Ebola Virus Disease: Preparing LA County

Acute Communicable Disease Control

Los Angeles Department of Public Health

County of Los Angeles Public Health

Objectives

- Background
- Describe current epidemic
- Describe Ebola
  - Epidemiology
  - Pathogenesis
  - Clinical picture
  - Therapies
- Outline LA County readiness
- Infection Control guidelines

County of Los Angeles Public Health

Emerging and Changing Infections (1)

- Malaria knowlesi
- Avian influenza
- Swine flu variants
- SARS
- Mers-Co-V
- Monkey Pox
- Chikungunya
- Dengue
- Ebola
- Antimicrobial Resistance
  - NDM1 (Metallo-beta-lactamase-1)
  - Gonococcal disease

Emerging and Changing Infections (2)

- Population growth and change:
  - Ebola: burial practices; interaction with animal reservoirs
- Technology advances and changes in industry practices
- Economic development, changes in land-use

1992 IOM report, Emerging Infections: Microbial Threats to Health in the United States

- Increases in international travel and commerce
- Food insecurity
- Microbial adaptation and change
- Climate change
- Decreased public health capacity

1992 IOM report, Emerging Infections: Microbial Threats to Health in the United States

Ebola Virus Disease (EVD)

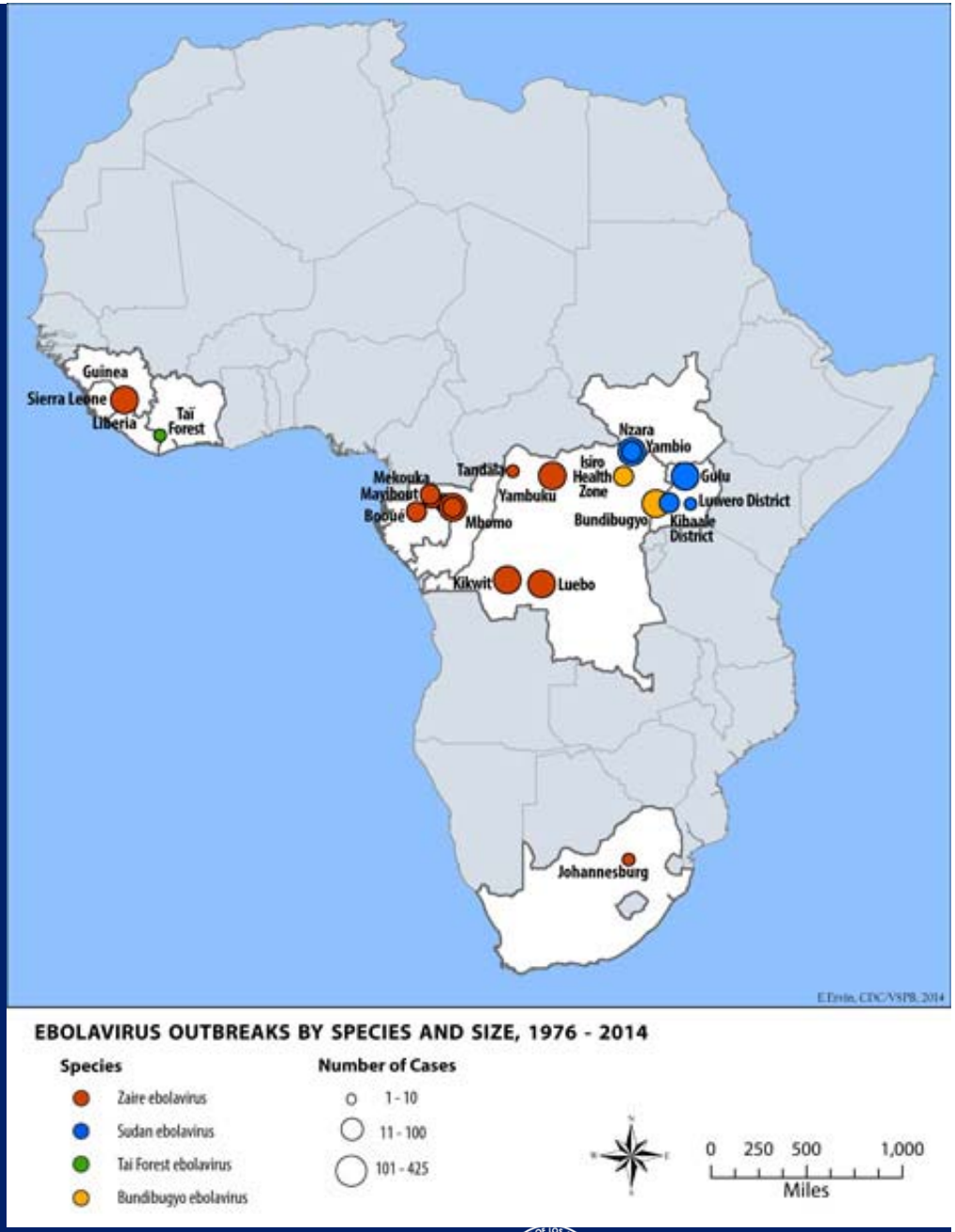
- Severe viral illness; hemorrhagic complications
- Zoonotic
- Filovirus (also Marburg)-single strand negative sense RNA
- 5 subtypes
  - 4 cause disease in humans
  - Current subtype *Zaire ebolavirus*
  - Outbreaks only in Africa

