Communicable Disease Control After Natural Disasters
Dr. Michelle Gayer, World Health Organization, Geneva
A Webber Training Teleclass

Communicable disease control after natural disasters
British Teleclass Lecture Series
Hosted by Paul Webber paul@webbertraining.com

Definitions
Emergency:
A serious situation or occurrence that happens unexpectedly and
demands immediate action.

Complex Emergencies
"...... are situations affecting large civilian populations, usually
involving a combination of war and civil strife, food shortage and
population displacement, resulting in significant excess mortality and
morbidity".... (WHO)

Natural disasters
any event or force of nature that has catastrophic consequences,
such as avalanche, earthquake, flood, forest fire, hurricane,
tornado, tsunami, and volcanic eruption.

Most common natural disasters

FACTS: Disaster deaths

- In the immediate aftermath of a disaster, most deaths are due to
  trauma and drowning.
- Communicable Diseases (CD) are caused mostly by secondary
effects/conditions and NOT by the primary hazard.

The importance of CDs in Emergencies and Disasters

- Disaster-affected people are particularly vulnerable when:
  - Post-disaster living conditions are precarious and unsanitary.
  - The disaster’s immediate consequences reduce resistance to
disease - such as malnutrition, stress, fatigue.

- The FIVE most common cause of death are diarrheal diseases,
  acute respiratory tract infections, measles, malnutrition and
  malaria (in endemic zones).

- All – except malnutrition – are CD and directly related to
  environmental conditions.

Disaster death tolls

Top 10 by number of deaths

<table>
<thead>
<tr>
<th>Disaster Type</th>
<th>Countries Affected</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsunami (December)</td>
<td>12</td>
<td>288,931</td>
</tr>
<tr>
<td>Hurricane Jeanne (September)</td>
<td>Haiti</td>
<td>2,754</td>
</tr>
<tr>
<td>Flood (May-June)</td>
<td>Haiti</td>
<td>2,665</td>
</tr>
<tr>
<td>Tropical storm Winnie (November)</td>
<td>Philippines</td>
<td>168</td>
</tr>
<tr>
<td>Flood (June-August)</td>
<td>India</td>
<td>900</td>
</tr>
<tr>
<td>Flood (June-August)</td>
<td>Bangladesh</td>
<td>750</td>
</tr>
<tr>
<td>Flood (May-June)</td>
<td>Dominican Rep</td>
<td>688</td>
</tr>
<tr>
<td>Denga Epidemic (January-April)</td>
<td>Indonesia</td>
<td>658</td>
</tr>
<tr>
<td>Earthquake (February)</td>
<td>Morocco</td>
<td>628</td>
</tr>
<tr>
<td>Meningitis epidemics (January - March)</td>
<td>Burkina Faso</td>
<td>327</td>
</tr>
<tr>
<td>Cyclone Gufo (March)</td>
<td>Madagascar</td>
<td>363</td>
</tr>
</tbody>
</table>

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**Most common types of disasters**

<table>
<thead>
<tr>
<th>Disasters</th>
<th>Affected Countries</th>
<th>Affected People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood (July)</td>
<td>China P Rep</td>
<td>33,652,826</td>
</tr>
<tr>
<td>Flood (June-August)</td>
<td>Bangladesh</td>
<td>36,908,900</td>
</tr>
<tr>
<td>Flood (June-August)</td>
<td>India</td>
<td>33,109,800</td>
</tr>
<tr>
<td>Typhoon Ramon (Aug)</td>
<td>China P Rep</td>
<td>8,904,080</td>
</tr>
<tr>
<td>Flood (September)</td>
<td>China P Rep</td>
<td>8,293,000</td>
</tr>
<tr>
<td>Drought</td>
<td>South Africa</td>
<td>4,000,000</td>
</tr>
<tr>
<td>Drought</td>
<td>Kenya</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Cold wave (July)</td>
<td>Peru</td>
<td>3,157,667</td>
</tr>
<tr>
<td>Typhoon Aere (Aug)</td>
<td>Philippines</td>
<td>1,058,849</td>
</tr>
<tr>
<td>Cyclone Galko (March)</td>
<td>Madagascar</td>
<td>984,132</td>
</tr>
</tbody>
</table>

Top 10 by number of affected

**The water effect**

Most common type of natural disasters have a water effect:
- avalanches
- earthquakes – causing river re-routing and/or damming of rivers
- mud slides
- typhoons
- tsunami
- volcanic eruptions
- melting glaciers

All of the above result in FLOODING

**Common consequences of the "water effect" in natural disasters**

- Breakage of water mains; overflow of sewerage systems; interruption of electric supplies for water pumping stations; salination of water supplies; stagnation of water pools; unearthing of dangerous objects/mines.
- Flooding potentially increase the transmission of the following communicable diseases:
  - water-borne diseases, such as cholera and other diarrhoeal diseases, hepatitis A, leptospirosis and typhoid fever;
  - vector-borne diseases, such as dengue and dengue haemorrhagic fever, scrub typhus, malaria, West Nile fever and yellow fever.

