Introduction

The outbreak of Ebola Virus Disease in West Africa constitutes an unprecedented public health emergency of worldwide significance. This “primer” is intended to educate the busy clinician with some of the basic considerations in respect to this outbreak and the approach to persons potentially infected with Ebola virus. This is not intended to be a comprehensive reference as to all aspects of this disease but hopefully will provide a basis of knowledge to those less familiar with the myriad aspects of the current outbreak.

More comprehensive Ebola Virus Disease information can be found at the CDC website: http://www.cdc.gov/vhf/ebola/index.html As circumstances surrounding this outbreak are very fluid, frequent access of this site is recommended for the most up to date information and guidance.

Ebola Virus Disease (EVD)

Ebola Virus Disease (formerly Ebola Hemorrhagic Fever) is disease caused by infection with Ebola virus. This is a highly lethal disease with mortality rates of 50-90% in those infected (in the current outbreak in West Africa mortality is estimated to be 70%). Initial signs and symptoms are nonspecific and include fever, headache, myalgias, nausea, and vomiting. Later manifestations include diffuse hemorrhage, mental obtundation, and multi-system organ failure leading to death.

The incubation period before the development of signs and symptoms of illness in person infected with Ebola virus is generally 8-12 days but may be as long as three weeks.
Epidemiology

Ebola virus and a related filovirus, Marburg virus, were first identified as causes of outbreaks of human disease in the 1960’s and 1970’s. Outbreaks of illness have occurred primarily in Africa. The current outbreak of Ebola Viral Disease has been in progress since the spring of 2014 in West Africa (principally in Sierra Leone, Liberia, and Guinea) and is by far the largest outbreak of such disease to date.

Efforts to contain the current outbreak have as yet been unsuccessful, and epidemiological models of worse case outcomes predict up to 1.4 million cases. International travel constitutes risk of Ebola Virus Disease establishing itself in distant locations as is illustrated by the identification of cases in Dallas, Texas and Spain during the current outbreak.

Transmissibility

The natural reservoir of Ebola virus is unknown, and it therefore is uncertain how the current epidemic arose and how the initial (presumably from animal source) transmission occurred to humans. Disease is significantly transmissible from human to human, and is said to be transmitted by direct contact with bodily fluids (urine, saliva, sweat, feces, vomit, breast milk, and semen) of an infected individual. Although EVD is not a disease transmitted by airborne routes, it could be transmitted by large droplets inhaled in close proximity (3-6 feet) of vomiting, retching, coughing severely ill patients. Disease can also be transmitted through accidental parenteral exposure to needles contaminated with the blood of Ebola victims and in handling the bodies of deceased patients if those handling the bodies do so without proper personal protective equipment (PPE). The virus is said to be potentially viable on inanimate surfaces for several hours and perhaps longer in collections of body fluids.
Triage - Approach to persons possibly exposed to Ebola virus or who have traveled to the epidemic region within the previous 21 days (period of possible incubating disease):

The likelihood of infection with Ebola virus depends upon the nature of possible exposure and forms the basis for triage. High risk exposures include:

1. Percutaneous (e.g., needle stick) or mucous membrane exposure to blood or body fluids from an EVD patient.
2. Direct skin contact with skin, blood or body fluids from an EVD patient.
3. Processing blood or body fluids from an EVD patient without appropriate PPE.
4. Direct contact with a dead body in an Ebola-affected area without appropriate PPE.

Household contacts of persons infected with Ebola virus and healthcare workers (lacking the above exposures) who have cared for EVD patients are considered to have had exposures of lesser risk by the CDC. Mere travel to an epidemic region (without significant exposures as above) is considered very low risk. It should also be noted that other diseases such as malaria and Lassa fever might also be encountered in travelers from West Africa.

Triage of persons possibly exposed:

1. **Those who have no signs or symptoms** of active disease should be advised to self monitor for fever twice daily until 21 days has passed since their last possible exposures. Should they develop signs or symptoms of EVD in that interval they should be advised to seek medical attention.