Epidemiology

- 1967 Initial recognition:
  - Germany and Yugoslavia: lab workers became ill after harvesting organs from primates from Uganda (Marburg)
- Since then limited lab exposure and illness

Outbreaks

1st Outbreak:1976 in Zaire



cdc.gov/ebola

Current Epidemic

- Largest Ebola outbreak to date
- 1st case: Guinea, then Liberia, Sierra Leone, Lagos, Nigeria
- WHO notified March 2014
- Continues to spread
- Mortality around 55%

cdc.gov/ebola

County of Los Angeles Public Health

Challenges

http://www.cdc.gov/media/DPK/2014/dpk-ebola-outbreak.html#multi

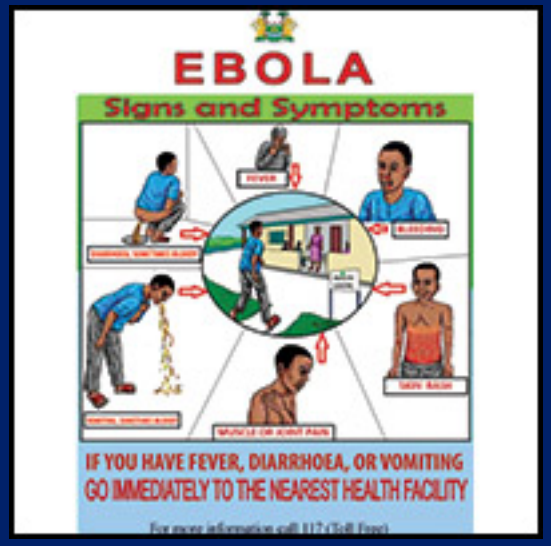
Challenges

http://www.cdc.gov/media/DPK/2014/dpk-ebola-outbreak.html#multi

County of Los Angeles Public Health

Challenges:

- Control spread
  - Education, infection prevention



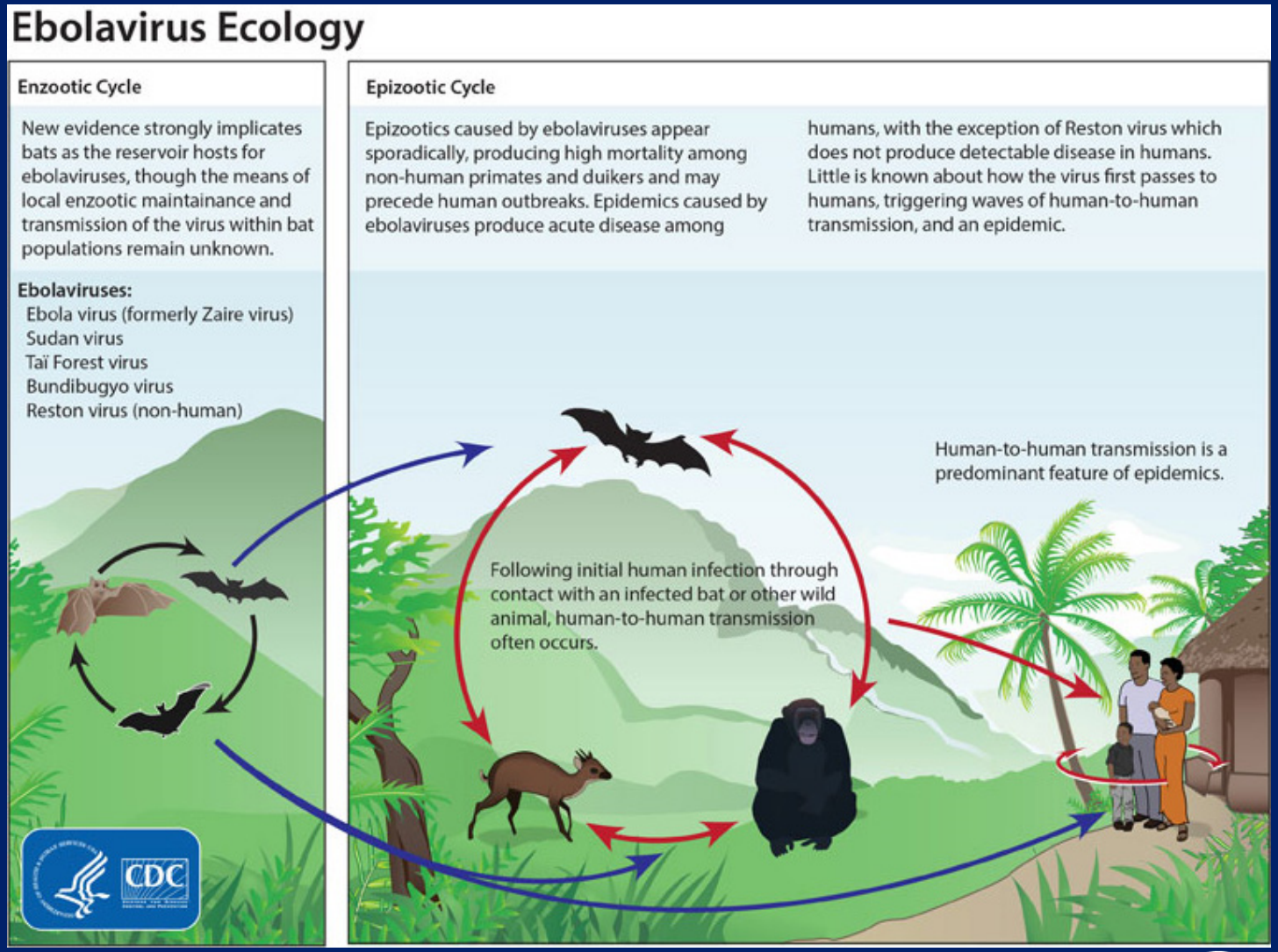
http://www.cdc.gov/vhf/ebola/outbreaks/guinea/print-resources-posters.html

County of Los Angeles Public Health

Viral Reservoirs

- Bats
- Non-human primates
  - Probably not reservoir as they get sick

Ecology and Transmission



cdc.gov/ebola

Transmission(1)

- Zoonotic
- Ingesting bat bitten fruit
- Person-to-Person
- Nosocomial

Transmission (2)

- Only symptomatic individuals are infectious
- Incubation 2-21 days, median 8-10 days
- Bodily fluids
  - Saliva
  - Blood
  - Urine
  - Feces
  - Emesis
  - Breast Milk
  - Semen, vaginal secretions

OTHER TRANSMISSION ISSUES

- JID: 173 household contacts of 27 Ebola
  - 16% transmission rate with no precautions
  - 78 had no contact and no infections;
  - Others with contact: highest risk after contact with blood
- Emerging Infectious Disease: contamination of care environment
  - 33 environmental samples tested
    - Only positive was from glove with gross blood

Dowel, SF et al. JID 1999:179 (Suppl1): S8-91. Francesconi P et al: Emerging Infect Dis 2003;9:143-7

Pathogenesis

Ebola infects

- Monocytes, macrophages and other immune cells
- Hepatocytes
- Fibroblasts
- Adrenal cortical cells
- Endothelial cells

Cytokine Response

- Methods
  - 86 EVD patient samples
  - 26 chemokine/cytokine
  - RT PCR used to evaluate viral load

Clinical Outcome	Immune response
Hemorrhagic	MCSF, MIP 1 alpha, ferritin, thrombomodulin
Fatal	IL-1alpha, IL-1RA, IL-6, MCP, MCSF, MIP 1alpha, ferritin, thrombomodulin
Survivors	Soluble CD40L

