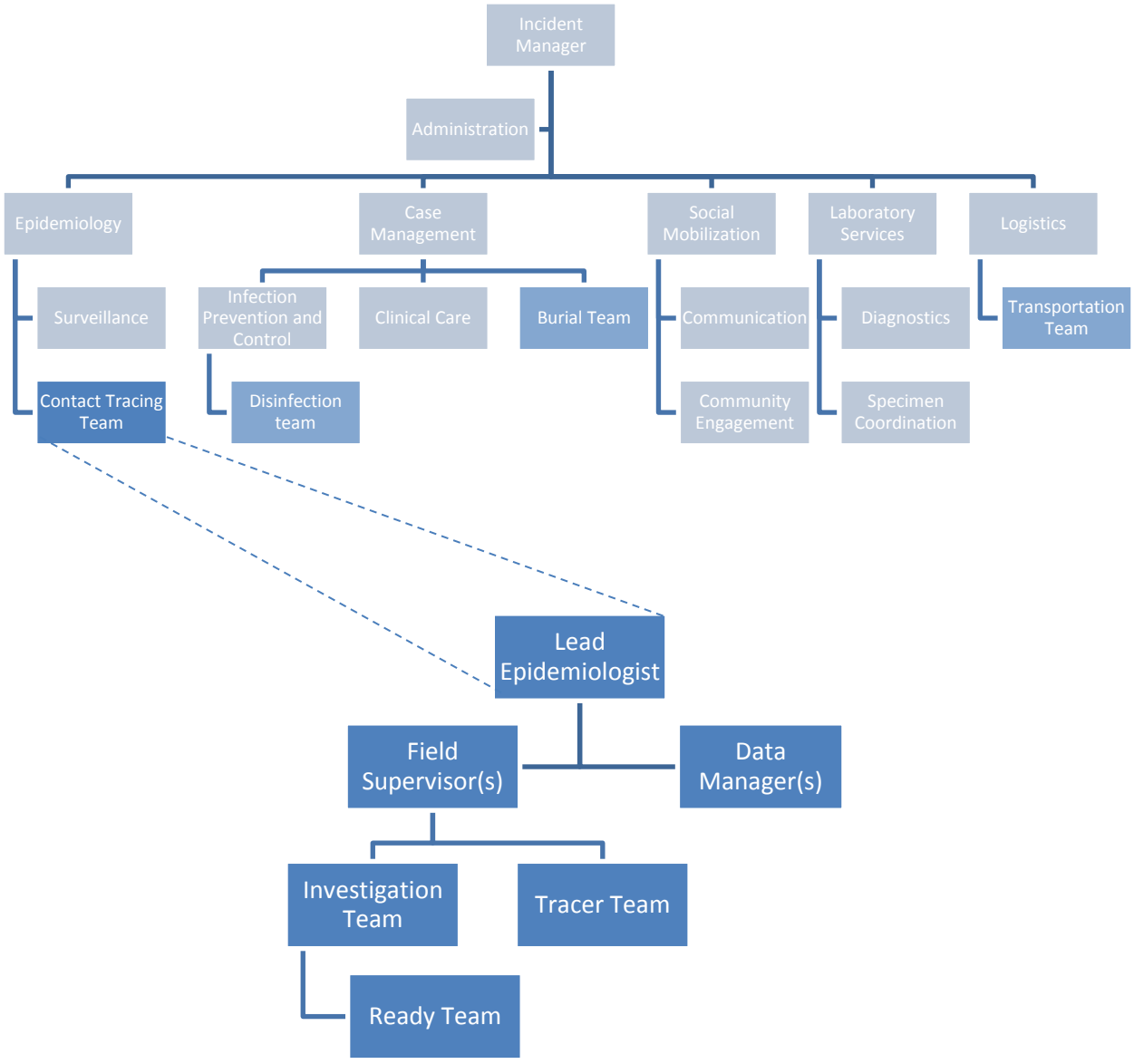
Data management

A specific data manager should be responsible for ensuring all data are entered and managed, including the daily follow-up of contact-persons. If contact-persons are in more than one district, data managers in each district may be needed. Electronic entry allows for immediate reporting to key stakeholders about current contact tracing activities, facilitates mandatory reporting to WHO, and allows for data exchange in areas that do not geographically or temporally facilitate quick or efficient reporting. Although not required, the Epi Info Viral Hemorrhagic Fever (VHF) software is free and available for managing case-patients and contact-persons at http://epiinfovhf.codeplex.com/. If the software is not working or available, data managers should use another platform, such as Microsoft Access or Microsoft Excel.

PERSONNEL

Under the incident management framework, different teams are needed to coordinate a response to identify, control, and eliminate EVD. This guide focuses on the Contact Tracing Team (see Figure 1) and provides an overview of several other teams with whom the Contact Tracing Team collaborates. These are suggested teams, titles, and responsibilities.

Figure 1: Sample Incident Management Structure for Ebola Virus Disease Response



CONTACT TRACING TEAM

Lead Epidemiologist

Background/Experience: Trained in contact tracing, the Lead Epidemiologist should be at the national level and oversees all Field Supervisors. This person should be highly organized and detail-oriented. They need to be able to commit full-time to contact tracing during an outbreak.

Responsibilities: The Lead Epidemiologist is responsible for

- Deciding which contact-persons should continue to be followed, which contact-persons are priorities, and which contact-persons can be discharged from follow-up.
- Communicating with other teams, such as the case management team and logistical team, when a contact-person becomes a suspect case-patient.
- Overseeing operations, monitoring completeness of investigations and training, and mobilizing resources.
- If the Lead Epidemiologist is at the national level, sub teams at the district and local level may need to be created.

Quantity: At least one person at the national level.

Field Supervisor

Background/Experience: An epidemiologist or other healthcare staff with prior contact tracing experience, if possible. This person should be highly organized and detail-oriented. They need to be able to commit full-time to contact tracing during an outbreak. They should speak the national language (e.g., English, French, Portuguese) and the local language of the area in which they work.

Responsibilities: The Field Supervisor is responsible for:

- Assigning tracers to contact-persons
- Handling challenges and questions that arise in the field
- Activating the Investigation Team if there is a symptomatic contact-person
- Identifying and pursuing contact-persons that miss follow-up
- Assessing quality assurance measures
- Collecting data on current tracing efforts to report to the data manager and Lead Epidemiologist

Quantity: One Field Supervisor for every 5 to 10 tracers. In addition to the number of people a supervisor oversees, geography must also be taken into consideration. A supervisor will typically oversee 1 to 2 villages or urban neighborhoods as is logistically feasible.

Data Manager

Background/Experience: Someone with prior data management experience and proficient computer skills. The person should be trained on how to use the Epi Info Viral Hemorrhagic Fever (VHF) database (http://epiinfovhf.codeplex.com/) or another database that can manage daily follow-up of contact-persons.

