Disease and Disasters
Risks, Epidemiology, Surveillance & Control

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Learning Objectives

Understanding:
• The health effects of disasters, groups particularly at risk, and the communicable disease risks involved
• The diseases most commonly associated with disasters
• Diseases as disasters

• The essentials of the control of communicable disease in disasters (Assessment, Prevention, Surveillance, Outbreak control, Management of cases)

• The basics of two of the tools used in disease control, Epidemiology and Surveillance
  – Basic epidemiological terms and key, indicators and how these can help define the health status of a population
  – Time, Person and Place
  – Application of these terms and indicators in the investigation of a disease outbreak

  – Definition of surveillance, essentials of surveillance systems
  – Designing and establishing a system
Disaster definition*

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

Annotation:
The effect of the disaster can be immediate and localized, but is often widespread and could last for a long period of time. The effect may test or exceed the capacity of a community or society to cope using its own resources, and therefore may require assistance from external sources, which could include neighbouring jurisdictions, or those at the national or international levels.'

*UNISDR website
Complex emergency

“A humanitarian crisis in a country, region or society where there is total or considerable breakdown of authority resulting from internal or external conflict and which requires an international response that goes beyond the mandate or capacity of any single agency and/or the ongoing UN country program.” (UN IASC)

Features:
- Economic, political, social decay and collapse
- High violence
- Catastrophic public health emergencies
- Vulnerable at greatest risk
- Primarily internal wars
- Increased resource competition – warring groups
- Increased refugee and IDP movement
- Long lasting
Natural disasters

The number of natural disasters & totals affected increased dramatically after 1970 but there has been a declining trend in recent years*.

[No of disasters reported in 2016 = 342 (2015: 395)
Numbers affected = 569 million (2015 : 441 million)]

Natural disasters 2016

Table 1 – Top 10 natural disasters by number of deaths in 2016

<table>
<thead>
<tr>
<th>Event</th>
<th>Country</th>
<th>No. of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquake, April</td>
<td>Ecuador</td>
<td>676</td>
</tr>
<tr>
<td>Hurricane Matthew, September</td>
<td>Haiti</td>
<td>546</td>
</tr>
<tr>
<td>Flood, August</td>
<td>Korea (the Democratic People's Republic of)</td>
<td>538</td>
</tr>
<tr>
<td>Heat wave, April</td>
<td>India</td>
<td>300</td>
</tr>
<tr>
<td>Earthquake, August</td>
<td>Italy</td>
<td>296</td>
</tr>
<tr>
<td>Flood, June</td>
<td>China</td>
<td>289</td>
</tr>
<tr>
<td>Flood, July</td>
<td>China</td>
<td>289</td>
</tr>
<tr>
<td>Flood, November</td>
<td>Zimbabwe</td>
<td>246</td>
</tr>
<tr>
<td>Flood, May</td>
<td>Sri Lanka</td>
<td>203</td>
</tr>
</tbody>
</table>

Table 4 - Top 10 natural disasters by number of people affected in 2016

<table>
<thead>
<tr>
<th>Event</th>
<th>Country</th>
<th>Total affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought, January-December</td>
<td>India</td>
<td>330,000,000</td>
</tr>
<tr>
<td>Winter storm Jonas, January</td>
<td>United States of America (the)</td>
<td>85,000,012</td>
</tr>
<tr>
<td>Flood, June</td>
<td>China</td>
<td>60,000,000</td>
</tr>
<tr>
<td>Drought, January-December</td>
<td>Ethiopia</td>
<td>10,200,000</td>
</tr>
<tr>
<td>Drought, June - August</td>
<td>China</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Drought, January-December</td>
<td>Malawi</td>
<td>6,700,000</td>
</tr>
<tr>
<td>Drought, January-December</td>
<td>Somalia</td>
<td>4,700,000</td>
</tr>
<tr>
<td>Drought, January-December</td>
<td>Zimbabwe</td>
<td>4,300,000</td>
</tr>
<tr>
<td>Drought, January-December</td>
<td>Haiti</td>
<td>3,600,000</td>
</tr>
<tr>
<td>Drought, February-November</td>
<td>South Sudan</td>
<td>3,600,000</td>
</tr>
</tbody>
</table>
Active Conflicts

• The number of conflicts has fallen since the end of the Cold War

• January 2018:
  – At least 17 active conflicts that cause >1000 fatalities/year
  – Many more smaller scale conflicts, terrorist activities

Wikipedia
Majority of disasters occur in developing countries

Natural disasters: threat level

Ongoing armed conflicts in 2018: updated January 2018

Wikipedia
Health effects of different types of disaster

• The nature of disasters determines the patterns of morbidity & mortality seen & subsequent health problems

• Multifactoral
  – Nature of the disaster
  – Duration
  – Location
  – Affected population
  – Access
  – Effects on infrastructure
  – Endemic diseases
  – Security
  – etc.

