Hemorrhagic Fever Outbreak Investigation

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Section A

From Surveillance to Outbreak Investigation
From Surveillance to Outbreak Investigation

- Major objective of surveillance is to detect and respond to epidemics
- For surveillance system to pick diseases that can cause epidemics
  - Need a list of reportable diseases
  - Establish procedures for immediate reporting
Commonly Reportable Diseases

- Diseases that can cause epidemics
  - Measles
  - Cholera
  - Meningitis
  - Hepatitis
  - Yellow fever
  - Tuberculosis
  - Dengue hemorrhagic fever
Background Information: Kenya

- El Niño rains nationwide
- Poor access to health care
  - Inadequate health facilities
  - Nurses and lab technicians on strike
- No government
  - Election fever
- Many districts/towns hit by cholera
  - Local/international NGOs took over care of affected communities
Background Information: North-Eastern Kenya

- Heavy toll of El Niño rains on animal and human health
- Poor access to most villages due to
  - Flooding
  - Insecurity from bandits
- All water/sanitation systems disrupted
Background Information: North-Eastern Kenya

- IFRC assisting Garissa flood victims
- MSF assisting refugees in Wajir
IFRC Cholera Preparedness

- Installed water purification systems
- Health education—community and leaders
IFRC Cholera Preparedness

- Set up treatment/lab facilities
  - Basic health care for acute illness
- Trained personnel
  - Seven health workers, 100 CHWs/TBA
- Stockpiled cholera kits
- Latrine construction materials available
IFRC Cholera Preparedness
Diarrheal Disease Surveillance

- Establish surveillance system for watery and bloody diarrhea
  - No./age/location of new cases
  - No./age/location of deaths
  - Data analyzed and reported weekly
- Health data collected from community and health facilities (private, NGO)
- Only declare outbreak on lab evidence
Cholera Outbreak Response Plan

- Response plan for outbreak
  - Immediate investigation to confirm outbreak, active case-finding, etc.
  - Strengthen water/sanitation system
  - Aggressive health education
  - Treatment protocols in place
  - Disinfection, disposal of bodies
Initial Reports of Hemorrhagic Fever Outbreak

- **Kenya**—December 21, 1997
  - 143 deaths in two districts
  - Characterized as bleeding disease

- **Somalia**—December 19, 1997
  - 335 deaths in seven villages in Torotoro
  - Characterized by bleeding and fever
Clinical Features of Hemorrhagic Fever

- Characterized by acute onset of . . .
  - Fever
  - Headache
  - Bloody stools
  - Vomiting blood
  - Bleeding from other orifices
**Differential Diagnosis for HF**

<table>
<thead>
<tr>
<th>Category</th>
<th>Conditions</th>
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<tbody>
<tr>
<td><strong>Viral</strong></td>
<td>Yellow fever, rift valley fever, Crimean Congo HF</td>
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<tr>
<td><strong>Bacterial</strong></td>
<td>Meningococcemia, typhoid, leptospirosis, rickettsiosis</td>
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<tr>
<td><strong>Protozoal</strong></td>
<td>Plasmodium malaria</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Bleeding disorder, (vasculitis, TTP, HUS)</td>
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</table>
Coordination of Initial Research

SOMALIA
Field Team
WHO, ICRC

KENYA
Field Team
PMOH, IFRC, WHO, AMREF, MSF, MDM

African Medical & Research Foundation
AMREF (Kenya)
(bacteria, parasites)

Kenya Medical Research Institute
KEMRI (Kenya)
yellow fever virus

National Institute of Virology
NIV (S. Africa)
(EB, MB, L, CC, DF, YF, TE, S, HV, WN, HE)

Centers for Disease Control
CDC (USA)
(like NIV + unknown viruses)
Coordination of Initial Research
Section B

Stage I
Stage I: Confirm Outbreak and Determine Possible Cause

- Interviewed people reporting bleeding symptoms and collected blood samples
  - Torotoro (Somalia)—no active case
Stage I: Confirm Outbreak and Determine Possible Cause

- Found human cases and contacts and ill livestock in nine villages in Garissa and Wajir districts (Kenya)
Stage I: Findings

- Possible risk factors for HF
  - Occupation—herdsman/spouse
  - Association with livestock—goat, sheep
  - Age—mainly adults between 25–40 years old
  - Gender—males more than females
Stage I: Findings

