

Ebola

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Sudan - June 27, 1976

- **Nazra Township**
Cotton factory
storekeeper became ill
 - 48 cases/ 27 deaths
 - Contact was admitted to local hospital in Maridi
- **Unrelated cases**
continued in cotton
factory workers July-
Oct.



Content Provider: CDC/ Dr. Lyle Conrad; 1976

World Health Organization. Ebola haemorrhagic fever in Sudan, 1976. Report of a WHO/International Study Team. *Bulletin of the World Health Organization*. 1978;56(2):247-270.

Sudan 1976



Content Provider: CDC/ Dr. Lyle Conrad; 1976

- Barrier nursing/disposable isolation equipment established early October
- WHO team arrived on October 20, 1976
 - Isolation precautions
- Last case occurred on November 20, 1976

284 cases, 151 deaths (mortality rate 53%)

World Health Organization. Ebola haemorrhagic fever in Sudan, 1976 . Report of a WHO/International Study Team . *Bulletin of the World Health Organization*. 1978;56(2):247-270.

Zaire - September 1, 1976



Content Providers: CDC/ Dr. Lyle Conrad; Photo Credit: Joel G. Breman, M.D., D.T.P.H; 1976

- First Case in Yambuku hospital
- 5 syringes/needles
- Sept 30th- hospital closed
 - 11/17 HCW died
- Last case – Nov 5th

**318 cases: 280 deaths
88% mortality**

World Health Organization. Ebola haemorrhagic fever in Zaire, 1976. Report of an International Convention. *Bulletin of the World Health Organization*. 1978;56(2):271-293.

Ebolavirus

- **Sudan ebolavirus (SUDV)**
- **Zaire ebolavirus (EBOV)**
- **Tai Forest (Ivory Coast) ebolavirus (TAFV)**
- **Bundibugyo ebolavirus (BDBV)**

- **Reston ebolavirus (RESTV)**

Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases, Seventh Edition. Gerald L. Mandell, John E. Bennett, and Raphael Dolin. 164, 2259-2263

Guinea- December 2013

- **Guéckédou, Guinea**
 - 2yr old Child
 - Fever, black stool, vomiting
 - Onset Dec. 2, 2013; died Dec. 6, 2013
- **Transmitted from HCW (patient #14) to neighboring towns**
 - HCW died Feb. 10, 2014
- **March 10, 2014 – Guinea Ministry of Health Notified**
- **March 14, 2014- Outbreak team in place**

111 suspect cases: 79 deaths (71% mortality)

Baize S. et al. Emergence of Zaire Ebola Virus Disease in Guinea – Preliminary Report. N Engl J Med. 2014 Apr 16.

August 21, 2014 – Ebola Cases

- **Suspected and Confirmed Case Count: 2473**
- **Suspected Case Deaths: 1350**
- **Laboratory Confirmed Cases: 1460**



Transmission

- **Zoonotic -introduced to humans through close contact with infected animal's bodily fluids**
 - **Fruit bats**
 - **Chimpanzees**
 - **Gorillas**
 - **Monkeys**
 - **Forest Antelope**
 - **Porcupines**



Author: Mnof
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Human to Human Transmission

- **Direct contact with infected bodily secretions**
- **Indirect contact with contaminated environments**
 - **In lab study: Ebola can remain active for up to 6 days**
 - **Environmental cxs: 2/33 samples positive for Ebola**
 - **Blood stained physical glove**
 - **Bloody IV insertion site**
- **Direct contact with infected corpses**
- **Men who survive can transmit virus via semen for up to 7 weeks**

<http://www.who.int/mediacentre/factsheets/fs103/en/>

Sagripanti JL, Rom AM, Holland LE. Persistence in darkness of virulent alphaviruses, Ebola virus, and Lassa virus deposited on solid surfaces. Arch Virol 2010; 155:2035-2039
Bausch DG et al. Assessment of the Risk of Ebola Virus Transmission from Bodily Fluids and Fomites The J of Infect Dis 2007; 196:S142-7

High Risk Exposures

- **Percutaneous**
 - **needle stick or mucous membrane exposure to body fluids**
- **Direct care or exposure to body fluids without appropriate personal protective equipment (PPE)**
- **Participation in funeral rites**

Low Risk Exposures

- **Household member or other casual contact with an EVD patient**
- **Providing patient care or casual contact without high-risk exposure with EVD patients**

Ineffective Transmission

Previous epidemics have calculated that 1 primary human case of Ebola generates only 1 to 3 secondary cases on average.