• This will in turn affect the nature of the response needed
Earthquake / tsunami

- Release of vast amounts of energy
- Wide areas affected
- Earthquakes above Force 7 on Richter Scale:
  - Extensive destruction
  - Many fatalities
  - Population displacement

- Trauma
  - many with minor cuts and bruises
  - smaller group with simple fractures
  - a minority need surgery / other intensive treatment
    - serious multiple fractures, internal injuries & crush syndrome

- Drowning
- Asphyxia
- Dust inhalation
- Burns and electric shock
- Environmental exposure (hypothermia)
Man–made disasters

*Terrorism:*
- May be large numbers of casualties
- Access to casualties may be difficult
- Major incident plans required
- Planning for a wide range of contingencies
- Not just explosives
  - Biological agents
  - Poison gas
- **Wide range of injuries**
  - Blast
  - Ballistic
  - Trauma
  - Crush
  - Etc.
Disasters & communicable disease

Natural disasters

Acute onset
– Trauma is the main immediate cause of morbidity & mortality, communicable diseases occur later
– Outbreaks of communicable disease are less frequently reported in disaster-affected populations than in conflict-affected populations

Long term
– Morbidity and mortality often related to malnutrition

Conflicts
– In many wars more people die from illness than trauma
– Estimates of mortality in Darfur (2004 – 8) suggested that > 80% of ca. 300,000 deaths were due to disease* 

*Degomme O, Guha-Sapir D. Patterns of mortality rates in Darfur conflict. The Lancet, 375 Issue 9711, 294 - 300, 23 January 2010
Factors increasing the risk of outbreaks of disease in disasters

- Breakdown of control measures
  - Damage to health facilities
  - Loss of staff
  - Damage to or loss of:
    - Immunisation programmes
    - Vector control programmes
    - WASH programmes
  - Damage to infrastructure (e.g. water purification)
  - Contamination of water and food

- Breakdown of long term treatment programmes
  - Infectious agents
  - Non infectious illnesses

- Increased susceptibility

- Displacement

- Crowding

The risk factors for outbreaks of communicable disease after disasters are associated primarily with population displacement*


**UNHCR data 30/06/2017**
Displaced persons - Groups at particularly high risk

- Children (especially <5Y and unaccompanied)

- Women (especially pregnant women and nursing mothers)
  - >75% of refugees and IDPs at risk from war, famine and natural disaster are women and children*
  - ~25% of this population are women of reproductive age.
  - 20% of these are likely to be pregnant*

- Elderly people

- Disabled people
Communicable disease risks due to population displacement

• Risk to displaced persons
  – Health status of the displaced population
  – Access to healthcare services
  – Increased susceptibility
    • Reduction in immune competence due to:
      – Stress
      – Poor diet
      – Malnutrition
  – Exposure to “new” organisms
  – Water & Sanitation
  – Exposure to contaminated food
  – Crowding

• Risk to host populations
  – Imported organisms
  – Malnutrition due to overexploitation of limited resources
Disasters - What diseases?

- Common things happen commonly
  - The communicable diseases facing displaced persons will generally be those normally present in the areas through which and to which they have moved

- Some diseases are more likely to cause immediate problems than others
  - GI (impure water, contaminated food)
  - Respiratory / respiratory route (crowding)
  - Vector borne (breakdown of vector controls and possibly increase of breeding potential for vectors)
Disasters - What diseases?

• 5 conditions consistently account for 60-95% of deaths in displaced populations*
  – Acute respiratory infection (ARI)
  – Malnutrition
  – Diarrhoea
  – Measles
  – Malaria

• Need to consider the long term as well as the short
  – TB
  – HIV/AIDS

Respiratory disease

- ARI are a major cause of illness and death among displaced populations

- Children <5 years of age especially at risk

- Risk of death from ARI increased by lack of access to:
  - health services
  - antimicrobial agents for treatment

- Risk factors among displaced persons include
  - crowding
  - exposure to indoor cooking using open flame
  - poor nutrition
Other important organisms transmitted via the respiratory tract