**Water borne diseases (I)**

Risk is low unless:

1) there is significant population displacement with overcrowding

Of the 14 major floods occurred globally between 1970 and 1994:
- only one led to a major diarrhoeal disease outbreak (Sudan, 1980).
- led to a large cholera epidemic (Bihar, India) (West Bengal, 1998)
- led to an increase in the incidence of diarrhoea (Mozambique, Jan – Mar 2000)

**Water borne diseases (II)**

Risk is low unless:

2) and/or water sources are compromised

- A typhoon in Truk District, Trust Territories of the Pacific, in 1971 disrupted catchment water sources and forced people to use many different sources of groundwater that were heavily contaminated with pig faeces ⇒ outbreak of balantidiasis.
- In Tajikistan in 1992, the flooding of sewage treatment plants led to the contamination of river water.
- contamination of drinking-water facilities in Iowa and Missouri (USA) in 1993.

**Vector borne diseases (I)**

- Standing-water caused by heavy rainfall or overflow of rivers act as breeding sites for mosquitoes ⇒ enhance potential for exposure of the disaster-affected population and emergency workers to infections such as dengue, malaria and West Nile Fever.

- Flooding may initially flush out mosquito breeding, but it resumes when the waters recede.

* West Nile fever has resurfaced in Europe subsequent to heavy rains and flooding, with outbreaks in Romania in 1996–1997, in the Czech Republic in 1997 and in Italy in 1998.
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Vector borne diseases (II)

Travel note:
Malaria outbreaks in the wake of flooding are a known phenomenon in malaria-endemic areas worldwide.
- an earthquake and subsequent flooding in Costa Rica’s Atlantic region in 1991 and flooding in the Dominican Republic in 2004 led to malaria outbreaks.
- Periodic flooding linked to El Nino-Southern Oscillation (ENSO) is associated with malaria epidemics in the dry coastal region of northern Peru, and with the resurgence of dengue in the past 10 years throughout the American continent.

Factors increasing risk of CDs after natural disasters (I)

1. Post-disaster living conditions
   - Loss of shelter
   - Overcrowding
   - Temporary accommodations without adequate ventilation
2. Minimal provision of basic needs
   - Disruption of public utilities (e.g. electricity, water and sewage treatment)
   - Lack of sufficient, safe water
   - Inadequate sanitation
   - Lack of food (leading to malnutrition and weakened immunity)
   - Inadequate facilities for personal hygiene
   - Lack of soap

Factors increasing risk of CDs after natural disasters (II)

3. Pre-disaster conditions
   - Population density in cities
   - Absence of poverty reduction/community development initiatives;
   - Relatively low levels of immunity;
   - High proportion of children;
   - High levels of malnutrition;
   - Low levels of vaccination coverage
   - Population displaced from low to high endemic area (eg malaria)
4. Human behaviour
   - Increased exposure to disease vectors (mosquitoes, fleas, lice) while sleeping outside or in crowded conditions
   - Lapse in preventive activities – such as hand washing, boiling of drinking water, vector larvicide, rodent control etc.

Priority CD control measures in disasters (I)

Short term measures
1. Provide safe water and sanitation
2. Provide food and shelter
3. Protect susceptible groups through vaccination: mass measles
   vaccination is priority, recommended vaccinations for expatriates.
4. Institute vector control measures
5. Control animal reservoirs
6. Health education re: safe water & food, excreta disposal, hygiene & hand washing
7. Surveillance / early warning and response system for rapid detection and response to CD outbreaks
8. Prompt and effective clinical case management
9. Appropriate handling of corpses

Priority CD control measures in disasters (II)

Long term measures
- Legislative and administration issues: disaster committee functions/activities, water quality and quantity regulations.
- Technical issues: update and update guidelines/protocols accordingly.

