DEVOTED TO REDUCING MALARIA DEATHS & SUFFERING IN HUMANITARIAN CRISSES
Lassa, Ebola, & Marburg Viruses

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Objectives

By the end of this presentation you will have an understanding of:

• the biological basis of Lassa, Ebola, and Marburg viruses
• the modes of transmission and behaviours that increase risk of outbreak
• how these diseases manifest in a humanitarian crisis situation
• strategies for outbreak control and containment appropriate for resource-poor settings

Photo courtesy of CDC Public Health Image Library (CDC PHIL)
Disease Background: Viral Hemorrhagic Fevers (VHFs)

- Diverse group of viral diseases characterized by systemic symptoms
  - Fever, headache, malaise, nausea, vomiting, blood and generalized hemorrhage from mucus membranes
  - Difficult and often impossible to diagnose based only on symptoms

Photo courtesy of CDC PHIL
Highly Infectious

Lassa, Ebola, and Marburg viruses are classified as Biohazard Safety Level 4 agents.

Photo courtesy of the CDC PHIL

Photo courtesy of the NIH archive
Distribution in Africa

Lassa Virus

Ebola Virus

Marburg Virus

Legend
- High risk
- Possible risk
- Low risk areas, but stay alert

Legend
- Reported cases of Ebola

Photos courtesy of Travel Approved (for Lassa and Ebola), Mehedi et al. 2011 (for Marburg)
Lassa Fever: Biology

- Lassa is a member of the arenavirus family
- 300,000 to 500,000 cases are reported yearly, with 5,000 associated deaths
  - 1% mortality rate, but increases to 15-20% in hospitals
  - Increased mortality for pregnant women and the fetus

Photo courtesy of PLoS Neglected Tropical Disease
Multimammate rats (*Mastomys natalensis*) are the animal reservoir for Lassa virus.

Virus is secreted in high concentrations in urine and feces.

Transmission to humans occurs via inhalation of aerosolized excreta, direct contact with excreta, or even ingestion of infected rats as a source of meat.

Photo courtesy of the University of Greenwich.
Lassa Virus: Risk Factors

- Frequent contact with bush rats, especially when rodents are present in and around food storage
- Dry regions due to increased aerosolization of excreta
- Most at risk are health workers and family members caring for infected patients

Photo courtesy of the Public Health Agency of Canada
Ebola Virus: Biology

- Rare but severe VHF with a mortality rate of 50-90%
- Typically found in areas of humid climate and rainforest environments in central and west Africa
- Risk of human-to-human transmission is extremely high

Photo courtesy of National Geographic
Ebola: A filovirus

Photo courtesy of CDC PHIL
Ebola Virus: A mysterious reservoir

Photos courtesy of the Public Domain Images Library

Devoted to reducing Malaria deaths & suffering in humanitarian crises
Ebola Virus: Risk Factors

- Contact with wild animals, especially non-human primates in a hunting and butchering context
- Healthcare workers and family

Photo courtesy of Nathan Wolfe

Photo courtesy of the CDC PHIL
Marburg Virus: Unknown Reservoir

Rousettus aegyptiacus

Photo courtesy of Dietmar Nill and naturepl.com
Marburg Virus: Risk Factors

- Mining projects and working in caves
- Caring for the sick: barrier nursing techniques are of primary concern

Photo courtesy of CDC Outbreak control
Diagnosis & Treatment

• Diagnosis with laboratory tests (Ag & IgG detection, PCR correlation, chemistries, liver enzymes, renal function, isolation of the virus itself)
• Treatment:
  – Isolation with supportive care (IV fluids, oxygen, fever and blood pressure medications)
  – Ribavirin intravenously for 10 days is effective for Lassa virus
  – Ebola and Marburg viruses have no specific treatment available

425 cases, 224 fatalities

(53% mortality)
Uganda 2000-2001 Ebola Outbreak
Uganda Outbreak: Timeline

Photo courtesy of Scott Harper and the CDC
Outbreak Containment & Control

1. Logistics and coordination: barrier nursing supplies & organization of teams, isolation unit for patients
2. Social mobilization: Outreach to the public
3. Laboratory diagnosis
4. Epidemiology and surveillance: database of cases and case contacts

Photo courtesy of ABC news
Humanitarian Crises

• High population density encourages transmission
• Medical resources are limited
• Surveillance is difficult or impossible
• Isolation wards and hospital protocols are compromised

Photo courtesy of Melanie Kotsopoulos
Key strategies for crisis settings

• **Isolation**: ideally find a separate room or building for infected patients, but a corner of a large room can still help reduce nosocomial spread

- use tarps or sheets to separate beds to avoid cross contamination with spills or splashes
- minimize flow of people through the area, and put most severe cases toward the back

Photo courtesy of Paul Jawor
Reduce Transmission

Photos courtesy of the CDC PHIL
Supplies for low-resource settings

Fig. 57. A completed incinerator

Pictures courtesy of the CDC
Future Directions

• Vaccines for Lassa virus, Marburg, and Ebola are currently in animal testing and are proving to be so far successful.

• The Global Viral Forecasting Initiative (GVFI) is using bushmeat hunters to monitor emerging and existing viruses in animal to predict viral outbreaks before they occur.

Photos courtesy of National Geographic
Summary

- Lassa, Ebola, and Marburg viruses are viral hemorrhagic fevers with similar symptoms, high infectivity, and high mortality.
- Transmission risk is highest in healthcare settings, so barrier nursing techniques, isolation, and disposal of contaminated items is crucial.
- Outbreak control and containment includes coordination, surveillance, and social mobilization.
- In resource-poor settings or during humanitarian crises, alternative but effective strategies can be used.
- Current research in viral forecasting will hopefully reduce epidemic occurrence and severity in the future.
The End

Photo courtesy of the CDC PHIL

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