• Measles
• Diphtheria
• Pneumonic plague
• Bacterial meningitis

Several of these have disaster implications
Malnutrition

- **Acute malnutrition** (wasting), especially in young children
  - Measured as weight-for-height, presence of bilateral oedema, MUAC
    - *Marasmus* – severe weight loss leaving "skin and bones" shortage of proteins & calories
    - *Kwashiorkor* – bloated appearance due to water accumulation (*oedema*) (protein, antioxidant and micronutrient deficiency)
    - *Marasmic-kwashiorkor* – a combination of both

- **Chronic malnutrition** (stunting)
  - Inhibits full mental and physical potential
  - Small mothers have small babies

Photographs reproduced by courtesy of Marie McGrath and the Emergency Nutrition Network
Malnutrition and communicable disease

• Malnourished individuals have an increased susceptibility to infection
  – PEM and micronutrient deficiencies damage the immune system

• Malnutrition magnifies the effects of disease
  – more severe disease episodes
  – more complications
  – longer duration of illness
Diarrhoeal disease

• The big three
  – Cholera (acute watery diarrhoea)
  – Dysentery (bloody diarrhoea)
  – Typhoid (Enteric fever)

• Also many other causes of GI infections - usually endemic rather than epidemic - can cause a large amount of morbidity

• NB. Diarrhoea +/- vomiting +/- fever may be a symptom of another type of disease – not a GI infection!

• Treatment usually (initially) symptomatic
Measles

• Potentially lethal disease
  – >20,000,000 cases/year

• Mortality:
  – 122,000 measles deaths globally in 2014
  – >95% in low-income countries
  – mostly children <5Y

• Common in crowded emergency settings, large population displacements and high levels of malnutrition.

• Worst single killer of children in refugee situations in some instances

• Vaccination and Vitamin A are vital components of initial control measures
Malaria

- Caused by protozoan parasites of the genus *Plasmodium*

- Transmitted by female mosquitoes of the genus *Anopheles*

- Widespread in tropical and subtropical regions
  - 3.3 billion people are at risk
  - 247 million cases of malaria/year
  - 212 million in sub Saharan Africa
  - Ca. 1 million deaths from malaria each year, (85% children <5Y)
  - 95% of malaria related deaths occur in Africa.

- Vector control, protective measures, treatment

Data from Roll Back Malaria, 2010; WHO, 2010
Malaria and disasters

- Majority of countries affected by disasters are in malaria endemic areas

- In 2010, 30% of Africa’s malaria related deaths were in countries experiencing complex emergencies*


**Number of victims of natural disasters by 100,000 inhabitants: 1976 - 2005**

Refugee map from UNHCR Statistical Yearbook 2010

Longer term problems: TB & HIV/AIDS

• Not acute problems in the short term

• Potential long term problems
  – Risks of transmission due to overcrowding, poor conditions, malnutrition, breakdown of social networks, economic vulnerability, sexual violence
  – Risks to aid workers

• Difficult to treat in mobile (e.g. refugee/IDP) populations
  – Incomplete treatment risks development of resistance
Diseases as the causes of disasters

• An important factor in the past
• Black death began 1348. Estimated to have reduced the world's population by 20% by 1400

• Less so now that we have:
  – good treatment methods
  – are aware of risks
  – are aware of preventive measures
  – can potentially undertake successful preventive measures
Diseases as the causes of disasters

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Or maybe not?
Ebola Virus Disease
West Africa, 2014-15

• 28,646 cases (suspected, probable & confirmed)
  – 15,261 Lab-confirmed
• 11,323 Deaths
• M:F ratio 1:1
• Median age of cases 32Y
• CFR during outbreak
  49 - 64% among hospitalized patients

Data from WHO and CDC Sitreps
## Ebola outbreak: cases/deaths as a % of population of the 3 main countries affected

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<thead>
<tr>
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<th>Numbers</th>
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<td>28,646*</td>
<td>0.13</td>
</tr>
<tr>
<td>Deaths</td>
<td>11,323*</td>
<td>0.05</td>
</tr>
<tr>
<td>Population</td>
<td>22,130,000**</td>
<td>-</td>
</tr>
</tbody>
</table>

* probably lower than the real figures because many cases and deaths in the community were probably not recorded

** estimated

Rate: 130/100,000 Persons
Effects of the outbreak:

• Serious increases in morbidity and mortality from all causes
  – Estimated 10,600 additional deaths due to untreated conditions
  – 30% increase in maternal deaths.
  – 24% increase in newborn deaths

• Continued risk of transmission

• Changes in behaviour
  – Greeting behaviour
  – Traditional burials
  – Unwillingness to engage in agriculture/trade
  – Attitudes to those infected/recovered & HCWs

• Economic impact
  – Rising costs & inflation
  – Job losses / unemployment
  – Agricultural output down
  – Loss of foreign investment
  – World bank estimates economic damage 2014-15 as $2.2 billion
Can the Ebola outbreak be defined as a Disaster?