Responsibilities: The Data Manager is responsible for

- Making sure that all data are entered electronically and for sending reports to the Lead Epidemiologist, as well as to other reporting authorities.
- Data managers need to provide accurate, up-to-date lists of all contact-persons to be followed to the Field Supervisors (daily or every time the list is modified).
- Data managers should also analyze contact tracing data to identify problems in contact tracing (e.g. contact-persons who haven't been followed successfully, case-patients with unrealistically low number of contact-persons, etc.).
- If additional staff are used for data entry, the data manager will supervise their activities and check for data quality.

Quantity: At least one person in the initial response.

Tracer Team

Background/Experience: Each member of the Tracer Team should have undergone contact tracing training, ideally taught by CDC staff. The Tracer Team can include healthcare providers, community health workers, and community members. These individuals should be reliable and responsible, and aware of local culture and customs. The tracers also need to be people who are known and respected in the local communities so that contact-persons will actually talk to them and be honest about their symptoms. They also need to be able to read and write in the language the rest of the contact tracing team is using, as well as speak local languages in the areas they are working in. Organizing Tracer Teams by geographic areas may help maximize efficiency. In addition, using Tracers from the specific or nearby communities may increase acceptability of contact tracing activities among community residents.

Responsibilities: The team is responsible for

- Visiting contact-persons every day for 21 days. During this time, they are responsible for
    - Interviewing and asking about the health status of the contact-person,
    - Providing daily reporting of follow-up activities, and
    - Notifying the Field Supervisor when a contact-person is ill.
- Tracers should alert Field Supervisors of other problems in their villages (such as community resistance or potential case-patients among people who were not known contact-persons) and also to continue trying to identify additional contact-persons for each case-patient (sometimes people were initially reluctant to admit they were contact-persons, or simply forgot they'd had contact until a few days later).

Quantity: Ideally, at least two Tracers should be assigned to each team. The number of contact-persons assigned to each Tracer will vary.

Investigation Team

Background/Experience: Team composed of epidemiologists, clinicians, psychosocial behavioral experts (for stigma and mental health issues), and health communication experts (for education and networking issues). The team should have experience and training in asking probing contact-person tracing questions. The Investigation Team should identify a smaller group of investigators called a "Ready Team," that are on call to deploy 24 hours a day when a CUI or suspect case-patient is reported.

Responsibilities:

- Ready Team responsibilities:

    - The Ready Team is responsible for interviewing any CUI or suspect case-patient (or proxies if the person is dead) and determining if the person meets the definition of a CUI/suspect case-patient, as well as generating an initial list of contact-persons from the CUI/suspect case-patient. A clinician is helpful for determining if the person meets the case definitions.
    - If the CUI/suspect case-patient is later determined to be probable or confirmed case-patient, then the larger Investigation Team will continue to ask probing questions and visit places the person visited to find more potential contact-persons.
- Investigation Team responsibilities:
    - Once the Ready Team identifies that a CUI/suspect case-patient is a probable or confirmed case-patient, the incident management system is activated and the Investigation Team is deployed.
    - Deployed if a Tracer is concerned about the health status of a contact-person.
    - Thoroughly question all people who had an interaction with a case-patient (CUI, suspect, probable, or confirmed case).
    - Assessing a symptomatic contact-person to determine whether the contact-person should be considered a case-patient.
    - If the contact-person is deemed symptomatic and therefore a suspect case-patient, they alert the Field Supervisor.
    - Identifying all contact-persons and interview them.
    - Alerting contact-persons of their status, telling them about the contact tracing procedure, and offering support.
    - Listing all contact-persons on the **Contact Listing Form**.

Quantity: At least two people for the Ready Team and each Investigation Team.

OTHER TEAMS

Although not specifically assigned to the Contact Tracing team, it is helpful if the following teams are readily available when the first case of EVD is detected for contact tracing to operate effectively. Communication between the Contact Tracing team and other teams, via the team leads, is vital before a contact-person becomes a case-patient. Example additional teams include the following.

Transportation Team

Background/Experience: Staff must have a sound understanding of the terrain and geography of the region. They must have undergone infection prevention and control training.

Responsibilities: The team is responsible for transporting CUI, suspect, probable, and confirmed case-patients to isolation units or ETUs. The team must be equipped with a vehicle that can transport people and that carries PPE and can be disinfected.

Quantity: At least three people on a team. Two people are designated to physically transport the person under investigation if needed, and one person is designated as the driver. The number of transportation teams depends on the number of cases, contact-persons, and geographic distribution.

Disinfection Team

Background/Experience: The Disinfection Team can be composed of community members and environmental health officers (sanitarians) who have been trained in EVD infection control.

Responsibilities: This team is responsible for sanitizing places where probable or confirmed case-patients have been, places where the initial identification occurred, and burial locations, depending on the situation. Additionally, they disinfect transport vehicles and therefore, coordinate with the Burial Team and Transportation Team. Disinfection should follow the latest CDC guidelines. More information can be found at http://www.cdc.gov/vhf/ebola/hcp/environmental-infection-control-in-hospitals.html.

Quantity: At least two members per team. The number of disinfection teams depends on the number of case-patients, contact-persons, and geographic distribution.

Burial Team

Background/Experience: The Burial Team can be composed of community members as well as environmental health officers who have undergone the Ebola infection prevention and control training.

Responsibilities: The team is responsible for the burial of dead people with probable and confirmed EVD, as well as of deceased contact-persons. By default, dead contact-persons without laboratory confirmation are probable cases unless there is clear evidence that they died of other causes.

Quantity: One team of at least six people. Four people are designated to carry the body, one person to disinfect the body, and one to drive. The number of Burial Teams depends on the number of cases, contact-persons, and geographic distribution.

RESOURCES

Resources and equipment should be acquired and ready for distribution for the Ready Team and initial response processes. Although scalability should be considered, the primary focus should be on the resources required for the initial response in order to avoid a delay in the intervention.

A sample minimum equipment list is provided in Appendix A. This should only be used as a guide. The required resources will vary by country, depending on the existing infrastructure and available resources.

FUNDING

A common barrier to rapid response during initial case identification is the lack of discretionary funds or an authority to release funds immediately if needed. Any delay in response activities, even just a few hours, can result in a large transmission chain. Funding needs to be allocated during the preparation activities and before the initial case identification.

Budgetary considerations for the initiation of the rapid response are provided in Appendix B. This should only be used as a guide. Required resources will vary by country, depending on existing infrastructures and financial status.