2. **Those ill with fever or one or more of the other signs/symptoms of possible EVD** (headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage) should undergo immediate medical evaluation. Those significantly ill and/or with high risk exposure histories should be hospitalized and placed in standard, contact, and droplet isolation (see Infection Prevention below). As symptoms and signs are nonspecific, those who are less ill and with lesser risk exposures may be followed as outpatients provided they can be relied upon to return for care should they become more ill and provided there is means to segregate them from others to avoid disease transmission should they actually be infected with Ebola virus. Assistance from the local health department should be sought for possible EVD cases not immediately hospitalized.

A very useful CDC schematic for assessing likelihood of EVD is attached as Appendix 1.
Diagnosis of Ebola Virus Disease

Diagnostic testing (PCR) is available from the CDC but can only be ordered with the assistance of the local health department (see Appendix 2).

Treatment of Ebola Virus Disease

There is no effective specific treatment for Ebola Virus Disease. There are no vaccines. Care is supportive.

Infection Prevention

Healthcare workers caring for Ebola infected patients are at substantial risk of becoming infected, and it is crucial that they utilize personal protective equipment (PPE) with meticulous care. A “buddy” should watch the donning and doffing of the PPE done in the correct order (CDC guidance - Appendix 3). Isolation involves the use of Standard, Contact, and Droplet (masks, eye protection) precautions “enhanced” with the use of Level 4 impermeable gowns, double gloving, and possibly head coverings, leg coverings, and shoe covers. Recommendations in regards PPE are in flux and evolving and individual training of healthcare workers in use of PPE, particularly its removal, is crucial. Entrance to rooms of EVD patients should be limited to that required for essential tasks, and procedures (including laboratory blood draws) should be kept to the minimum necessary to provide adequate patient care. A record of those visiting an Ebola Virus Disease patient’s room (including that of healthcare workers) should be maintained for contact tracing/disease containment purposes.

The need for proper use of PPE by healthcare workers cannot be overemphasized as over four hundred health care workers have contracted the EVD in West Africa with a roughly fifty percent mortality rate, and there have been cases of disease transmission in healthcare workers in western countries even when they were utilizing recommended PPE.

Employee Health

Asymptomatic staff who have had a significant exposure (i.e., unprotected exposure to bodily fluids of an EVD patient) should receive medical evaluation and follow-up care including fever monitoring twice daily for 21 days after the last known exposure. They may continue to work while receiving twice daily fever checks if approved by the hospital and after discussion with public health authorities.

Staff who develop any of the signs or symptoms of EVD within twenty-one days of an exposure should not report to work or should immediately stop working, notify their supervisor, and seek prompt medical evaluation and testing.

Staff without significant exposure who have cared for patients with EVD should nonetheless self monitor for fever twice daily up until 21 days after their last caring for an EVD patient.
Ebola Virus Disease (Ebola)
Algorithm for Evaluation of the Returned Traveler

**Algorithm for Evaluation of the Returned Traveler**

**Ebola**

**Fever** (subjective or ≥101.5°F or 38.6°C) or compatible Ebola symptoms* in patient who has traveled to an Ebola-affected area** in the 21 days before illness onset

* headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage

**Report** asymptomatic patients with high- or low-risk exposures (see below) in the past 21 days to the health department

**YES**

1. Isolate patient in single room with a private bathroom and with the door to hallway closed
2. Implement standard, contact, and droplet precautions (gown, facemask, eye protection, and gloves)
3. Notify the hospital Infection Control Program and other appropriate staff
4. Evaluate for any risk exposures for Ebola
5. IMMEDIATELY report to the health department

**HIGH-RISK EXPOSURE**

Percutaneous (e.g., needle stick) or mucous membrane contact with blood or body fluids from an Ebola patient

OR

Direct skin contact with, or exposure to blood or body fluids of, an Ebola patient