[On the basis of the UNISDR definition of a disaster]

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Control of Communicable Disease in Disasters

Epidemiology

Surveillance
Communicable disease control

- Rapid Assessment
- Prevention
- Surveillance
- Outbreak control
- Disease management
Assessment

To:

• Identify the communicable disease threats faced by the population affected by a disaster
• Define the health status of the population
• Detect outbreaks
• Determine the ability of the population and the responding agencies to control the various diseases
• Determine needs
Prevention

• Maintain a healthy environment & good living conditions
• Ensure a good nutritional status
• Introduce measures to:
  – prevent person to person spread
  – control vectors
  – prevent contact with vectors
  – prevent spread via the environment
• Public health education programmes
• Vaccination
Set up or strengthen surveillance programmes with early warning mechanisms to:

- Ensure early reporting of cases
- Monitor disease trends
- Facilitate prompt detection and response
- Assessment of response
Control outbreaks

• Preparedness:
  – Stockpiles
  – Treatment protocols
  – Training

• Rapid detection

• Rapid response
  – Investigation
  – Confirmation
  – Implement controls
Disease Management

• Prompt and accurate diagnosis
  – Syndromic
  – Laboratory
• Case definitions
• Treatment
  – Stockpiles
  – Effective treatment
  – Standard protocols
  – Training
Monitoring effectiveness of control programmes

- Estimate disease burden
- Identify risk groups
- Determine incidence trends over time
- Measure outcomes and impacts of preventive and public health interventions
- Evaluate the overall control interventions
To undertake health programmes and disease control activities you need to know:

• Population makeup
  – Numbers
  – Ages
  – Sex ratios

• The health status of the population

• What diseases affect the population

• Who might be affected

• Any information about transmission (e.g. seasonal factors, vectors)

• What is the makeup, skills etc. of the health services

• What health care facilities are available

• Etc!!!
Epidemiology

The study of diseases in human populations in order to promote, protect & restore health
Disaster epidemiology

The use of epidemiological methods to study and manage the public health aspects of disasters.
I keep six honest serving men
(They taught me all I knew)
Their names are What and Why and When
And How and Where and Who

Rudyard Kipling (Just So Stories, 1902)
Time

• When did the problem start?
• Is it still happening?
• If it has finished – when?
• What might have been happening at those times?
Time – outbreak curves

Point source outbreak

Continuing common source

Point source with secondary transmission
Person

• Old?
• Young?
• Female?
• Male?
• Defined group?
• Characteristics?
Place (The Soho cholera outbreak and the Broad Street pump, August 1854)
The Broad Street Cholera outbreak

The Widow of Hampstead

Broad Street to West End every day, and it was the custom to take out a large bottle of the water from the pump in Broad Street, as she preferred it. The water was taken on Thursday, 31 August, and she drank of it in the evening, and also on Friday. She was seized with cholera on the evening of the latter day and died on Saturday. A niece, who was on a visit to this lady, also drank of the water. She returned to her residence in a high and healthy part of Islington, was attacked with cholera and died also. There was no cholera at the time either at West End or in the neighbourhood where the niece died.’ When Snow had published his first cholera
**Numbers & Rates**

- **Numbers of cases:**
  - Assessment of needs for resources (human and material)
  - Can be misleading regarding disease situation

- **Rates** (numbers per unit of population)
  - Assessment of changes of disease levels in the population
  - Used to calculate key indicators
Key indicators: Mortality #1

Changes in mortality rates are often the first indicator of health problems.

**Crude Mortality Rate (CMR)**
- The most important - indicates the severity of the problem.
  - Changes in CMR show how a medical emergency is developing.
  - Usually number of deaths / 10,000 persons / day

- CMR >1/10,000/day = an acute emergency is developing
  - N.B. For <5Y, the daily CMR cut off value is >2/10,000/day (if population data for <5y is not available, use an estimate of 17% of the total population).

- The emergency phase lasts until the daily CMR falls to 1/10,000/day or below.
Key indicators: Mortality #2

• *Age-specific mortality rate* - mortality rate for a specified age group.
  – In children usually given as:
    No. deaths in <5y & >5y / 1,000 children of each age / day

• *Cause specific death rates (case fatality rates)*
  – % of cases of a specified condition fatal within a specified time.
Key indicators: Mortality #3

• *Maternal mortality rate*
  – No. of mothers dying from puerperal causes within \( x \) days of giving birth / \( y \) births / \( z \) time
  – *Maternal death* - the death of a woman whilst pregnant or within 42 days* of the termination of the pregnancy, from any cause related to the pregnancy or its management.