TRAINING MODULES

Implementing contact tracing should be the priority when the first probable or confirmed case-patient is identified. The following training modules are necessary for staff to be ready to implement contact tracing immediately. Although other emergency response staff may not be directly involved in contact tracing, everyone involved in the emergency response should be aware of the general contact tracing process and its importance, including members of logistics, case management (such as healthcare workers), and social mobilization groups. These modules can be found on the CDC SharePoint website (https://partner.cdc.gov/sites/OPHPR/ebolaprep) or where listed below.

Tracer Training Module

This 1-day training course should be administered to members of the contact Tracer Team and Field Supervisors. The objective of the module is to understand EVD, how EVD is spread, infection prevention and control, the contact tracing procedure (specific to the tracers), safety, and how to deal with common challenges in the field.

Implementation and Management Module

This 2-day training course should be administered to epidemiologists and Field Supervisors. The course covers the implementation and coordination of the contact tracing process, highlighting common challenges of implementation and ongoing management (see "Contact tracing tabletop exercise").

Contact Tracing Tabletop Exercise

A simulation exercise that is usually performed on the second day of the 2-day training course in Implementation and Management but that can be administered as a stand-alone training also. The exercise was developed to be administered to contact tracing leaders, such as epidemiologists and Field Supervisors. The goal of this tabletop exercise is to identify areas for improvement but also to educate those leading a contact tracing investigation about proper protocols and problem solving, while familiarizing them with documents and resources needed to trace contact-persons. The exercise starts from the introduction of a case into a fictitious country and continues through a contact tracing simulation of case finding, contact identification, contact listing, contact follow-up, and contact discharge.

Epi Info VHF Database Training

CDC's Epi Info VHF Database is the recommended tool to track contact tracing activities. Although no formal training course exists, the manual can help in training and is essential for the data manager's training. The Epi Info Viral Hemorrhagic Fever (VHF) free software is available for managing case-patients and contact-persons at http://epiinfovhf.codeplex.com/ and several guides and video tutorials are also available on this site under the "Documentation" tab.

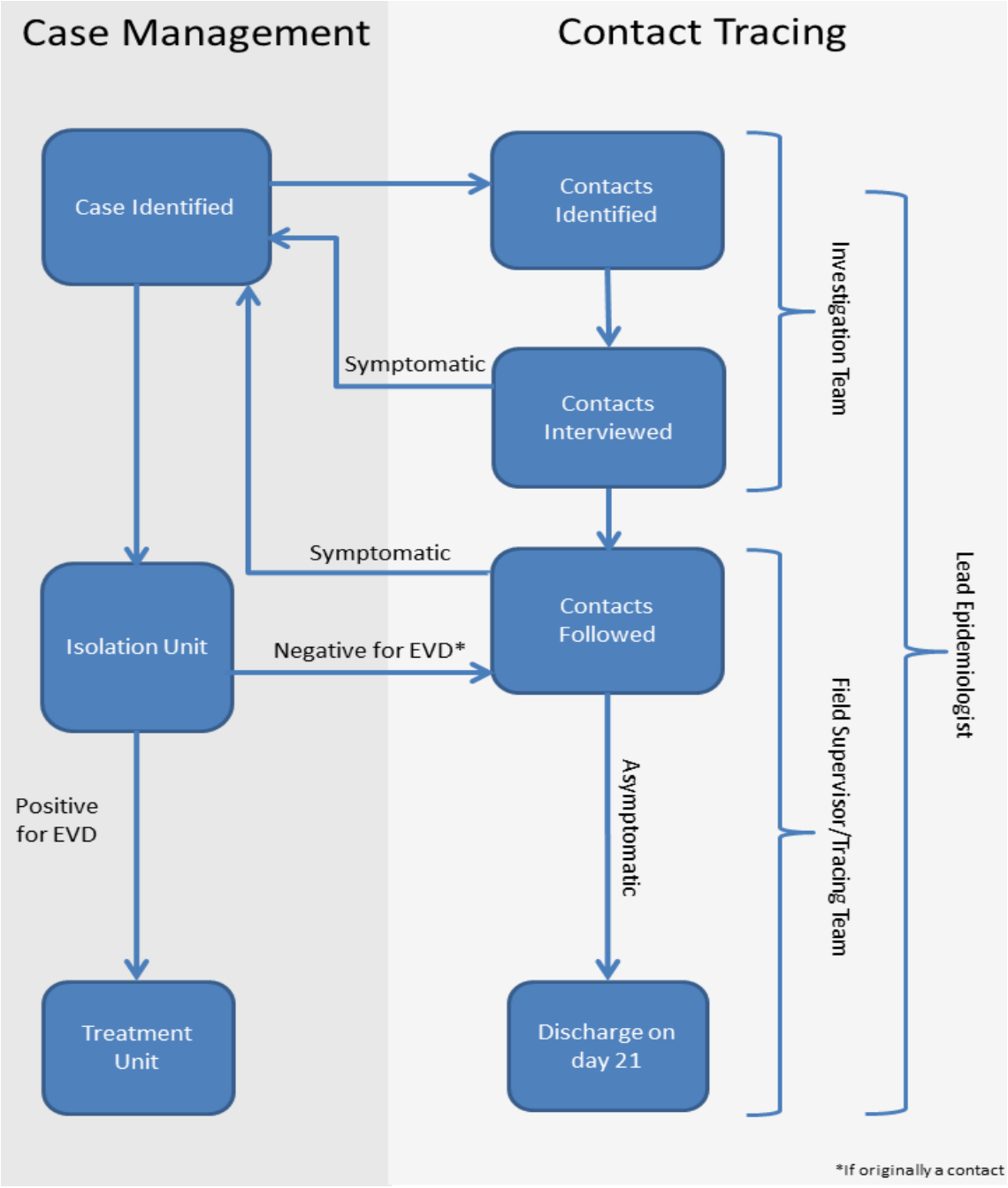
Infection Prevention and Control Training

This training is essential for all personnel who will be involved with the Ebola response. In addition to basic understanding of infection prevention and control, the training covers procedures that are specific to EVD, such as proper use of PPE. There are no formal training courses at this time but guidelines are available from WHO and CDC[4].

IMPLEMENTATION

General contact tracing procedures follow. A flow diagram is provided in Figure 2. An outline of the step-by-step procedures is available in Appendix C.

Figure 2: Flow Diagram for Ebola Virus Disease Response



CONTACT IDENTIFICATION

When a CUI or suspect case-patient of EVD is first detected, the Ready Team should be immediately activated to investigate. Do not wait for laboratory confirmation to initiate preliminary contact tracing.

The Ready Team should generate an initial list of contact-persons for the CUI/suspect case-patient. If the person meets the definition of a probable or confirmed case, then the Incident Command Structure is activated and the greater Investigation Team is notified to deploy.

