Tools and methods used to evaluate emergence of other zoonotic diseases

Pierre Formenty – 9 October 2008, Verona, Italy

Avian Influenza at the Human-Animal interface

Our world is changing

- The way we live
- 2025: 5 Billions urban
- Microbes evolve
- New threats emerge
44 megacities in 2020

Emerging Severe Zoonoses: complexity of implementing disease control strategies
61% of EIDs are Zoonoses affecting Humans

- Frequency of all EID events has significantly increased since 1940, reaching a peak in 1980-1990
- 61% of EID events are caused by the transmission from animals (zoonoses)
- 74% of these from wildlife.
- Zoonotic EIDs from wildlife reach highest proportion in recent decade

Tools and methods used to evaluate emergence of other zoonotic diseases: from forecasting to outbreak response.
Risk mapping and Forecasting EID emergence.
Modeling EID events: Relative risk of an EID


Modeling EID events: CCHF risk map

Courtesy David Roger, Oxford University, Department of Zoology, Oxford, UK
Forecasting EID emergences

Ebola surveillance in Central Africa

Collaborators:
WCS, CIRMF, IRD, ECOFAC, MoH, National Park Boards, MSF, WHO.

Geographic Distribution of Filovirus and Henipavirus outbreaks and fruit bats of the Pteropodidae Family.
Forecasting Rift Valley Fever outbreaks

El Niño, SST, IOD

NDVI data

NASA / GSFC

Animal Outbreaks (FAO/OIE)

Human Cases WHO/GOARN

Forecast possible RVF outbreaks

Early Warning

FAO/WHO Warning message

1. Intensified surveillance
2. Human/Vet. collaboration
3. General guidelines
4. Reference laboratories
5. Shipment guidelines

Conditions for RVF Risk during November 2006

El Niño effect, October 2006

NDVI anomalies, November 2006
HoA climatic and ecological conditions and RVF outbreak sites Sept 2006 to May 2007

Mapping of the RVF human case locations shows that
● 64% of the cases were reported in areas at risk within the RVF potential epizootic area,
● 36% were reported in areas not thought to be at risk of RVF activity.

Sudan climatic and ecological conditions and RVF outbreak sites May to November 2007

Mapping of the RVF human case locations shows that
● 50% of the cases were reported in areas at risk within the RVF potential epizootic area,
● 50% were reported in potential epizootic areas not thought to be at high risk of RVF.
Madagascar climatic and ecological conditions and RVF outbreak sites Sept 2007 to May 2008

- RVF Risk Area
- RVF Potential Epizootic Area
- Outbreak identified as Non-Risk
- Outbreak identified as Risk

Epidemic and Pandemic Alert and Response

West Nile and RVF Outbreaks, August-Sept 2003

- Morocco, Sept. WN 8 horses
- Tunisia, Monastir, Sept. WN ~50 cases, 8 deaths
- Egypt, Aug-Sept RVF +/- WN ?

Epidemic and Pandemic Alert and Response
Yellow fever outbreak August-November 2005

Sudan, Aug-Nov.
YF 560 cases 143 deaths +/- Dengue

Need more collaboration with MoA, Vet services, NGOs working in conservation for surveillance of Animal outbreak that precede human cases (Ebola, Yellow Fever, Nipah Hendra)

Several RVF Alerts send to countries and Regions but only 2 RVF outbreaks were "predicted" (2003 and 2006)
- Some countries take appropriate measures, prepare outbreak response team and vector control program
- Detection of other Arboviruses outbreaks (dengue, West Nile, Yellow Fever)
- Need for more systematic way of sharing forecasting maps with countries (web site)

Develop models for other diseases (CCHF, Hantavirus)

Is forecasting helping detection?
Surveillance of EID emergence

● 24 hours / 7 days a week.
● 900 events of potential international importance verified, in all countries, in 5 years.
● >400 advice/assistance provided.
● More than 50 international outbreak response coordinated through the Global Outbreak Alert & Response Network (GOARN).
● > 450 issues of the Outbreak Verification List.
● Numerous Outbreak News update on WHO Web site.

WHO Alert and Response Department
**Response strategy and Operations**

**Formal**
- WHO laboratory networks, (sub-)regional networks, WROs & MoH, UNOs

**Informal**
- Global Public Health Intelligence Network (media), NGOs

**Risk Assessment**

**Verification**

**Epidemic Intelligence**

**Response strategy and Operations**

**Coordination**
- Technical & Operational Medias - Information Finances

**Epidemiological**
- Investigation Surveillance Laboratory

**Case management**
- Funerals Infection Control

**Social Mobilization**
- Health Education Medical Anthropology

**Logistic Security Communications**
GPHIN
Real time gathering information on outbreaks

Sources:
- GPHIN 39%
- WHO System 33%
- Pro-MED 6%
- Others (labs, NGO) 22%

EIDs Alert and Surveillance Perspectives

● Surveillance of zoonotic emerging diseases is improving
● Intensified collaboration with animal disease sector: domestic and wildlife
  ● GLEWS with FAO and OIE
  ● Formal collaboration with wildlife disease experts
  ● Support EID vector borne network (bats, rats, primates, entomology)
  ● Connect the different Lab networks
● Improve forecasting models based on environment and meteorological data
Emerging Infectious Diseases
Response and control