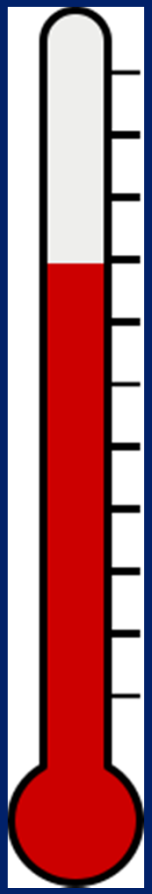
McElroy et al JID 2014:210 (15 August)

Clinical Presentation

- Nonspecific
- High index of suspicion
- Travel history
- Broad differential diagnosis
  - Malaria
  - Typhoid fever
  - Dengue

Symptoms and Signs

- Common
  - Fever (90%)
  - Weakness
  - Diarrhea
  - Nausea/vomiting
- Frequent
  - Abdominal pain
  - Headache
  - Sore throat
  - Myalgia
  - Anorexia
  - Bleeding-only 30-50%



- Rare
  - Rash
  - Hiccups
- Signs
  - Conjunctival injection
  - Elevated transaminases
  - Thrombocytopenia

County of Los Angeles Public Health

Diagnosis

Day 1-23

- PCR
- Viral Isolation

Day 6-72

- IgM

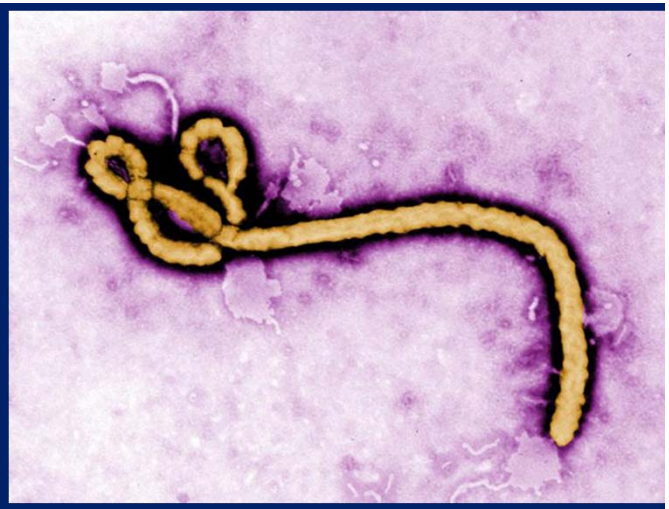
Convalescent

- IgG (persists)
- IgM

Treatment

- No specific therapy
- Supportive and Symptomatic
  - Correction of coagulopathy
  - Restoring perfusion
  - Antimicrobials for secondary infection

Experimental Treatment



- 1995 DRC:
  - Convalescent blood transfusion
- Zmapp (Mapp pharmaceuticals)
  - 3 monoclonal antibodies-not FDA approved
- TKM-Ebola (Canada)
  - Small RNA molecule blocks adenosine
- Favipiravir (T-705)
  - Inhibits RNA polymerase
- BCX4430
  - Inhibits RNA polymerase

Mupapa et al. JID: 1999; 179)Suppl 1):S18-23

County of Los Angeles Public Health

Vaccine

- 2 under development
  - VSV vector
  - Adenovirus vector

Domestic Response

- As of August 18, 2014
  - 2 cases in US (healthcare workers)
- Local, state, and federal planning
- LA County
  - No direct flights from Africa
  - International flights—CDC quarantine
  - Domestic flights—ACDC response

When to consider Ebola?

- Travel history
  - Within 21 days of travel to affected areas
- History of exposure to EVD
  - Healthcare workers
  - Household members

Ebola and LA County Surveillance

- Present:
  - Aid worker returning from West Africa
  - Tourist returning from Lagos

- How will LA county hospitals respond?
  - Coordinated effort: CDC, State of California, Los Angeles Department of Public Health

County of Los Angeles Public Health

Outbreak Control Requires

- Early identification
- Contact tracing
- Stringent Infection Prevention Guidelines

High Risk Exposure

- Percutaneous/mucous membrane exposure to body fluids of EVD patient
- Direct care of an EVD patient without PPE
- Laboratory processing body fluids without PPE
- Participation in funeral rites with direct exposure to human remains

County of Los Angeles Public Health

Some Risk Exposure

- Household member or close contact with an EVD patient.
- Close* contact with EVD patients in in affected areas
- Bat, rodent, or primate exposure in affected area