The Investigation Team systematically identifies all potential contact-persons since the case-patient's onset of symptoms (see Appendix D). They should ask probing questions to find out all the case-patient's activities since the onset of illness and identify everyone involved in those activities. This interview is comprehensive, detailed, and extensive. No aspect of the case-patient's daily activities since becoming ill should be missed. Find out all the activities the case-patient performed, and identify other people who were involved in the activities since the case-patient started to feel sick.

If the case-patient is well enough to talk, the Investigation Team asks questions directly to the case-patient. If the case-patient is dead, the team will talk to people who were involved in situations surrounding the dead person in the hours and days before death. The team should talk to family and other contact-persons regardless of whether the case-patient is alive or dead – sometimes a case-patient may forget or deliberately leave contact-persons off the list (or the contact-person might be too sick to provide an accurate list). The team gathers information from people who had geographic proximity to the case-patient, including family and neighbors, and therefore must visit the household of each case-patient.

To ensure a complete and accurate list of contact-persons, the team may have to conduct several interviews and visit places that the case-patient went to after they started to feel sick to get the names of contact-persons that the case-patient does not know (such as others at a restaurant, hotel, conference, market, or clinic or workplace). All persons, including the case-patient as well as their family or other close contact-persons, should be provided with an easy way to reach the Investigation Team if he or she recalls more contact-persons after an interview is over.

CONTACT LISTING

Each potential contact-person identified by the Investigation Team is reported on the **Contact Listing Form** (Appendix D). This form can also be printed from the Epi Info VHF application. Information should be collected about:

- A contact-person's interaction with the case-patient
- Their relationship to the case-patient
- Date of last interaction
- Type of interaction

Additional information should include where the contact-person lives (address) and a telephone number.

Each potential contact-person listed will then be interviewed by the Investigation Team**.** During this interview, the potential contact-persons will be asked about their last date of interaction with the case-patient. If there is a

discrepancy between the date listed by the case-patient and the date listed by the contact-person, the most recent date will be used as the start of the 21-day follow-up period.

After the interview, exposure status of the potential contact-person is determined by the team's Lead Epidemiologist. If any risk is established, then the potential contact-person is defined as a contact-person and will need follow-up. If no risk is identified, the person will no longer be considered a contact-person and will not need follow-up.

When contact-persons are identified and confirmed, they should be informed of their risk status and the plan for follow-up. Contact-persons should be educated about the signs and symptoms of EVD and preventive measures they should take to protect themselves and others. They should be given information to allow them to alert the Tracer Team, the Field Supervisor, and the local public health office if any symptoms develop. If symptoms do develop, the contact-person should then self-isolate and notify their tracer, in order to keep others from getting EVD. The contact-person should also be made aware of the importance of notifying the team if they move or leave the area.

Any contact-person that is found to be symptomatic during the initial interview is a potential suspect case. In this situation, the Investigation Team will contact the Field Supervisor, who will activate the Transportation and Disinfection Teams. The suspect case-patient will then be transported to an isolation unit for further testing. While awaiting EVD testing, the contact identification and contact listing should be initiated for this new suspect case-patient.

The required follow-up may vary depending on the policies of the ministry of health. In some cases, asymptomatic contact-persons will be allowed to continue their activities of daily living during the 21 days of follow-up provided they have timely access to healthcare facilities if they become symptomatic (5). More stringent guidelines such as in-home quarantine of high-risk contact-persons can be used at the country's discretion.

CONTACT FOLLOW-UP

The Tracer Team performs contact follow-up through daily visits with the contact-person at a predetermined location and time. Tracers should ideally be assigned to the same contact-person for all 21 days of follow-up. This will ensure continuity and the development of a relationship, which will foster trust. Such an environment will encourage contact-persons to report if they develop symptoms. Additionally, this continuity will help identify the details of a contact-person's activities of daily living, to ensure that all contact-persons are consistently found every day of follow-up.

During the daily visits, Tracers will evaluate the health status of the contact-person by direct observation and by asking at least the following two questions: 1) How are you feeling? 2) Have you had a fever? This data should be recorded on the **Daily Contact Follow-Up Form** (Appendix E). If the contact-person reports no symptoms, the temperature can be measured. Measuring the temperature is not required but is at the discretion of the country and the context of the EVD response. If resources are available, each contact-person should receive a thermometer to use during the 21 days so the Contact Tracer can avoid direct physical interaction with the contact-person*.

If there is any concern about the health status of the contact-person during the follow-up process, the tracer should immediately communicate with the Field Supervisor, who will activate the next step in the alert system to determine if the contact-person meets the suspect case definition.

*Do not over rely on temperature, particularly using the Thermo-Flash, which may be less accurate when used outside of ideal conditions, such as arid or extreme temperatures. Subjective fever and or other symptoms in a contact-person should arouse suspicion.

If the contact-person fits the case definition of a suspect case, the Field Supervisor is alerted. The Field Supervisor will alert the Lead Epidemiologist, who will coordinate with the case management team to activate other teams, like the Transportation Team and Disinfection Team. The Investigation Team should coordinate efforts with other teams like the Disinfection and Transportation teams to ensure they reach the suspect case-patient quickly. The suspect case-patient should be sent to an isolation unit for medical care and confirmation testing. During this time, the Investigation Team should start contact identification for this new suspect case-patient.

The RT-PCR assay for EVD does not always detect EVD during the first three days that a patient is symptomatic. For this reason, a negative lab test (RT-PCR assay) for EVD from a blood specimen collected less than 72 hours after the onset of symptoms **does not rule out EVD.** If the patient is still symptomatic 72 hours after symptom onset, the test should be repeated. If the patient has recovered within 72 hours from the illness that brought them to medical attention, a repeat test is not required.

If the contact-person-turned-suspect case-patient tests negative for EVD after day 3 (72 hours) of symptoms, the suspect case-patient can return home and continue with the previous 21-day follow-up process, as they now return to being a contact-person. Note that if a suspect case-patient was brought to an ETU but tests negative, MSF recommends restarting the person's 21-day follow-up period with day of last exposure as the day of discharge from the ETU. This is because the person was in the ETU and thus potentially exposed to other case-patients in the ETU. However, this is a difficult situation because it may worsen fear of ETUs in the community if people are told they have to be followed for 21 days in case they were infected in the ETU. Thus some countries may choose to not implement this guideline.

If the suspect case-patient tests positive for EVD, the patient is now a confirmed case-patient and will be transported to an ETU (or other designated location for evaluation of EVD patients) and the Investigation Team will continue with this case-patient's contact identification and tracing (Figure 2).

The Tracer Team should report all contact-persons found and any contact-persons that were not found at the end of the day to the Field Supervisor. This should be recorded by listing the names of all the contact-persons in the appropriate categories in the **Tracing Summary Form** (Appendix F). The information should then be given to the Data Manager, who in turn will send the information to the Lead Epidemiologist.