(* Can be 1 year)

A sensitive indicator of the effectiveness of health care systems.
Key indicators: Morbidity

The main morbidity figures that are routinely sought are:

• **Incidence** *The number of new cases during a defined period of time*
  
  – **Attack rate** *(used in outbreaks – usually expressed as %)* (also incidence proportion or cumulative incidence).
    
    No. of new cases within a specified time period / size of the population initially at risk.
    
    (e.g. if 30 people / 1000 persons develop a condition over 2 weeks, the AR/IP/CI is 30/1000 [3.0%])
  
  – **Incidence rate.** No. of new cases per unit of person-time at risk.
    
    *(In the above example: the IR is 15/1000 person-weeks).*
    
    (Useful where the amount of observation time differs between people, or when the population at risk varies with time)

• **Prevalence.** *(Indicates how widespread the disease is)*
  
  *The total number of cases of a particular disease recorded in a population at a given time.*
Other indicators: Nutritional status

- Prevalence of:
  - Global acute malnutrition (moderate & severe malnutrition) in children 6-59 months of age (or 60-110 cm in height)
  - Severe acute malnutrition in children 6-59 months of age (or 60-110 cm in height)
  - Micronutrient deficiencies

- No. of children needing selective feeding programmes (SFP)
- No. of additional calories/day to be provided by SFP
Other indicators: Immunization

• Assess *need* for campaigns on the basis of:
  – national vaccination records
  – questioning mothers
  – if children or parents have written vaccination histories with them

• Assess *effectiveness* of programmes by:
  – recording % of children vaccinated (can use children attending clinics as surrogate value). (Says nothing about vaccination success!)
Other indicators: misc

- **Vital needs**
  - Water, sanitation, food and shelter

- **Health service activities**
  - Numbers of consultations/day
  - Numbers of vaccinations
  - Number of admissions to hospitals
  - Numbers of children in feeding programmes
  - Effectiveness of the supply chain
  - Maintenance of the cold chain
  - Laboratory activities
Outbreak investigation, Angola, Oct-Nov 2007

- Investigation of outbreak of neurological illness undertaken by Angolan Ministry of Health (MINSA)
- Supported by WHO (Angola, AFRO region and Geneva offices)
On 24th October 2007, the Direction Provinciale de la Santé (DPS) in Angola reported that 42 cases of a “neurological illness” with 3 fatalities had occurred in the municipality of Cacuaco to the north-east of the capital Luanda since the beginning of October.
Symptoms

General
- Affected patients normally and previously healthy
- No fever, headache, diarrhoea, abdominal pain, vomiting

Neurological symptoms
- Dizziness
- Weakness
- Muscular spasms
- Ataxia
- Somnolence or semi-coma
Case definition

“Any person who presents with sleepiness, deep asthenia, blurred vision, dizziness, difficulties in speaking and difficulties in walking”.
Outbreak curve, Cacuaco 2007

- **Causative agent identified**
- **Route of exposure identified**
- **Control measures introduced**

No. of cases

Oct | Nov | Dec
---|---|---

Day

No of cases

Continuing common source

Day
Sex and age of cases (compared to Angola age pyramid)

62% Female, 38% Male
Angola 2007: location of cases

Bengo (N=17)
Cacuaco (N=461)
• 461 cases in Cacuaco Municipality
• Mainly children, majority female
• No exclusively breastfed infants
• Households of 8/19 bairros (neighbourhoods) affected
• Additional 17 cases in Caxito, Bengo Province (north of Cacuaco)
  – 15 linked to travel in and around Cacuaco; 2 lost to follow-up
  – No new cases in Bengo after 14 November
Hypothesis

• Cases due to a toxin rather than an infectious agent.
• Samples of food and blood sera tested at labs in UK and Germany for over 8000 possible toxins: all negative
Cause

• Bromide poisoning suggested as cause.
• Blood sera from cases +ve
• High concentrations of sodium bromide (>80%) found in table salt
• None in other foods

• Cause was probably ingestion of table salt contaminated with sodium bromide
Sodium bromide

- White crystalline compound
- Similar appearance to sodium chloride
- Tastes weakly “salty”

- Widely used as an anticonvulsant and a sedative in the late 19th and early 20th centuries.