OR

Processing blood or body fluids from an Ebola patient without appropriate personal protective equipment (PPE) or biosafety precautions

OR

Direct contact with a dead body (including during funeral rites) in an Ebola affected area** without appropriate PPE

**LOW-RISK EXPOSURE**

Household members of an Ebola patient and others who had brief direct contact (e.g., shaking hands) with an Ebola patient without appropriate PPE

OR

Healthcare personnel in facilities with confirmed or probable Ebola patients who have been in the care area for a prolonged period of time while not wearing recommended PPE

**NO KNOWN EXPOSURE**

Residence in or travel to affected areas** without high- or low-risk exposure

**Testing IS Indicated**

The health department will arrange specimen transport and testing at a Public Health Laboratory and CDC

The health department, in consultation with CDC, will provide guidance to the hospital on all aspects of patient care and management

**Testing IS NOT Indicated**

If patient requires in-hospital management:

- Decisions regarding infection control precautions should be based on the patient’s clinical situation and in consultation with hospital infection control and the health department
- If patient’s symptoms progress or change, re-assess need for testing with the health department
- If patient does not require in-hospital management:
  - Alert the health department before discharge to arrange appropriate discharge instructions and to determine if the patient should self-monitor for illness
  - Self-monitoring includes taking their temperature twice a day for 21 days after their last exposure to an Ebola patient

**Review Case with Health Department Including:**

- Severity of illness
- Laboratory findings (e.g., platelet counts)
- Alternative diagnoses

**Ebola not suspected**

* CDC Website to check current affected areas: www.cdc.gov/ebola

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**Appendix 1**

This algorithm is a tool to assist healthcare providers identify and triage patients who may have Ebola. The clinical criteria used in this algorithm (a single symptom consistent with Ebola) differ from the CDC case definition of a Person Under Investigation (PUI) for Ebola which is more specific. Public health consultation alone does not imply that Ebola testing is necessary. More information on the PUI case definition: www.cdc.gov/vhf/ebola/hcp/case-definition.html
INTERIM GUIDANCE FOR
Specimen Collection, Transport, Testing, and Submission for Patients with Suspected Infection with Ebola Virus Disease

Hospitals should follow their state and/or local health department procedures for notification and consultation for Ebola testing requests before contacting CDC.

CDC cannot accept any specimens without prior consultation.

WHEN SPECIMENS SHOULD BE COLLECTED FOR EBOLA TESTING

Ebola virus is detected in blood only after the onset of symptoms, usually fever. It may take up to 3 days after symptoms appear for the virus to reach detectable levels. Virus is generally detectable by real-time RT-PCR from 3-10 days after symptoms appear.

Ideally, specimens should be taken when a symptomatic patient reports to a healthcare facility and is suspected of having an Ebola exposure. However, if the onset of symptoms is <3 days, a later specimen may be needed to completely rule-out Ebola virus, if the first specimen tests negative.

PREFERRED SPECIMENS FOR EBOLA TESTING

A minimum volume of 4 milliliters of whole blood preserved with EDTA is preferred but whole blood preserved with sodium polyanethol sulfonate (SPS), citrate, or with clot activator can be submitted for Ebola testing.

Specimens should be shipped at 2-8°C or frozen on cold-packs to CDC. Do not submit specimens to CDC in glass containers. Do not submit specimens preserved in heparin tubes.

Specimens other than blood may be submitted upon consult with CDC.

Standard labeling should be applied for each specimen. The requested test needs to be identified only on the requisition and CDC specimen submission forms.

DIAGNOSTIC TESTING FOR EBOLA PERFORMED AT CDC

Several diagnostic tests are available for detection of Ebola virus disease. Acute infections will be confirmed using a real-time RT-PCR assay (CDC test directory code CDC -10309 Ebola Identification) in a CLIA-accredited laboratory. Virus isolation may also be attempted. Serologic testing for IgM and IgG antibodies will be completed for certain specimens and to monitor the immune response in confirmed Ebola virus disease patients (#CDC-10310 Ebola Serology).