CONTACT DISCHARGE

Contact-persons who have been seen and interviewed on the 21st day and do not have symptoms of EVD, can be discharged from the tracing process. Contact-persons who have not been seen on day 21 require priority follow-up daily until found. No contact-person can be discharged from follow-up without being seen and evaluated on the 21st day or later.

DATABASE MANAGEMENT

To effectively and efficiently manage case-patients and their respective contact-persons, an electronic database is a necessity. In addition to being able to register information about case-patients and contact-persons, the database should be able to produce daily reports, export data for analysis, geographically map contact-persons, and visually represent the chains of transmission if possible. However, if the number of contact-persons is small,

these extra features may not be necessary. Using an electronic database will allow quick reporting of data and trends, which in turn will allow quicker decisions about the contact tracing process.

Although the VHF Epi Info database is recommended, other databases, such as WHO's Field Information Management System (FIMS), can also be used.

If sufficient resources and infrastructure exist, electronic data collection in the field should be considered. This would include providing mobile data collection devices (such as smartphones or tablets) to Investigation and Tracer Teams so they could enter all data directly. This would reduce the need for paper forms and additional data entry; it would also require coordinating data movement from the field to the office either using the Internet or by manually connecting devices to office computers.

CONTACT TRACING MANAGEMENT

PERSONNEL

HIRING

Because of the increased exposure to suspect and confirmed EVD case-patients that can occur while performing contact tracing, hiring staff may be challenging. Addressing this will be country-dependent but incentives include

- Increasing wages
- Providing health and/or life insurance for staff
- Providing PPE for staff

Potential staff should be reassured that all the training and resources will be provided for them to perform their job safely.

Additionally, staff may be stigmatized by their peers, families, or communities by engaging in EVD control activities. Health communication and education efforts in the community may help to reduce these stigmas. EVD survivors are ideal for helping in this effort. Another great strategy is to educate communities about how contact tracing is the best way to fight Ebola and keep their community safe – contact tracing staff are heroes!

Paying staff on time is very important. Personnel should know how much and how often they will be paid and that they will be paid reliably. However, they should be paid only after they perform their duties.

TRAINING

Training should be provided when employees are hired and before the employee starts contact tracing. Ensure that they feel comfortable with and are well-trained to perform their assigned duties. Training should be tailored to their job duties, and refresher trainings should be conducted regularly to remind staff of standard operating procedures and to counteract "bad habits" they may develop in the field. Retraining may also be necessary if issues arise in the field that the teams are not properly trained for or if standard operating procedures change. Educate tracers and local officials about EVD. Without education, tracers may be afraid to interact with contact-persons.

There are situations when contact-persons will outrank the tracer (for example, the tracer is a nurse following a contact-person who is a doctor). These rank differences can impede the contact follow-up process if the contact-person refuses to be followed by the tracer. Awarding a formal certificate of completion to those who have undergone training may help prevent this problem.

It's also important to empower contact tracers by telling them that many people don't understand the symptoms of Ebola and many people are afraid to admit they are sick, so they really need to verify for themselves the health status of each contact-person instead of trusting what the contact-person reports. Tracers should also be told that if they're having a problem like this, they need to alert the Field Supervisor so that the contact-persons in question can receive education or an alternative follow-up plan can be developed.

HEALTH

Maintaining the health of staff is essential so that they can fulfill their duties. Health care should be provided for any medical issues, including EVD infection, while employed.

The health of staff depends on maintaining their safety while interacting with contact-persons and potential case-patients. The following measures should be strictly enforced:

- Avoid direct physical contact with all contact-persons, like shaking hands or hugging.
- In highly affected countries, avoid all contact with anyone in an affected village.
- Maintain a distance of at least 3 feet (1 meter) from the contact-person at all times.
- Do not enter a contact-person's home.
- Do not sit in chairs in or near the contact-person's home.
- Do not share or accept a meal or drink with the contact-person. Try to have a good breakfast before home visits to avoid the temptation of eating or drinking while visiting contact-persons.
- If you must take the contact-person's temperature:
    - Wear gloves when taking the contact-person's temperature.
    - Have the contact-person turn around and take their temperature in the armpit.
    - Avoid touching the contact-person and step back to wait for the thermometer result.
- Otherwise no physical protective equipment (PPE) should be worn.
- If the contact-person is visibly ill, do not take their temperature. Notify the Field Supervisor.
- Maintain infection prevention and control measures.

It can be very alarming for communities if contact tracers show up wearing protective gear – then the entire community feels like they need protective gear and there's a huge risk of stigmatization for the contact-persons. If PPE is provided to staff it should be provided on the understanding that it won't be worn when initially going to see contact-persons, only if the staff becomes aware that someone they are interacting with is ill.

SAFETY

Safety of staff is essential. The following should be communicated to staff and strictly enforced.

- Do not enter communities that seem hostile, aggressive, or unwelcoming.
- Do not try to stop contact-persons or case-patients who are trying to flee.

The Field Supervisor should be immediately contacted if there are any incidents so that the appropriate support and resources can be provided to the affected staff member. The Field Supervisor also needs to communicate with another appropriate team (such as a community education team) to try to resolve the problem that occurred in the community.

Engaging local law enforcement, police, or military may be necessary, depending on the country and context, but training staff adequately in infection prevention and control for EVD should help avoid this outcome. If security professionals interact with any EVD case-patients, they themselves may meet the definition of a contact-person and require Tracer Team follow-up.

It may be important to involve community members or liaisons before arrival in certain jurisdictions to ensure local customs, practices, and attributes are acknowledged and respected, which will help increase the likelihood of being welcomed into the community and improve safety. For example, in Guinea before contact tracing was started in a new village, a key first step was to meet with the village chief to tell them why contact tracing is important. Meeting with local community members before starting contact tracing activities can really help reduce resistance.

CONTACTS

IDENTIFICATION AND ENROLLMENT

Contact tracing relies on a case-patient's willingness to identify potential contact-persons. Failure to identify even a single contact-person that could become a case-patient can lead to more spread of EVD. Case-patients may be unable to remember all their contacts, especially if they have been sick for a long period. The members of the Investigation Team are epidemiologists with skill in contact tracing, and asking probing questions. The Investigation Team needs to develop a list of contacts for a case-patient in order to find all contacts. During initial contact tracing, it may be helpful to split investigation teams so that one group can focus on healthcare contact-persons and one focuses on community contact-persons. However, it is important to maintain strong communication between teams (there may be overlap in contact-persons).