1 case of Measles in West Africa generates 14-17 cases.

Chowell G, Hengartner NW, Castillo-Chavez C, Fenimore PW, Hyman JM. The basic reproductive number of Ebola and the effects of public health measures: the cases of Congo and Uganda. *J Theor Biol* 2004;229:119-126
Legrand J, Grais RF, Boelle PY, Valleron AJ, Flahault A. Understanding the dynamics of Ebola epidemics. *Epidemiol Infect* 2007;135:610-621

Clinical Manifestations

- Incubation period of 8-10 days (range 2-21)
- Abrupt onset of fever, with HA and myalgia
 - Nausea, vomiting, abdominal pain, and diarrhea
 - Maculopapular rash by day 5-7
 - Chest pain, shortness of breath
 - Hemorrhage
 - Confusion, seizures

Kortepeter MG, Bausch DG, Bray M. Basic clinical and laboratory features of filoviral hemorrhagic fever. *J Infect Dis.* 2011 Nov;204 Suppl 3:S810–6

Differential Diagnosis

- | | |
|----------------------------|---------------------|
| • Malaria | • Marburg Virus |
| • Typhoid Fever | • Yellow fever |
| • Dengue | • Viral hepatitis |
| • Lassa Fever | • Anthrax |
| • Shigellosis | • Chikungunya fever |
| • Meningococcal septicemia | • Leptospirosis |
| • Plague | • Typhus |
| • Relapsing fever | |

Pathogenesis

- Monocytes, macrophages, and dendritic cells are infected early
- Virus suppresses type 1 interferon responses and induces cytokine and chemokine release
- Virus replicates, released and migrates to local lymph nodes, travels through the lymphatic system to blood
- Virus disseminated throughout the body

Feldmann H, Geisbert TW. Ebola haemorrhagic fever. *Lancet*. 2011 Mar 5;377(9768):849-62.

- Lymphocytes undergo apoptosis, which undermines adaptive immunity
- Hepatocellular necrosis → DIC
- Adrenal necrosis → Hypotension
Impaired Steroid Synthesis
- Extensive tissue necrosis and shock

Diagnostic labs tests

- **Ebola virus is detectable in blood only after onset of symptoms**
- **Detectable by real-time RT-PCR between 3 to 10 days post-onset of symptoms**

Lab Abnormalities

- **Leukopenia**
- **Thrombocytopenia – 50 to 100K range**
- **Transminitis: AST>ALT**
- **Proteinuria may be present**
- **PT and PTT prolonged**
- **Fibrin elevated**

Fatal Illness

- LFTS and D-dimer higher in fatal illness.
- Calcium <6mg/dL associated with death
- Median survival of 9 days
- Most patients die during the second week
- Alive on day 14 portends >75% survival
- Fatally infected patients do not develop an AB response

Kortepeter MG, Bausch DG, Bray M. Basic clinical and laboratory features of filoviral hemorrhagic fever. *J Infect Dis.* 2011 Nov;204 Suppl 3:S810–6

Treatment

- Supportive care
- Antibiotics for secondary infections
- September 4-5, WHO scheduled conference on potential Ebola therapies and vaccines in Geneva

Additional References



Dr. Margaret Isaacson as she was tending to the needs of an Ebola patient in a Yambuku, Zaire hospital theatre block that was used as a temporary ICU for Ebola patients during the country's 1976 outbreak.

CDC Ebola Hemorrhagic Fever site:
www.cdc.gov/ebola

WHO:
<http://www.who.int/csr/disease/ebola/en/>

<http://www.nejm.org/page/ebola-outbreak>

Content Providers: CDC/ Dr. Lyle Conrad; Photo
Credit: Joel G. Breman, M.D., D.T.P.H; 1976

Ebola

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Hospital preparedness
EVD

Why prepare?



Author: PA2 Dan Tremper, USCG cropped by USer:Ultra7

Why prepare?



Why prepare?



Why prepare?



Why prepare?



Why prepare?



Why prepare?