CDs and Corpses: the real risk

- The risk that dead bodies pose for public health is very small
  - the living pose a greater risk!
- Victims of natural disasters usually die from trauma and are unlikely to have "epidemic-causing" infections.
- However observe universal precautions for persons involved in close contact with human remains.
  - may be exposed to chronic infectious hazards – including hepatitis B, hepatitis C, HIV, enteric pathogens and Tuberculosis.
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Preparedness
Key to CD control in disasters
- Risk assessment of disease threats
- Standard & locally adapted guidelines & tools for CD control
- Strengthening disease surveillance and response systems.
- Raising community awareness among populations likely to be affected by disasters.
- Training of health outreach staff on CD case identification and management.
- Pre-positioning local stocks of supplies and equipment for CD diagnosis/treatment and outbreak control.

WHO CD response (I)
Example post-tsunami 2005
1. Technical guidelines and tools
   available at https://www.who.int/infectious_disease_nnews/ and www.who.int/csr
   and www.who.int/tdme/teach/cources/communicable_diseases/emergency/index.html
   - Flooding and communicable diseases – WHO fact sheet
   - CD risk assessment and interventions – WHO technical note
   - Communicable Disease Control in Emergencies – WHO Field Manual
   - WHO CD toolkit for Tsunami-affected areas:
     - CD profile for Indonesia 2005
     - Surveillance/EWARN guidelines, outbreak management and supplies, health assessment forms, guidelines for laboratory specimen collection.
     - Electronic system for data entry & analysis including mapping (Health mapper, Arc View)

WHO CD response (II)
Example post-tsunami - Indonesia, 2005
2. CD field teams
   - Epidemiologists, laboratory experts, logisticians, food safety, disease-specific experts
   - Implement Surveillance/Early Warning and Response, incl. laboratory facilities, conduct outbreak investigation and control activities
   - Technical co-ordination by CD field teams in WHO Country offices
   - Agree appropriate package of CD interventions (eg malaria, dengue) based on CD country epidemiological profiles
   - Technical support for proposal development and implementation
   - WHO/MOH Weekly bulletins: feedback to NGOs, and other international partners.
   - Onsite training

Disease surveillance – a priority for CD control in emergencies
- As soon as possible
- Only principal health problems during emergency phase
- Limit to public health matters which can and will be acted upon
- Keep simple and flexible to respond to new health problems
- Keep data analysis at level where action occurs (field)

Public Health Surveillance
Different Objectives, Different Data, Different Methods
- Epidemic intelligence
  - Early warning information
  - Health Status Monitoring
    - Health indicators
  - Control activities
  - Resource allocation
- Incidence data
  - Disease Monitoring
  - Administrative data
  - Health System Monitoring

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Objectives of Disease Surveillance

- Detect communicable disease outbreaks requiring immediate action
- Monitor communicable disease trends in order to take appropriate public health action
- Monitor workload at health facilities to optimise allocation of resources

Objective of Early Warning Surveillance

- To predict, detect and confirm outbreaks of public health importance in a timely fashion and to disseminate that information to those who need to know so that effective public health action can be taken

Attributes of effective surveillance/early warning and response system

- Close collaboration with authorities and partners from the start – create network
- Small number of priority diseases
- Syndromic reporting
- Simple case definitions
- Processes for dealing with alerts (“rumours”)
- Rapid case investigation and sampling
- Rapid laboratory confirmation
- Standard procedures for information sharing and initiation of response
- Preparedness plans in place

Before implementing surveillance/early warning and response system

- In collaboration with MOH and partners:
  - Set surveillance priorities
  - Agree on:
    - Objectives
    - Case definitions for diseases
    - Thresholds for action
  - Identify responsible persons / tasks

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Key components of surveillance/early warning and response system
- Population under surveillance
- Data to be collected / attributes of surveillance system
- Data providers
- Data flow
- Periodicity
- Reporting period/method
- Data analysis
- Feed-back
- Laboratory facilities
- Outbreak preparedness
- Outbreak investigation and response

Post-tsunami surveillance/early warning and response - Aceh province 2005
- Population = Residents and IDPs
- Data to be collected / attributes of system
- Sensitivity:
  - Syndrome-based
  - Simple:
    - Morbidity (cases) and mortality (deaths)
    - Epidemic-prone diseases
    - Diseases of major morbidity and mortality
    - 12 reportable events (>2 additional for IDP)
    - 2 age groups <5 and ≥5
- Standardised form with case definitions agreed with PHI and all partners
- Total deaths
- Total consultations
- Pregnancy-related death
- Neonatal death
- Acute watery diarrrhoea
- Acute bloody diarrhoea
- Suspected measles
- Confirmed malaria
- Acute jaundice syndrome
- ARI
- Suspected meningitis
- Other fever (>38.5°)
- Tetanus
- Traumatic injury