- In Angola, used extensively in the oil industry.
- Very large amounts transported in 25kg bags on trucks.
Sex and age association

• Females more affected than males because at home more, cooking & tasting food.

• Children are at home and (especially female) taste food when helping mothers cook. (Also lighter and toxic dose smaller).
Public health measures

• Remove contaminated salt from the community
  – Identification of safe salt supply
  – Recall and replacement process

• Develop public health messages

• Source investigation
  – Investigation of other food sources

• Prevention of similar incidents
  – Improved security of chemicals
  – Education
Summary #1
Time, Person & Place etc.

• **WHERE** – *(Place)* Cacuaco (8/19 bairros) (+Bengo)
• **WHEN** – *(Time)* Oct-Dec 2007, probably initial event late Sept-early Oct
• **WHO** – *(Person)* Inhabitants of 8 bairros in Cacuaco, mainly female, mainly young.
• **WHY** – Contamination of table salt
• **WHAT** – Sodium bromide
• **HOW** – Unknown (Deliberate?).
Summary #2

- **Outbreak identified** by
  - Reports to surveillance system
  - Enhanced surveillance to define extent
- **Epidemiological methods** used to describe and investigate the outbreak
- **Causative agent** identified due to personal knowledge/expertise
- **Laboratory work** used to find and confirm cause & contaminated material
- **Clinical measures** used to treat patients
- **Public health measures** used to end outbreak and prevent recurrence

- NB. Descriptive study
- Investigative methods such as *case-control* or *cohort* studies probably would not have worked in this instance.
Surveillance
Obtaining adequate information from the very start is the key to an effective emergency response.
Surveillance
(WHO definition)

“The ongoing systematic collection, analysis and interpretation of data in order to plan, implement and evaluate public health interventions”.

• In humanitarian emergencies, normal health surveillance systems may be overwhelmed, underperforming, disrupted or non-existent

• An early warning alert and response network (EWARN) is often set up to supply essential data particularly in the acute phase of an emergency

• Not a substitute for a national disease surveillance system, after the acute emergency phase it should be integrated into the national surveillance system.
Surveillance data

Provides information to:

• Set priorities
• Detect disease outbreaks in a timely manner & prevent epidemics
  – Determine distribution and spread of disease
  – Set up appropriate & effective public health responses
  – Provide data to evaluate control measures
• Programmes
  – Plan and set up
  – Monitor progress
  – Modify
• Prepare funding applications
In emergencies

You need to obtain information that is:

– reliable
– relevant
– collected systematically
– standardised enough to be collated
– timely & regular enough to be useful
– acceptable to those surveyed
In emergencies

You need to collect *enough* information to implement an *effective* response

- Too much – wastes time
- Too little – ineffective response

Therefore the methods used need to be practical, consistent and rapid rather than absolutely accurate.

[“In emergencies it is better to be approximately right than precisely wrong”. (D.Guha Sapiir – CRED Louvain)]
Essential principles for surveillance programmes

- Simple and flexible
- Sustainable (long term, local resources)
- Appropriate (information & resources)
- Acceptable to those surveyed
- Case definitions
- Able to provide:
  - essential minimum of accurate information
  - timely reporting
  - overage of the whole affected area
  - information regularly from defined sites
- Compatible with existing systems & use existing records & systems
- Collaboration between agencies and with local services
When designing a health surveillance system you need to:

- Define the population under surveillance
- Determine what type of system can be established (e.g. sentinel, comprehensive)
- Set surveillance priorities
  - What is to be monitored (e.g. diseases or syndromes)
  - What data should be collected
  - Key indicators and epidemic thresholds (e.g. incidence rates, mortality rates, when should outbreaks be declared)
When designing a health surveillance system you need to:

• Identify data sources
• Set up agreed case definitions
• Establish data handling systems
  – Recording and transferring data
  – Verifying data
  – Frequency of reporting
  – Data analysis (Who, where and how often)
  – Disseminating results (to whom and how often)
• Protocol for evaluating the system
What data?