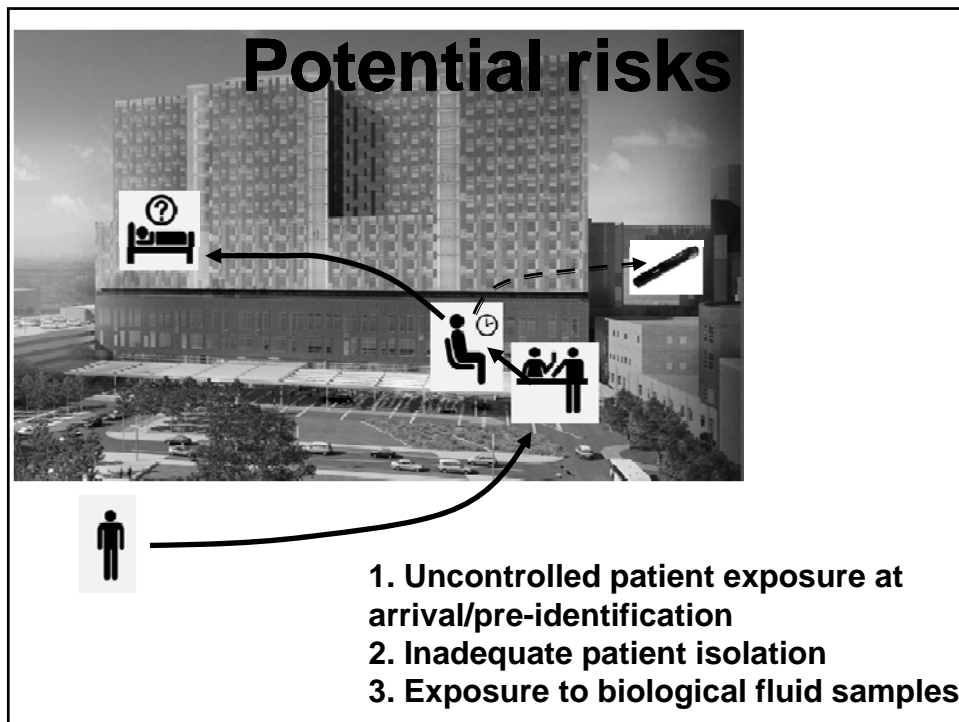


Why prepare?



Why prepare?





Preparedness: more than patient isolation

Within minutes, he dispatched one member of his staff to make sure that the sick man remained isolated and that doctors and nurses were taking precautions to protect themselves against contracting the virus. Then he turned to a second staff member.

“Stop what you’re doing right now,” Dr. Phillips told him, and sent him to the hospital’s laboratory.

The lab?

NYT, 8/10/2014, Rachel Swarns

<http://www.nytimes.com/2014/08/11/nyregion/fighting-deadly-diseases-without-breaking-a-sweat.html?module=Search&mabReward=relbias%3Aw>

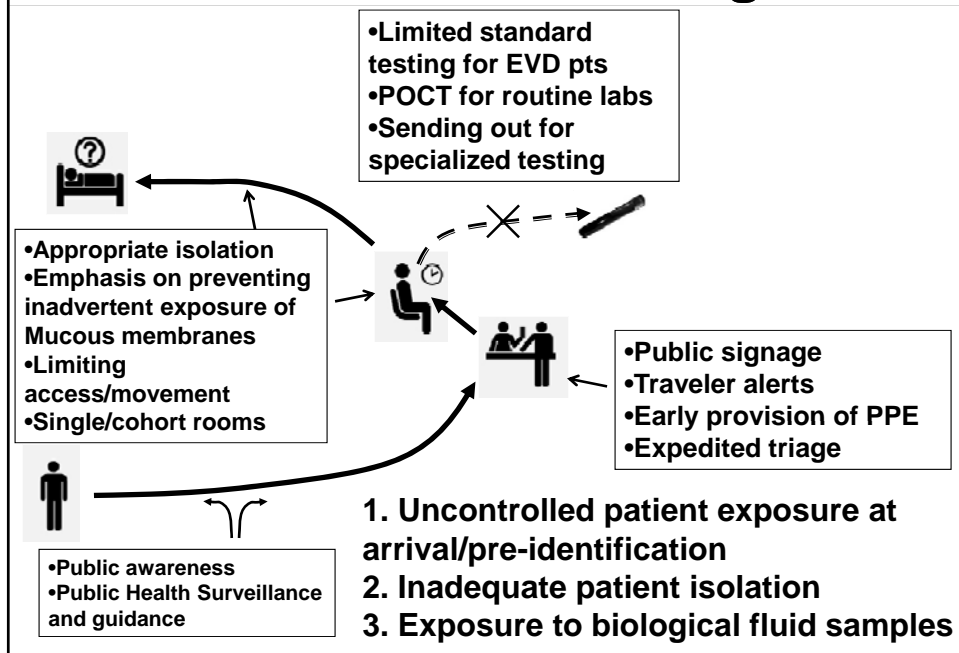
Case study: CJD

Risk of infection	Tissue	Special procedures
High	Brain, spinal cord	<ul style="list-style-type: none"> • Notification • PPE disposal • Laundry disposal • Terminal room cleaning • Disposable equipment use • Special equipment decon. procedures
Low	CSF, liver, lymph node	<ul style="list-style-type: none"> • Notification • Dedicated instrument • Usual cleaning after sample assay
None	Whole blood, nasal mucous, saliva, sputum, feces	<ul style="list-style-type: none"> • Notification • Usual cleaning after sample assay