Lassa fever is also endemic in certain areas of West Africa and may show symptoms similar to early Ebola virus disease. Diagnostic tests available at CDC include but are not limited to RT-PCR, antigen detection, and IgM serology, all of which may be utilized to rule out Lassa fever in patients who test negative for Ebola virus disease.

TRANSPORTING SPECIMENS WITHIN THE HOSPITAL / INSTITUTION

In compliance with 29 CFR 1910.1030, specimens should be placed in a durable, leak-proof secondary container for transport within a facility. To reduce the risk of breakage or leaks, do not use any pneumatic tube system for transporting suspected Ebola virus disease specimens.

PACKAGING & SHIPPING CLINICAL SPECIMENS TO CDC

Specimens collected for Ebola virus disease testing should be packaged and shipped without attempting to open collection tubes or aliquot specimens.

Specimens for shipment should be packaged following the basic triple packaging system which consists of a primary container (a sealable specimen bag) wrapped with absorbent material, secondary container (watertight, leak-proof), and an outer shipping package.

THE SUBMISSION PROCESS

Contact your state and/or local health department and CDC (770-488-7100) to determine the proper category for shipment based on clinical history and risk assessment by CDC and to obtain detailed shipping guidance and required CDC submission documents. State guidelines may differ and state or local health departments should be consulted before shipping.

INFORMATION ON SHIPPING & TRACKING IS AVAILABLE AT

www.cdc.gov/ebola

FOR CONSULTATION, CALL THE CDC EMERGENCY OPERATIONS CENTER AT

770-488-7100
SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN
   • Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
   • Fasten in back of neck and waist

2. MASK OR RESPIRATOR
   • Secure ties or elastic bands at middle of head and neck
   • Fit flexible band to nose bridge
   • Fit snug to face and below chin
   • Fit-check respirator

3. GOGGLES OR FACE SHIELD
   • Place over face and eyes and adjust to fit

4. GLOVES
   • Extend to cover wrist of isolation gown

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

• Keep hands away from face
• Limit surfaces touched
• Change gloves when torn or heavily contaminated
• Perform hand hygiene
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE)
EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES
   - Outside of gloves are contaminated!
   - If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
   - Hold removed glove in gloved hand
   - Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
   - Discard gloves in an infectious* waste container

2. GOGGLES OR FACE SHIELD
   - Outside of goggles or face shield are contaminated!
   - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Remove goggles or face shield from the back by lifting head band or ear pieces
   - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in an infectious* waste container

3. GOWN
   - Gown front and sleeves are contaminated!
   - If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Unfasten gown ties, taking care that sleeves don’t contact your body when reaching for ties
   - Pull gown away from neck and shoulders, touching inside of gown only
   - Turn gown inside out
   - Fold or roll into a bundle and discard in an infectious* waste container

4. MASK OR RESPIRATOR
   - Front of mask/respirator is contaminated — DO NOT TOUCH!
   - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
   - Discard in an infectious* waste container

5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE

* An infectious waste container is used to dispose of PPE that is potentially contaminated with Ebola virus.

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE)

EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

1. **GOWN AND GLOVES**
   - Gown front and sleeves and the outside of gloves are contaminated!
   - If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
   - While removing the gown, fold or roll the gown inside-out into a bundle
   - As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into an infectious* waste container

2. **GOGGLES OR FACE SHIELD**
   - Outside of goggles or face shield are contaminated!
   - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
   - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in an infectious* waste container

3. **MASK OR RESPIRATOR**
   - Front of mask/respirator is contaminated — DO NOT TOUCH!
   - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
   - Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
   - Discard in an infectious* waste container

4. **WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE**

   *An infectious waste container is used to dispose of PPE that is potentially contaminated with Ebola virus.

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