• Primary data – from your own system
  – Demography
  – Mortality
  – Morbidity
  – Nutrition
  – Health sector activities inc. local health services
  – Activities in related sectors

• Secondary data from:
  – Other agencies, government, UN, local health services
    (you may not be able to check the accuracy of such data)
Demographic Data

• Population
  – With age/sex breakdown and sometimes by other categories as well
    • Ethnic group
    • Groups at risk
      – elderly
      – unaccompanied children
      – pregnant and lactating women

• In emergencies the number of <5Y is usually a key factor in planning services.
Population Estimates

• Essential information
• Needed to calculate:
  1. Rates.
  2. Resource needs (food, water, shelter, medical)
• Establish methods to obtain the figure
• May need to start with a rough estimate and refine later.
• Triangulate methods.
• Can be politically sensitive
Determining Population Size in Refugee Camps

- Registration census
- Estimates
  - Information from community leaders
  - Observation
  - Hut counts
  - Vaccinations
  - Waterpoints
Mortality Data

• Obtain data by
  – Health centres, hospitals, feeding centres
  – Surveys
  – Body collection
  – Graveyard watch 24hr.
  – Shroud distribution
  – Community workers/leaders (inc religious)

• Aim to get the following information for each death:
  – date, name, age, sex, “address”, cause of death
Morbidity

• Health information systems based on health centre attendance are the most common
  – passive
  – rely on who presents to the services

• Other sources of data:
  – Community workers
  – Surveys
  – PM questionnaires,
  – Outbreak investigations.
Other “Condition” Information

• Pregnancy and childbirth.
• Disability
• Other physical and mental vulnerabilities including unaccompanied minors and elderly.
• Previous TB treatment
• Chronically ill on treatment - more common in “European” emergencies.
Nutritional Information

• Anthropometric: community and centres
  – W/H, BMI, MUAC, Oedema, (W/A), Vitamin and mineral deficiencies
Evaluation of surveillance systems

• The usefulness of the surveillance data and the system should be evaluated in the context of the two key surveillance functions
  – early warning
  – routine programme monitoring.

• Evaluations should determine the extent to which surveillance objectives are being met.
Any questions?
Surveillance in a complex emergency with a refugee/IDP problem
The war in Former Yugoslavia

- June 1991 - Serbs attack Slovenia (10 day war).
- War in areas of FY claimed by Croatia but with a Serb majority.
- Truce early in 1992 - these areas placed under UN supervision (4 UNPAs/Sectors - UNPROFOR1).
- War in Bosnia began May 1992 - affected much of central Bosnia & the mainly Muslim Bihac Pocket.
- UNPROFOR 2 established to protect aid effort
Displaced persons

- By mid 1992 >3.5 million persons displaced
- Most were IDPs, relatively few refugees
- Most IDPs in host families (>90%)
- Some IDP camps but most of the population of these was transient
The civil situation in Bosnia

• Large numbers of displaced persons swelling existing populations
• Infrastructures broken down
• Food supplies poor
• Extensive damage to buildings especially “official” structures (hospitals, schools, mosques, churches)
Communications disrupted
Surveillance situation in Bosnia in 1992-3

• Existing systems not functioning
• Communications severely disrupted
• Medical staff overworked, very poorly paid (special feeding programme)
What did we need to know?

- Population data
- Morbidity and mortality data
  - Chronic
  - Infectious
  - Trauma
- Health services information
- Supply situation
- EPREP situation
- Access
- Communications
WHO surveillance programme

- Decided to set up a sentinel surveillance programme
- Sites chosen as being UNHCR bases with radio communications
- Sites also had important medical centres
Sources of information

- **Sentinel sites** - mainly near UNHCR offices
  - Dom Zdravlja
  - Ambulantas
  - Regional Hospitals

- **Additional sources**
  - UN military
  - UNCIVPOL
  - UN civil
  - NGOs
  - Local contacts
Material provided

- Monitoring form
- Guide to use
- Case definitions
- Treatment and response guidelines

WORLD HEALTH ORGANIZATION
SENsitEL SITE
HEALTH MONITORING FORM

Information for the week ending on ..../..../ (dd/mm/yy)
Area: ...........................................
Name and type of facility: ..................
Date form filled in: ..../..../ (dd/mm/yy)
Filled in by: .................... Position: ..........

HEALTH SERVICES MONITORING
Patients seen this reporting period: ______

<table>
<thead>
<tr>
<th></th>
<th>&lt; 5 yrs</th>
<th>5-14 yrs</th>
<th>15-59 yrs</th>
<th>60+ yrs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Patients referred to another health facility:
for trauma ____ for medical reasons ____

Please report any changes in the nature or functioning of this health facility, such as the kind of services offered, installation of in-patient services, etc.