Probing questions should be context- and culture- dependent and should focus on the period when the case-patient developed symptoms. Questions should be designed to elicit the names of

- People with direct physical contact
- People with sexual contact
- People who lived with the case-patient in the same household
- People who visited the case-patient (e.g., at home, healthcare facility, funeral/burial)
- Places the case-patient visited (e.g., work, pharmacy, church, extended family, traditional healers)
- Healthcare facilities visited/used by the case-patient and all healthcare workers who cared for the case-patient

It may be helpful to use a calendar or specific dates, such as holidays or birthdays, to help potential case-patients recall activities. Additionally, when people under investigation and probable or confirmed case-patients are first notified of their status, the fear response can slow down their ability to recall contacts. Including psychosocial support staff on the Investigation Team may facilitate contact identification.

In the event that the case-patient is dead, the Investigation Team should identify the following:

- All people who lived with the case-patient (alive or dead) in the same household since symptoms started
- All people who visited the case-patient (alive or dead) either at home or in the health care facility since symptoms started
- All places visited by the case-patient since symptom onset (e.g., traditional healer, church/mosque, place of work)
- All health care facilities visited by the patient since onset of illness and all health workers who attended to the patient (alive or dead)
- All people who had contact with the dead person, including those who attended burial ceremonies
- Anyone else who might have been exposed to the case-patient (alive or dead)

Enrollment of contact-persons requires that they can be found and interviewed by the Investigation Team. Finding all contact-persons can be a massive logistical challenge. Common challenges include contact-persons without addresses, locations with no street names, regions using personal nicknames for family members, and countries with no national identification program (e.g., no licenses, birth certificates or other national identification). Some resolutions to these challenges have included engaging community leaders to help find where contact-persons live and enlisting the help of cell phone companies to perform GPS tracking of contact-persons.

The use of local law enforcement may be needed to find contacts.

STIGMA

Enrollment of contact-persons relies on their willingness to be followed, and they may be less willing to be followed based on their understanding of EVD, the stigma associated with being a contact-person (from peers, family, or the community), and how they feel about the overall EVD response. They also may not want to be found if they know quarantine or prohibitions from work or school are likely, and they may not want to report other contacts because of this stigma. Therefore the information that the Investigation Team provides to the contact-person is very important, as well as the health communication in the community and the psychosocial support.

The following measures may help avoid stigma:

- Engage and educate community leaders regarding EVD infection, spread, and how the community can combat it. Religious centers, like churches, may be a great resource for getting messages to community and potential contact-persons.
- Use early health communication and education efforts before the first introduction of EVD.
- Use early psychosocial support to overcome the fear associated with EVD.
- Determine a “safe” meeting place and time for contact-persons that will not identify them as an EVD contact-person to their peers, family, or community (optional).
- Educate the media on the importance of a contact-person’s confidentiality.

FOLLOW-UP

A contact-person may be unwilling to continue in the follow-up process in order to maintain activities of daily living. This pressure can result in the inability to commit to daily meetings with tracers. Contact-persons that continue to work in jobs which require interactions with large numbers of people or that impede a contact-

person's ability to report immediately if symptoms develop (for instance, flight attendants) should be taken into consideration.

Measures that can be used to overcome this pressure include

- Engage community leaders about the importance of the follow-up process
- Create incentives to participate *
- Provide basic resources such as food, water, soap, buckets, and at home PPE kits*

*Note that if these are offered, people may come forward who are not actually contact-persons.

Contact-persons may flee the area for several reasons. Any lost contact-person can hurt the contact tracing process and the ability to stop the ongoing spread of EVD. Countries should develop a standard operating procedure for how to classify flight risk in contact-persons and document what the correct response should be. Countries can decide to create a special Tracer Team to work with evasive contact-persons. Quarantine should be instituted for contact-persons at high risk for fleeing.

POST FOLLOW-UP

Contact-persons who have completed the 21-day tracing may continue to be stigmatized by their family, peers, or community. Health communication campaigns and educational activities and efforts may need to be considered to help the contact-persons return to their community.

QUALITY ASSURANCE

Ensuring that contact tracing is operating efficiently and effectively is essential to ending the spread of EVD. Even a single contact-person that is lost to follow-up or not accurately assessed clinically increases the risk that EVD will spread. Quality assurance should be performed at all steps of the contact tracing process. More specifically, the following should be addressed by the listed personnel.

Ready Team(s)/ Investigation Team(s)/Lead Epidemiologist

- Evaluate case-patients with a low number of reported contact-persons. This information should come from the data manager.
    - The number will depend on the geographic location, culture, living conditions, activity/profession, and the amount of time the case-patient was symptomatic before being found.
    - Be cautious when the numbers don't match to previous case-patients with similar characteristics.
        - Consider re-interviewing the case-patient, family, and neighbors.
        - Consider prompting for additional daily activities that the contact-person may have forgotten.

- Another key way to assess contact tracing quality is to assess how many new case-patients were previously being followed as contact-persons. If case-patients occur in people who weren't already listed as contact-persons, something is going wrong.

Field Supervisor(s)

- Ensure tracers are visiting the contact-persons they are required to evaluate each day.
    - If the technology is readily available, employ mobile GPS tracking of the contact tracers.

    - If culturally appropriate, consider having the tracer take a picture of the contact-person near a key landmark associated with the contact-person to submit to the field officer each day.
    - Perform house-checks by randomly selecting contact-persons of different Tracer Teams and interview the contact-persons to ensure they have been receiving a visit by a tracer every day. If days were missed, confirm they were accurately recorded by the Tracer Team.
- Ensure tracers are providing an accurate assessment of a contact-person's health status†
    - Perform house-checks by randomly selecting contact-persons of different Tracer Teams to interview and evaluate whether the assessment of the health status is similar to the tracers' reports.

†Although it is recommended that a single tracer be assigned to the same contact-person for all 21 days, if there is significant fear and stigma associated with the ETUs in the country, the developing relationship may make the tracer less likely to report should the contact-person start having symptoms that could be EVD.

QUALITY MEASURES

The following quality measures have been adopted from the WHO Ebola Response Roadmap and modified for this document (6). The Lead Epidemiologists and Field Supervisors must be held accountable for ensuring all of the following quality measures are accurate and complete to help stop the spread of EVD. The following quality measures should be used:

- Daily situational reports (also called SitReps)
- Weekly active surveillance reports
- Percentage of contact-persons being traced daily (goal is to reach 100% of contact-persons)
- Percentage of contact-persons followed for all 21 days (goal is to reach 100% of contact-persons)
- Percentage of cases that had contact-person tracing implemented within 24 hours of case identification (goal is 100% of case-patients)

Additionally, the Field Supervisors and Lead Epidemiologists should prioritize the contact-persons not reached each day and identify if some have not been reached for multiple days. These contact-persons must be reached to ensure that they are not lost to follow-up.

SCALABILITY

Although the initial focus should be on preparing for an initial case and the case-patient's contact-persons, there should be planning at the same time to be able to increase the size and scale of the response.