Outpatient weekly surveillance form

Post-tsunami surveillance/early warning and response - Aceh province
- Data providers
  - Clinics
  - Hospitals
  - Laboratories
  - Alerts (from above but also public, media, NGOs, military, religious organizations etc)
- Periodicity
  - Weekly (clinic, hospitals)
  - Daily (laboratory)
  - Immediate alert system (phone/sms)

Schematic representation of surveillance system

Data Flow – Aceh province 2005
Emergency Phase

MOH

Provincial Health Office

District Health Office

NGOs

Puskesmas/Health Centre

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Data Flow – Aceh province 2005
Rehabilitation Phase

MOH

WHO

Provincial Health Office

District Health Office

NGOs

Puskesmas/Health Centre

Post-tsunami surveillance/early warning and response - Aceh province 2005

- Reporting period/method
  - Monday-Sunday
  - Send forms by following Monday to Provincial Health Office or WHO or outbreak@who.or.id

- Data Analysis
  - Analyzed by WHO/Provincial Health Office
  - Electronic database for data entry/analysis
  - Epinfo 6/EpiData 3.2/Epi2000
  - Data linked to
    - Healthmapper 4.1/arcview 3.2s
    - Maps showing cases by sub-district level

Acute Watery Diarrhoea

Acute Bloody Diarrhoea

Measles

Acute Respiratory Infections

Acute, Surveillance system weeks 1-26 2005

Feedback

- Epidemiology group meetings
- Health sector coordination meetings
- Weekly bulletin (Indonesian and English)

Versatile disease surveillance/early warning protocol

Example:

Nias island (Aceh Prov)
Epidemiological bulletin

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Public Health Laboratory – Aceh province 2005
- Laboratory facilities established in Banda Aceh & Meulaboh
  - For confirmation of major epidemic and endemic communicable diseases
- SOPs developed and agreed for
  - Sample collection
  - Packaging
  - Transport
  - Specimen analysis
- Tracking samples from different agencies
- Reporting and analysis of lab data

Outbreak preparedness – Aceh province 2005
- Sensitive surveillance / early warning
- Outbreak preparedness plans
- Outbreak control teams set up
- Partners identified for specific tasks
- Drugs stockpiled for priority diseases
- Standard treatment protocols available
- Isolation facilities identified
- Lab capacity ensured
- Sampling kits procured for outbreak investigations
- Personal protective equipment (PPE) procured

Outbreak investigation and response
- Multidisciplinary / Many partners / Coordination crucial
  - Epidemiology
  - Laboratory
  - Clinical Management
  - Mass immunization
  - Infection Control
  - Environmental health
  - Social Mobilization
  - Health education
  - Media Relations
  - Harm Reduction / Risk communication
  - Logistics / transport / cold chain
  - Security considerations

Priority CD control measures in disasters
Short term measures
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Priority CD control measures in disasters (II)
Long term measures
- Legislative and administration issues: disaster committee functions/activities, water quality and quantity regulations.
- Technical issues: update and update guidelines/protocols accordingly.

Conclusions
- Most common natural disasters are associated with flooding, with a heightened concern for an unusual increase in water- and vector borne diseases.
- However, in the absence of secondary physical environmental effects, CDs have not been demonstrated to cause a high incidence of mortality in the aftermath of a natural disaster.
- Mortality and morbidity associated with CDs after a natural disaster (and emergencies) is avoidable through implementing priority CD control interventions.

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Other 2005 Teleclasses
For more information, refer to
www.webbertraining.com/schedule.cfm

- August 11  Effective Presentation of Infection Control Data
  With Bonnie Barnard, Mountain Pacific Quality Health Foundation

- August 24  Community Acquired MRSA
  With Dr. Rachel Gorwitz, Centers for Disease Control, Atlanta
  Sponsored by JohnsonDiversey (www.johnsondiversey.com)

- September 15  Vaccines – Adding to the Arsenal of Disease Control
  With Centers for Disease Control, Atlanta

- September 20  UK Teleclass – Controlling Device-Related Infections
  With Dr. Robert Pratt & Carol Pellowe, Thames Valley University

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