General strategy for controlling outbreak

Epidemic and Pandemic Alert and Response

World Health Organization

(* COMBI = communication to change behaviors)
General strategy for controlling outbreak

- Establish a co-ordination mechanism for response
- Inform the public / health education / social mobilization
  - Restrict practices that promote transmission and source infection
- Establish isolation ward / Safe and Humane case management
  - Conduct safe funerals that allow the process of mourning
- Establish an active surveillance system
  - Identification of cases and follow up of their contacts during the incubation period (prophylaxis if available, isolate if ill).
  - Stop transmission chains and stop source infection.
- Psychosocial support (patients, families, HCW).
- Recommendations on travel and trade

Outbreak response : evaluate emergence

- Need to understand the disease in human:
  - epidemiological patterns (CFR, human to human transmission, transmission patterns, behavior risk)
  - Improve clinical data collection (diagnosis, biochemistry, hematology, autopsy, etc..) to establish the effectiveness of some treatment measures and to progress in our knowledge on pathogenesis and to be ready when new countermeasures come (antiviral and vaccines)
  - Social context (community, medical anthropology,...)
- Need to understand disease in animal that precede human infection
  - Occupation risk
  - Coordinated human and animal health surveillance
  - Ecological studies

Ebola incubation period (DRC, Sudan, Gabon, Uganda and Congo (souche Zaire et Soudan)
- Ebola maximum incubation period was 19 days
- Ebola incubation period median was 7 days
Outbreak control: field laboratory

Rift Valley Fever outbreak response, Sudan

Laboratory: NAMRU-3 was deployed in Kosti (PCR) for 5 days and in Khartoum (IgM by ELISA) for 7 days. NAMRU-3 confirmed 16/47 human cases in Kosti and Khartoum labs.
Outbreak control: Laboratory

- Diagnostic field laboratory essential (AI, MPX, large outbreaks, concomitant measles/Ebola, VZV/MPX, help link the lab with the field...)
- Field Labs doing Animal and Human tests
- Biochemistry + Hematology field lab for better care of patients
- Non-invasive methods of diagnostic
- Blood bank for future testing development
- WHO CC work is crucial, regional approach, international collaboration.
Outbreak control: Laboratory

- Promote post mortem for acquiring better knowledge in pathogenesis and pathology of emerging diseases

Outbreak control: Social Mobilization

- For many EID the only effective control measure is the Prevention
- COMBI = Communication for Behavioral Impact
  - Precise and clear objectives for behavior change
  - Administrative mobilization/public relation/advocacy: intense collaboration with administrative, civil and military local authorities.
  - Interpersonal communication/counselling: Psycho-social aid to the families (food, discussions, condolences, visits, coffins, supplies)
  - Community mobilization; Advertising; Point-of-Service Promotion
- Importance of the social psychology in sanitary interventions
- Essential contributions of the medical anthropology to understand the populations and to adapt the behavior of the medical teams
- Discussion with/Help from traditional medicine
Outbreak control: Ecological studies
Importance of Wildlife Species in Understanding the Epidemiology of Zoonoses

- Monkeypox
- Avian Influenza
- West Nile
- SARS
- Nipah

EID general conclusion (1)

- **EID outbreak detection** is better than in the past but could be improve
  - To intensify collaboration between wildlife, domestic animals and human health sectors
  - To improve forecasting models
- **EID outbreak response** quality need to improve to ensure acceptance by the affected populations (relational behavior with the patients, respect of the local culture and beliefs, respect of funeral customs, etc...).
EID general conclusion (2)

- The absence of effective therapies or vaccines for EIDs severely limits monitoring activities and containment operations.

- Human new vaccines and new “treatments”
  - may change the situation
  - improve the perception of the medical profession in areas of the world where modern medicine is often lacking.

- New animal vaccines may prevent human infection or decrease human exposure

EID general conclusion (3)

- Human and animal health authorities, including OIE FAO and WHO, should have a common and coordinated strategy to forecast, detect and control outbreak of emerging diseases

- Need for common SOPs for District Surveillance Officers and Vets to control selected EID (e.g. RVF) from forecasting to outbreak containment with an FAO OIE WHO agreed strategy: One Message, "all on the same page".

- Need for preparedness and occupation health guidelines (e.g. how to protect slaughtering house personnel in different technology settings, farmers, hunters, ...)
Today's technologies can help to better detect, manage and contain the international spread of Emerging zoonotic diseases

NOT Enough

Key points remain high level governments commitment and international collaboration.

OIE/FAO reporting system an WHO IHR 2005 support this mechanism and will help the reinforcement the countries capacities in outbreak alert and response

3 Worlds = 1 Health → Need to intensify collaboration between wildlife, domestic animals and human health sectors at country level and internationally
THANK YOU
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