Scale-up requires hiring more personnel, expanding infrastructure, and acquiring more resources, as well as the financial sources to support these efforts. A country plan should be in place to coordinate scale-up, possibly involving assistance from external sources and the international community. Additional sources of funding (such as nongovernmental organizations) should be considered.

In the event that the emergency response needs to be scaled up because of an increase in the number of case-patients or contact-persons, the contact tracing process can be modified to hire more investigation teams, Field supervisors, and contact tracers.

Additional measures for scale-up will depend on the country and the outbreak scenario.

CONCLUSION

Contact tracing is essential for the identification, control, and elimination of the spread of EVD. If even one contact-person is missed, continued spread is possible and can lead to a rapid increase in the number of case-patients and contact-persons, quickly overwhelming the response. It is therefore extremely important that contact tracing is started immediately and managed correctly so that the EVD response will be effective.

APPENDICES

APPENDIX A: SAMPLE EQUIPMENT LIST FOR EBOLA VIRUS DISEASE RESPONSE

	Contact Tracing Team				
	Lead Epidemiologist	Field Supervisor	Investigation Team	Tracer Team	Data Manager
Personal Protective Equipment					
Disposable gloves			X	X	
Gowns					
Face shield (or goggles)					
Face mask N95/FFP2					
Surgical mask for the case-patient					
Biohazard plastic bags					
Information Technology					
Global positioning system (GPS)		X	X	X	
Cell phones (with credit)	X	X	X	X	X
Computers	X	X			X
Internet Access	X	X			X
Electronic data collection tools			X	X	X
Field Equipment					
Thermometers[1]				X	
Office supplies[2]	X	X	X	X	X
Weather appropriate gear[3]			X	X	
Hand sanitizer or bleach	X	X	X	X	X
Appropriate forms	X	X	X	X	
Transportation					
Driver/car		X	X	X	

[1] Do not over rely on temperature, particularly using the Thermo-Flash which may be less accurate when used outside of ideal conditions, such as arid or extreme temperatures. Subjective fever and or other symptoms in a contact-person should arise suspicion.

[2] Such as paper, pens, folders (or waterproof folders if it is rainy season). Most people do not have these materials already.

[3] For example, if it is rainy season, rain coats and rain boots.

APPENDIX B: BUDGETARY CONSIDERATIONS FOR EBOLA VIRUS DISEASE RESPONSE

Setting up a functional system for contact tracing requires significant human, financial, and logistical resources. These suggestions below provide an example of resources needed for contact tracing. These examples are for the Contact Tracing Team only. Other teams mentioned in this document will also need to be budgeted. For a more detailed template budgeting tool for contact tracing, please see the WHO document "*Contact Tracing During an Outbreak of Ebola Virus Disease* (7)."

Example Resources Needed:

Salaries

- Lead epidemiologist
- Field supervisors
- Ready Team / Investigation Team
- Tracers
- Data manager
- Driver(s) (if used)

Equipment

- See **Appendix A** but also consider:
    - Cost of cell phone credits
    - Printing forms
    - Hand sanitizer

Transportation (for Field Supervisors, Tracers, and Investigation Team)

- Taxis (if used)
- Fuel (if using own vehicles)
- Rental vehicles (if needed)

APPENDIX C: STEP-BY-STEP PROCEDURE FOR EBOLA VIRUS DISEASE RESPONSE

Initial Case Identification:

1. The initial suspect EVD case-patient is identified by the alert system.
2. The Ready Team is activated.
3. The Ready Team assesses the patient's clinical signs and symptoms as well as their risk factors and determines whether they meet the definition for CUI or suspected case-patient.
4. If the patient meets the definition for CUI or suspected case-patient, the investigation team interviews the CUI and performs a household visit to establish an initial list of contact-persons.
5. The Investigation Team meets with each contact-person and performs the following tasks:
    a. Assess the health status of the contact-person.
    b. Alert the contact-person of their status.
    c. Interview the contact-person.
    d. Explain the procedure of being traced daily for 21 days.
    e. Evaluate flight risk of the contact-person.
    f. Identify an appropriate meeting place and time for follow-up with the contact-person.
    g. Identify a tracer to follow up with the contact-person for 21 days.
    h. Prepare the **Contact Listing Form** (Appendix D).
6. The Lead Epidemiologist assigns Field Supervisors based on the geographic distribution of contact-persons.

Daily:

7. The Lead Epidemiologist distributes an updated contact list to Field Supervisors.
8. The Field Supervisors meet with their assigned Tracer Teams and distribute the contact list for each team, clustering contact-persons with geographic proximity.
9. The tracers meet each contact-person and perform the following tasks:
    a. Observe the contact-person's general condition for any overt signs of illness.
    b. Interview contact-person regarding health status (presence of absence of specific symptoms).
    c. Fill out the **Daily Contact Follow-Up Form** (Appendix E).
    d. Ask if the contact-person knows of anyone else who is sick.
10. The Field Supervisor provides
    a. Logistical support, including arranging the transportation of Tracer Teams and ensuring payment.
    b. Activation of the next step in the alert system (which is setting-specific) for any contact-person whom tracers identify as having developed symptoms.
    c. Quality assurance to ensure accuracy of the tracer's reports. Check on:
        i. Number of contact-persons followed that day vs. the number of contact-persons recorded on form.
        ii. Number of contact-persons well, symptomatic, and not seen (not just symptomatic contact-persons).

iii. Contact-persons not seen in the past 24 hours, who should be investigated by contact tracers using all the information they can gather from the family or neighbors.
iv. Completeness of the form per contact-person (demographic information, symptoms).
v. Contact-persons not seen to determine if sufficient follow-up was done or if there is additional investigation to be done.

d. Review of any safety or security concerns with contact-person tracers (check if tracer is ill).

11. At the end of the day, tracers contact their Field Supervisors and report on the status of their contact-persons.
12. The Field Supervisors complete the **Tracer Summary Form** based on the information provided by the contact tracers and Investigation Team, and the data is sent to both the Lead Epidemiologist and data manager.
13. The Data Manager or data entry staff enters the data electronically.
14. The Data Manager assesses whether there are case-patients with no or too few contact-persons, whether there are contact-persons that haven't been seen for several days with no explanation, and gives that information to the Lead Epidemiologist.
15. The Lead Epidemiologist reviews the data and sets up the list of current/ongoing contact-persons for the following day.
16. Ensure all symptomatic contact-persons have been followed up.