- Laboratory results
  - 15/36 specimens had evidence of recent RVF infection
# History of Rift Valley Fever Outbreaks

<table>
<thead>
<tr>
<th>Africa</th>
<th>Low-level endemic transmission in most regions with poor surveillance. Periodic epidemics/epizootics every 5-10 years.</th>
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</table>
| Kenya  | **1930**—First identified as fatal lamb disease at farm near Lake Naivasha  
|        | **1962**—Last outbreak in NE Kenya  
|        | **1989**—Most recent epidemic |
| Somalia| No prior outbreak reported |
Rift Valley Fever Transmission

Mosquito

Domestic

Flies

Animals

Man

R V F V
RVF Control Measures

- BBC Somalia
  - Warn against slaughter
  - No aspirin treatment for febrile patients
RVF Control Measures

- CHWs/local leaders
  - IEC on risks of slaughter or consumption of sick livestock
RVF Control Measures

- Improve handling of dead humans and animals
RVF Control Measures

- Health staff
  - Improve patient care, specimen collection, self-protection
RVF Control Measures

- *Surveillance/counseling* of community
- *Press releases*—via local/int’l media
- *Press conferences*—update general public on RVF status
- *Neighboring countries*—health officials urged to increase surveillance
Section C

Stages II and III
Stage II: Establish Magnitude

- Revise case definition/reporting forms
  - Case of recent RVF = positive IgM
- Establish national surveillance for RVF reporting and follow-up of cases
  - Alert all health authorities and NGOs
- Active case-finding in affected districts
- Train rapid outbreak response teams
Stage II

Cases With Bleeding And Fever

Reported on the WHO Questionnaire
February 1998

- Case with IgM or PCR positive
- Case without IgM or PCR positive
### Stage II: Laboratory Results

<table>
<thead>
<tr>
<th>RVF</th>
<th>Case</th>
<th>Non-Case</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgM +ve</td>
<td>21 (32%)</td>
<td>17 (44%)</td>
<td>38</td>
</tr>
<tr>
<td>IgM -ve</td>
<td>45</td>
<td>32</td>
<td>77</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>49</td>
<td>115</td>
</tr>
</tbody>
</table>
Conclusion of Stage II

- RVF most likely accounted for 1/3 of the cases with hemorrhagic fever
- Other diseases may account for the other hemorrhagic fever cases (2/3)
Stage III: Confirm RVF Disease and Risk Factors

- To determine the following:
  - RVF seroprevalence among human and animal populations
  - Different modes of transmission
  - Personal and lifestyle factors and exposures in sample population
  - Other possible causative agents
Stage III Field Study Team

- Many teams joined local investigators:
  - Min. of Health/Agriculture/Livestock
  - WHO
  - EPI CENTRE, EPI ET
  - CDC
  - NIV
  - SDR (Swiss Disaster Relief)
Coordination of Field Studies

KMOH/WHO
Research Task Force

- Human Epidemiology Team
- Laboratory Team
- Veterinary Team
- Entomology Team
## Description of Field Studies

| Human Cross-Sectional Study | New case-finding  
|                           | Repeat case-finding  
|                           | Clinical services  
| Laboratory Processing | Serum separation  
|                           | Blood cultures  
|                           | Malaria, rbcs, wbcś  
| Animal Data Collection | Herd loss/abortions  
|                           | Vaccination status  
|                           | Biological specimens  
| Mosquito Traps | Wild ponds (sylvatic)  
|                           | Peri-domestic  
|                           | Urban domestic  


Sampling

- Garissa—84 sub-locations 12 divisions
  - Population 231,022 (non-refugee)
- Randomly selected
  - 30 clusters (sub-locations)
  - Seven households per cluster
- Recruited one person/household for study
  - Cluster—1(2–9ys) + 5(10–49ys) + 1(>50ys)
Field Study Population

- 29 Clusters by GPS coordinates
  - Cluster #7 (Harehare) not found geographically => Liboi volunteers
  - Urban = 6, rural = 13, nomadic = 10
  - Cluster #19—only six sampled
  - Four clusters replaced children with adults
Field Study Population