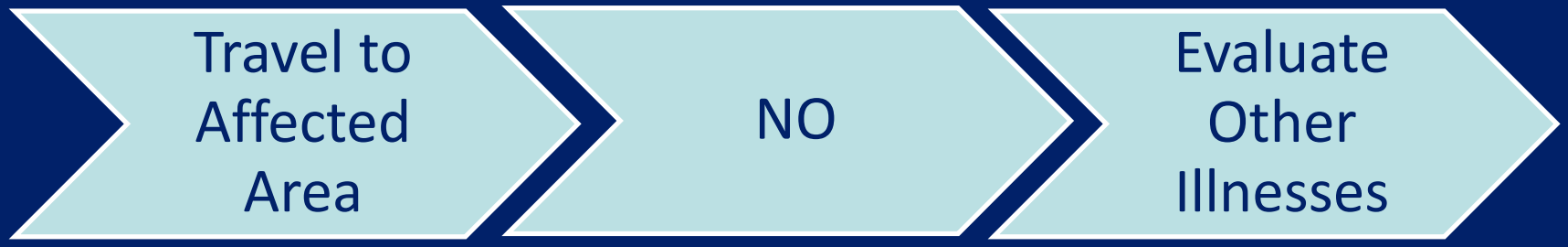
*Being within approximately 3 feet of an EVD patient or within the room for a prolonged period of time not wearing recommended personal protective equipment (PPE) or having direct brief contact (e.g., shaking hands) with an EVD case while not wearing recommended PPE.

County of Los Angeles Public Health

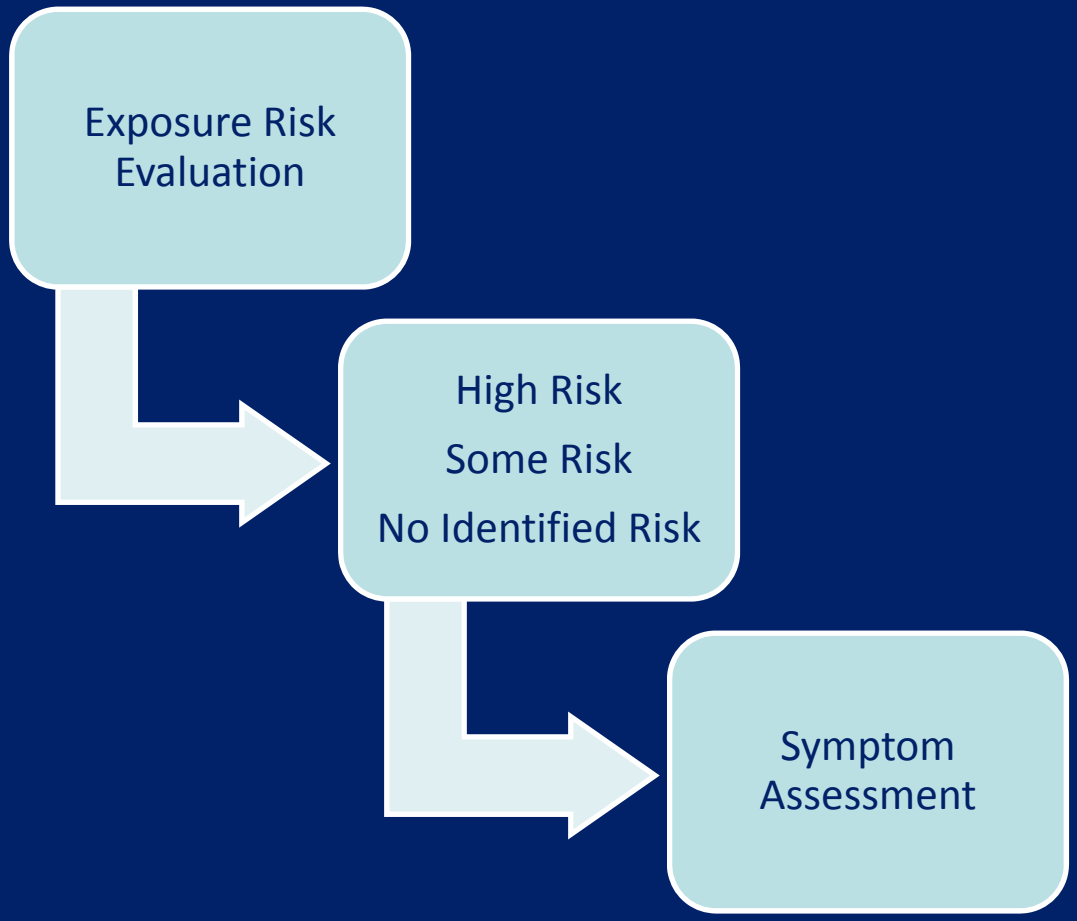
No Identified Risk

- Travel to affected areas within 21 days

Algorithm




Multi-organ failure or hemorrhage
YES
Isolate. Contact ACDC


Exposure Risk Evaluation
High Risk
Some Risk
No Identified Risk
Symptom Assessment