APPENDIX D: CONTACT LISTING FORM FOR EBOLA VIRUS DISEASE RESPONSE (FOR EPIDEMIOLOGIST)

CONTACT LISTING FORM[1]

Case Information

Outbreak Case ID	Surname	Other Names	Head of Household	Address	Town	District	Date of Symptom Onset	Location of Case Identified

Contact Information

Surname	Other name	Sex (M/F)	Age (y)	Relation to Case	Date of Last Contact with Case	Type of Contact (1/2/3/4)* List all	Head of Household	Address	Town	District	Phone Number	Health Care Worker (Y/N) *If yes*, what facility?

*** Types of Contacts**

1 = Touched body fluids of the EVD case (blood, vomit, saliva, urine, feces, semen, sweat)

2 = Had direct physical contact with the body of the patient (alive or dead)

3 = Touched or cleaned the linens, clothes, or dishes of the patient

4 = Slept or ate in the same household as the patient

Contact sheet filled by: Name: Title: Telephone:

[1] *For use by epidemiologists interviewing anyone with a suspected, probable, or confirmed case of Ebola virus disease (EVD).*

APPENDIX E: DAILY CONTACT FOLLOW-UP FORM FOR EBOLA VIRUS DISEASE RESPONSE (FOR TRACERS)[2]

DAILY CONTACT FOLLOW-UP FORM FOR TRACERS

Name: _____ Gender: _____ Age: _____ Date of last contact (dd/mm/yy): _____

Address: _____ Telephone number: _____

Instructions: For each day, evaluate the contact-person for the symptoms below and write "yes" if the contact-person has the symptom and "no" if the contact-person does not have the symptom. If a contact-person has any of the symptoms, immediately call the Field Supervisor at: _____.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Date																					
Fever																					
Malaise																					
Muscle pain																					
Headache																					
Weakness/ Fatigue																					
Sore throat																					
Vomiting																					
Diarrhea																					
Rash																					
Hemorrhage																					
Hiccups																					

Comments:

[2] For use by Tracers who are following contacts of suspected, probable, or confirmed cases of Ebola Virus Disease.

APPENDIX F: TRACING SUMMARY FORM FOR EVD RESPONSE (FOR FIELD SUPERVISOR)[3]

DAILY TRACING SUMMARY FORM FOR FIELD TEAM SUPERVISORS

Date:_____

1) Field supervisor name:	
2) Team name:	
3) Team members:	
4) No. of contacts currently under follow-up	
a. No. of contacts followed-up today (non-symptomatic)	
b. No. of contacts followed-up today (symptomatic)	
c. No. of contacts discharged from follow-up today	
d. No. of contacts not followed-up today	
(*TOTAL rows a–d above should equal the no. of contacts currently under follow up*)	
5) No. of contacts not seen in the past 24+ hours	
a. No. of contacts not seen in the past 24+ hours with family / neighbor visits done today	
b. No. of contacts not seen in the past 24+ hours without family / neighbor visits done today	
(*TOTAL rows a–b above should equal the no. of contacts not seen in the past 24+ hours)*	
6) No. of contact follow-ups for quality assurance done by Field Supervisor today	
7) No. of tracer observation visits done by supervisor today	
Notes regarding observation visits:	
8) No. of alerts called today (for symptomatic contacts)	
Notes regarding outcome of each alert called:	
9) Other notes from today:	

[3] For use by Field Supervisors who are follow contacts of suspected, probable, or confirmed cases of Ebola virus diseases.

ACKNOWLEGMENTS

This document was prepared by Dr. Ashley Greiner, MD, MPH, and Dr. Kristina Angelo DO, MPH-TM, Epidemic Intelligence Officers with the Centers for Disease Control and Prevention.

We acknowledge the contributions of

Fred Angulo, DVM, PhD

Deborah Hastings, MD, MS

Barbara Knust, DVM

Rupa Narra, MD

Andrea McCollum, PHD, MS

Lucy McNamara, PHD, MS

Kari Yacisin, MD, MSc

Kelsey Mirkovic, PhD

Tasha Stehling-Ariza, PhD

Jennifer Harris, PhD, MPH

Craig Kiebler, DVM, MPH, MS

Antonio Vieira, DVM, MPH, PhD

Julia Painter, PhD, MPH

A. Russell Gerber, MD

Marta Guerra, DVM, PhD, MPH

Angela Ahlquist Cleveland, MPH

REFERENCES AND ADDITIONAL RESOURCES

1. World Health Organization. Ebola and Marburg virus disease epidemics: preparedness, alert, control, and evaluation 2014 [updated August 2014; cited 2014 September 15]. Available from: http://www.who.int/csr/disease/ebola/manual_EVD/en/.

2. Centers for Disease Control and Prevention. Case Definition for Ebola Virus Disease (EVD) 2014 [updated October 27, 2014; cited 2014 September 15]. Available from: http://www.cdc.gov/vhf/ebola/hcp/case-definition.html.

3. Centers for Disease Control and Prevention. Interim Guidance for Specimen Collection, Transport, Testing, and Submission for Patients with Suspected Infection with Ebola Virus Disease [cited 2014 September 20]. Available from: http://www.cdc.gov/vhf/ebola/pdf/ebola-lab-guidance.pdf.

4. World Health Organization. Interim Infection Prevention and Control Guidance for Care of Patients with Suspected or Confirmed Filovirus Haemorrhagic Fever in Health-Care Settings, with Focus on Ebola 2014 [updated September 2014; cited 2014 September 25]. Available from: http://apps.who.int/iris/bitstream/10665/130596/1/WHO_HIS_SDS_2014.4_eng.pdf?ua=1&ua=1.

5. Centers for Disease Control and Prevention. Interim U.S. Gudiance for Monitoring and Movement of Persons with Ebola Virus Disease Exposure 2014 [updated November 3, 2014; cited 2014 September 15]. Available from: http://www.cdc.gov/vhf/ebola/hcp/monitoring-and-movement-of-persons-with-exposure.html.

6. World Health Organization. Ebola Response Roadmap 2014 [updated August 28, 2014; cited 2014 September 15]. Available from: http://apps.who.int/iris/bitstream/10665/131596/1/EbolaResponseRoadmap.pdf?ua=1.

7. World Health Organization. Contact Tracing during an Outbreak of Ebola Virus Disease 2014 [updated September 2014; cited 2014 October 21]. Available from: http://www.who.int/csr/resources/publications/ebola/contact-tracing/en/

8. World Health Organization. Ebola Surveillance in Countries with No Reported Cases of Ebola Virus Disease [updated 05 September 2014; cited 12 November 2014]. Available from: http://who.int/csr/resources/publications/ebola/ebola-surveillance/en/

9. World Health Organization. Technical Guidelines for Integrated Disease Surveillance and Response in the African Region. [updated 2010; cited 2014 December 2]. Available from: http://www.afro.who.int/en/clusters-a-programmes/dpc/integrated-disease-surveillance/features/2775-technical-guidelines-for-integrated-disease-surveillance-and-response-in-the-african-region.html