DEMOGRAPHIC DATA
Total population ______

<table>
<thead>
<tr>
<th></th>
<th>Resident</th>
<th>Refugees/ Displaced</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-14 yrs</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15-59 yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+ yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No of Live Births Since Last Report: ______
Information sought

• Population data
• Patients seen since last report
• Change in use
• Mortality data
• Morbidity data
Mortality data

- Communicable disease
- Trauma
- Hypothermia
- Obstetrical
- Other
Morbidity data

- VPD
- Water/foodborne diseases
- RTI
- Ectoparasite/louseborne diseases
- Specific parasites
- Meningitis
- TB
- Nutritional
- Trauma
- Other

---

### Mortality Data

- Communicable diseases
- Trauma
- Hypothermia
- Obstetrical
- Other

---

### Morbidity Data

<table>
<thead>
<tr>
<th>Disease</th>
<th>&lt;5 yrs</th>
<th>5-59 yrs</th>
<th>60+ yrs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pertussis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningococcal disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viral hepatitis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probable poliomyelitis</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Scabies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head lice</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body lice</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Scurvy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-tibial oedema</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (specify)</td>
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<td></td>
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### Mortality Data

<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt;1 mo</th>
<th>1mo-12mo</th>
<th>13mo-5yrs</th>
<th>6-14 yrs</th>
<th>15-59 yrs</th>
<th>60+ yrs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicable diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothermia</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstetrical</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td></td>
<td>XXXXX</td>
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<tr>
<td>Other</td>
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<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td>XXXXX</td>
<td></td>
<td>XXXXX</td>
</tr>
<tr>
<td>Problem</td>
<td>Details</td>
<td>Source</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------</td>
<td>----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typhoid</td>
<td>13 cases in Livno, (Hercegovina)</td>
<td>ICRC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>30 cases in Sarajevo</td>
<td>UNICEF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>5 cases in a refugee camp, Zagreb</td>
<td>MDM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brucellosis</td>
<td>Outbreak in Macedonia</td>
<td>WHO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken pox</td>
<td>23 cases in Plaski, UNPA North</td>
<td>UNCIVPOL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UNCIVPOL – Sector South  
(Sitrep Feb 24th, 1993)

- Hospitals need antibiotics
- Total deaths = 4
- Causes of death:
  - Female (59Y)  Shot
  - Male (22Y)  Shot
  - Male (80Y)  Shot
  - Male (50Y)  Mine
• Health warnings (phone, fax, radio)
• Routine data (phone, fax, radio)
• “Health Monitor”
Did it work?

- **Additional sources** - Yes
- **Sentinel** - No (only as *Ad hoc*)
Successes

• Establishment of a surveillance system that detected outbreaks in a timely fashion
• Database allowing prediction
• Successful information dissemination
• Health warnings & advisory material
• Durable contact network
The sentinel scheme

• Extra admin burden?
• Challenging competence?
• Intermittent access?
• Inadequate staff?
• Supply of medicines?
• Security/intelligence data?
After 1 year

- Rethink of surveillance system for WHO
- Efforts to revive existing national systems
- Additional staff brought in to WHO offices in Zagreb, Belgrade and Sarajevo
Planning a surveillance and response system for a remote area with poor communications
El Nino

- Raised temperatures
- Crop failure
- Malnutrition
  - Increased movement into valleys
  - Increased malaria
  - Mosquitoes move upwards
    - Localised outbreaks of ? haemorrhagic fever
    - Social breakdown including failure to plant crops
Proposed surveillance and response

• **Sentinel surveillance** based on villages with a missionary presence (clinic, airstrip/helipad, radio)

• **EPREP**

• **Rapid response team** (doctors, nurses, lab techs, Missionary Aviation Fellowship)
JAYAWIJAYA REGION
Weekly report form

<table>
<thead>
<tr>
<th>Question No:</th>
<th>Content</th>
<th>Total/answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name of reporting site</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Date of report</td>
<td>…/…/… (dd/mm/yy)</td>
</tr>
<tr>
<td>3</td>
<td>Reporting period</td>
<td>From: …/…/… (dd/mm/yy)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To: …/…/… (dd/mm/yy)</td>
</tr>
<tr>
<td>4</td>
<td>Report made by (name)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No. of patients seen by clinic since last report</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>No. cases of fever</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>No. of cases of ARI</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>No. cases of diarrhoea</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>No. cases of injury</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>No. of deaths in the community</td>
<td></td>
</tr>
</tbody>
</table>
Outbreak

Increase in cases reported to Dinas by local clinics

Travel to outbreak area, investigate outbreak, begin treatment, report to Dinas

Additional responses as required

Reports to clinics

Rapid response team activated:
- Doctor(s)
- Nurse(s)
- Mobile lab
- Drugs

DINAS
- Data analysis
- Surveillance database
- RRT base

Reports to MoH, WHO etc.
Any questions?