EVD comparison

- **Blood and secretions are infectious**
 - PCR positive in blood only
- **Implications**
 - Common laboratory testing samples for the febrile patient **ARE** infectious
- **Mitigation?**

Potential risks with mitigation



Summary Hospital Preparedness

- Collaborate/Communicate with local Health Department
- Communicate and advertise in public spaces dependent on local burden of international travelers
- Plan for
 - early patient identification/isolation
 - Slow and contained diagnostic testing
- Normal protective equipment
 - Need for complete coverage of mucous membranes
 - Attention for the duration of the treatment period
- Make a personnel plan
 - Special training, reduce myth/mystery, increase education

Ebola HF in the Acute Care Settings

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Ebola HF in the Acute Care Setting

- Objectives for acute presentation of Ebola HF (Hemorrhagic Fever)
 1. Identification & Recognition
 2. Isolation
 3. Medical Treatment



Image from CDC

Identification of Ebola HF Patients

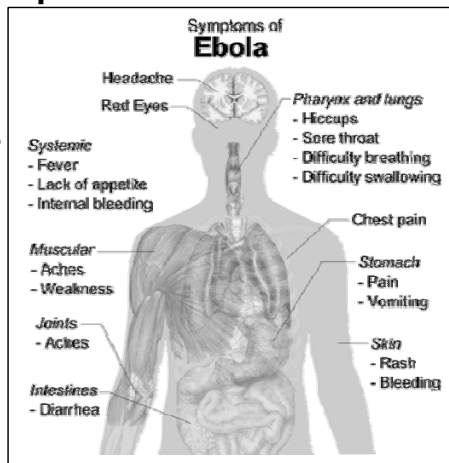
- Education of staff
- Increased awareness levels at portals of entry
 - Clinics
 - Urgent care centers
 - Emergency departments
- Public health awareness
 - Patient self-selection
 - Signage & outreach



Image from CDC

Identification of Ebola HF Patients

- Screening criteria for Ebola HF in the ED:
 - Any of the following symptoms:
 - Fever >101.5F
 - Headache
 - Joint / muscle aches
 - Weakness
 - Vomiting
 - Diarrhea



Author: Mikael Häggström. – Public Domain

Identification of Ebola HF Patients

- Ask about travel to high-risk areas <21days:
 - Guinea
 - Liberia
 - Nigeria
 - Sierra Leone
- Concerning symptoms PLUS high risk travel requires immediate isolation!



Isolation of Ebola HF Patients

- Place a mask on the patient
 - Initiate contact, droplet, & airborne precautions
- Staff personal protective equipment includes:
 - Gown
 - Gloves
 - Mask
 - Eye protection



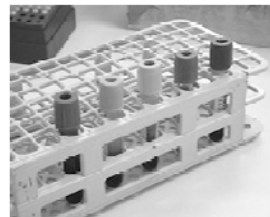
Image from CDC

Isolation of Ebola HF Patients

- Outpatient setting
 - Arrange transfer to ED (via ambulance with PPE)
- Emergency Department
 - Place patient in private room with bathroom
 - Negative airflow not required
 - Contact, Droplet & Airborne isolation precautions
 - Dedicated medical equipment should be disposable when possible

Isolation of Ebola HF Patients

- Notifications:
 - ED Attending
 - Critical Events Officer
 - Infectious Disease Team
 - Public Health Department (via the CE Officer)
 - This notification chain is institution dependent
- Initiation of laboratory testing



Author: Tristanb
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Acute Medical Treatment of Ebola HF

- **Supportive therapy:**
 - **Fluids and electrolytes**
 - **Blood pressure and oxygen status**
 - **Treatment of complicating infections**
- **Initial management of complications**
- **Admission to the inpatient setting**
 - **Level of care depends on acuity of illness**



Author: Harmid
Public Domain