High Risk

- + Symptoms: Isolate. Contact ACDC for testing
- - Symptoms: Contact ACDC.

Some Risk

- + Symptoms: Isolate. Contact ACDC for testing
- - Symptoms: Contact ACDC. Conditional release

No Identified Risk

- + Symptoms: Isolate. Contact ACDC. No testing.
- - Symptoms: Contact ACDC. Self-monitoring

County of Los Angeles Public Health

Diagnostic Testing Procedure

- Ebola diagnostic testing: Contact PHL

- http://www.cdc.gov/vhf/ebola/hcp/interim-guidance-specimen-collection-submission-patients-suspected-infection-ebola.html

Personal Protective Equipment

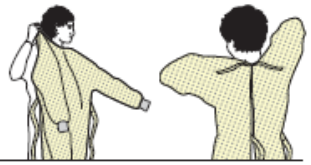
- Routine:
  - Gloves
  - Impermeable gown
  - Mask
  - Eye protection (goggles, or face shield)
- If needed:
  - Shoe covers
  - Leg covers
  - Double gloving
- Aerosolizing procedures:
  - Add N95

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

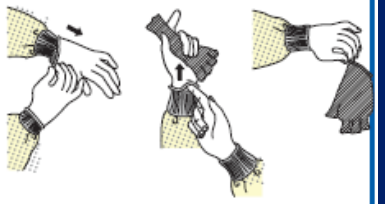
- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene

SEQUENCE FOR REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

Except for respirator, remove PPE at doorway or in anteroom. Remove respirator after leaving patient room and closing door.

1. GLOVES

- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist
- Peel glove off over first glovet
- Discard gloves in waste container



2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield is contaminated!
- To remove, handle by head band or ear pieces
- Place in designated receptacle for reprocessing or in waste container

3. GOWN

- Gown front and sleeves are contaminated!
- Unfasten ties
- Pull away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- Grasp bottom, then top ties or elastics and remove
- Discard in waste container

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

County of Los Angeles Public Health

Lessons from South Africa

- Patient:
  - Admit day 4 symptoms
  - Extensive initial workup
    - Lumbar puncture, blood, CSF culture, HIV, malaria
    - Immunofluorescence negative VHF
  - Exploratory Laparotomy
- Day 12
  - GI hemorrhage
  - + EVD cultures
- Day 14 transfer

Guy et al. Crit Care Med 2000:28

South Africa Results

- Over 300 contacts
- No spread of Ebola

Guy et al. Crit Care Med 2000:28

Infection Control in Uganda

- Uganda 2012:
  - 3 viral hemorrhagic fever outbreaks
  - HIV clinic: 465 patients/day
  - At time of outbreak
    - Infection Control Nurse
    - Screen all patients for VHF symptoms
    - Hand washing station
    - Suspect cases sent directly to National Referral Hospital Ebola Unit

Parkes-Ratanshi et al. PLoS 2014:9

LA Infection Control Plan

- Private patient room, bathroom
- Dedicated equipment
- Log of all persons entering room
- Only necessary staff entering room
- Minimize lab draws
- Minimize aerosol generating procedures

What To Do If You Are Exposed

- Notify your supervisor
- Supervisor to notify ACDC
- In addition to normal post-exposure procedures
  - Monitor fever curve x 21 days
  - Department of Public Health Check-in

Conclusion

- EVD is a severe viral illness
- Large outbreak in West Africa
- Challenges to control in West Africa
- LA county is well prepared
  - Unlikely to have a case in LA

For Further Information

- www.cdc.gov/ebola
- www.lapublichealth.com/acd/diseases/Ebola.htm
- ACDC: 213-240-7941

County of Los Angeles Public Health

Thank You

- Acknowledgements
  - Laurene Mascola
  - Ben Schwartz
  - Moon Kim