Cross-Sectional Survey, Garissa, Kenya
February, 1998

- Number of Clusters Per Division
Data Collection: Humans

- Interviews from 2/8–2/14, 1998 (20 minutes)
- First obtained verbal consent
- Trained health-workers fluent in English, Swahili, and Somali issued questionnaire (under supervision)
- Enquired on exposure/illness since floods started
- Blood specimens collected
Data Entry and Analysis

- Survey data analyzed with Epi-Info 6.04
  - Demographic characteristics
  - Lifestyle factors (butcher, animal)
  - Diet factors (intake of raw milk/meat)
Data Entry and Analysis

- Survey data analyzed with Epi-Info 6.04
  - Environmental factors (shelter, displacement)
  - Economic factors (loss of livestock)
- Different groups and exposure categories further analyzed
## Field Study Results: Human and Laboratory

| **Human Cross-Sectional Study** | 172/202 had illness  
78% had fever  
56% had headache  
7% had bleeding |
|-------------------------------|--------------------------------------------------|
| **Laboratory Processing**     | Survey—8.9% positive (+ve)  
Bleeding (survey)—1/12 +ve  
All tests—22% +ve  
All bleeding cases—22% +ve |
Discussion/ Recommendations (Human and Laboratory)

- Survey confirmed major RVF outbreak
- Suggests RVF as a major contributor to hemorrhagic fever cases/deaths
- Low RVF positivity among true cases
  - Implies other causes of HF
  - Or false negative results
- New HF cases to be properly investigated
# Field Study Results: Veterinary and Entomology

| **Animal Mortality** | Sheep 84%  
Goats 78%  
Cattle 30%  
Camels 23% |
|----------------------|--------------------------------------|
| **Mosquito Traps**    | 3,180 mosquitoes  
*Anopheles coustani*  
*Mansonina africana*  
*Mansonina uniformis* |
Discussion/ Recommendations (Veterinary)

- 20–80% livestock died since floods
  - >75% among sheep/goats
  - RVF not a major contributor of loss
- Excess abortions from many factors (foot rot, pleuropneumonia)
- Livestock loss economically costly

Continued
Discussion/ Recommendations (Veterinary)

- Establish appropriate disease control measures
  - Vaccination
  - Drug supply
Discussion/ Recommendations (Entomology)

- *Anopheles coustani*—a potential RVF transmitter during epizootics
- *Mansonina africana/uniformis*—low density, confined to water ponds
- Conclude outstanding studies
  - Flight range, host preference, infectivity rate of *A. Coustani*
  - Vector competence of *Mansonina*
Field Study Conclusion

- 11 clusters with IgM positive
  - Implied RVF widespread
Field Study Conclusion

- Survey found 8.9% RVF seroprevalence
  - Total RVF infections ~ 89,000
  - (Garissa/Wajir/S. Somalia ~ 1 million)
  - 445 HF cases, assuming all susceptible and 0.5%
- Close association between RVF positivity with animal contact
Section D

Conclusion
Outstanding Research Questions

- Validity of +ve IgM results,
- Validity of reported HF cases,
- Sensitivity/specificity of Elisa test
- Reporting bias
- Repeated negative specimens to be tested for other causes
Lessons Learned: National

- Heavy toll of El Niño rains on human and animal health
  - Worsened by poor health care access
- Surveillance affected by inadequate systems, health workers strike, no government
Lessons Learned: National

- Initial epidemic response rapid
  - Slowed by logistics, infrastructure, resources
- Need to strengthen national laboratories serology, virus isolation
Lessons Learned: International

- WHO mobilized resources, partners
- Much achieved through collaboration with all centers and NGOs
- Local/international media drew attention of authorities and world
  - Powerful health education medium
  - Given/reported accurate information
Lessons Learned: Role of NGOs

- Local and international NGOs vital link between donors and affected people
- Locally based NGOs can develop effective partnerships in surveillance
Final Recommendations

- Conclude outstanding studies/reports
- MOH and partners to improve surveillance
- MOH and WHO to build local capacity
  - Multi-sectoral collaboration
Final Recommendations

- Improve media collaboration
- EWS via satellite remote sensing
- WHO/FAO to address Somalia’s livestock export embargo
Summary

- Initial reports of HF morbidity/mortality in humans and livestock in NEP, Somalia
- Initial case finding showed RVF present
- Further studies on risk factors revealed existence of known vectors of RVF
- RVF antibody rates in Garissa reflected in Wajir and Somalia