



Animal Health Matters.
For Safe Food Solutions.



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Introduction to Outbreak Investigation (focus on foodborne outbreak investigation)



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Ppt outline

- Definition and purposes of outbreak investigation
- Key steps in outbreak investigation
- Food-borne outbreak investigation
- Epidemic curve

Definition and purposes of outbreak investigation

- **Quiz 1**

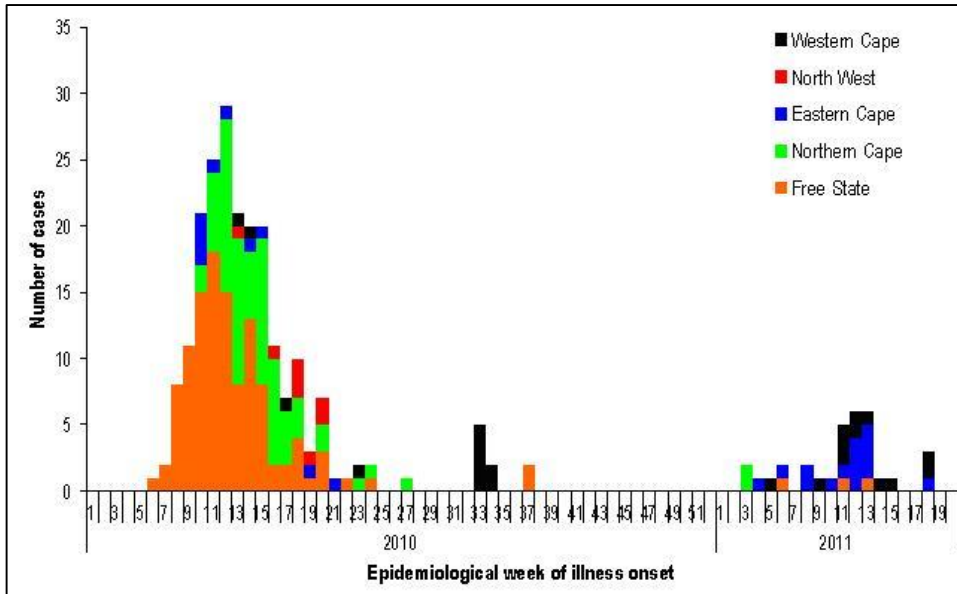
- Anybody ever involved in outbreak investigation?

- Can you define what an outbreak is?

Definition: outbreak

- *Outbreak* is defined as an **epidemic limited to localized increase in the incidence of a disease**, e.g. in a village, town, or closed institution (Last, 2001)
- The terms “*Outbreak*” and “*Epidemic*” are often used interchangeably
- Sometimes ***epidemic*** used in situations involving larger numbers of people/animals over a wide geographic area

Outbreaks examples

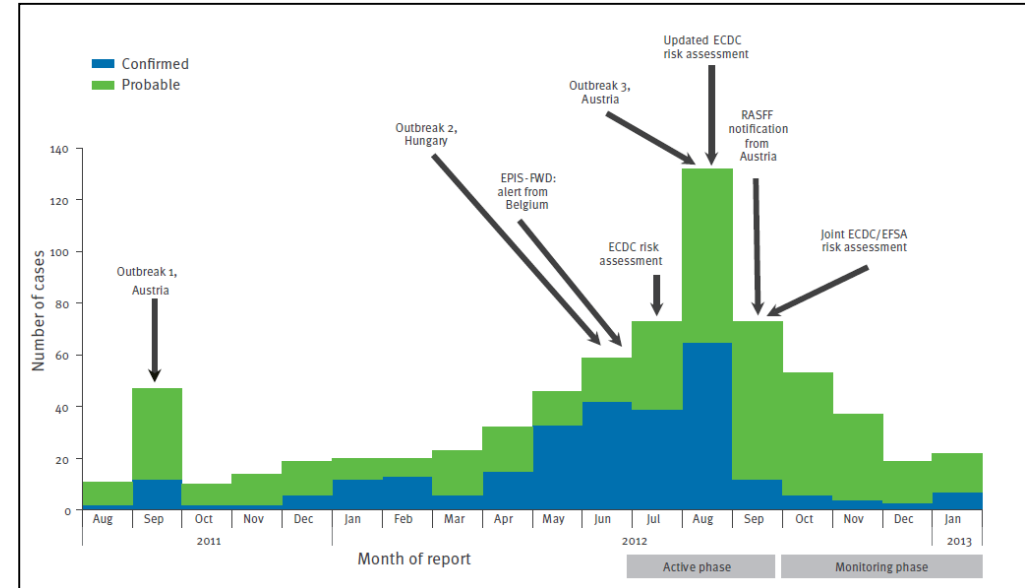


Epidemic curve illustrating the number of laboratory-confirmed **RVF** cases by epidemiological week of illness onset, by province, South Africa, last updated 20 May 2011

http://www.nicd.ac.za/?page=rift_valley_fever_outbreak&id=94

SAFOSO

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Confirmed and probable cases of **Salmonella Stanley** infection in humans by month of report in affected European Union

Member States, August 2011–January 2013

<http://www.eurosurveillance.org/images/dynamic/EE/V19N19/art20801.pdf>

Purposes of an Outbreak Investigation

- **Stop** the outbreak
- **Prevent spread** of the pathogen/disease
- Ensure **public's and animal health**
- Improve **surveillance** (e.g. establishment of early warning system)
 - to guide rapid reaction of public and animal health authorities
- Improve **knowledge** about a specific pathogen
- **Prevent** future outbreaks

Understand key steps of outbreak investigations



Approaches for outbreak investigation

1) Foodborne - outbreak investigation



2) Animals health - outbreak investigation



Usual Scenario When Investigating an Outbreak

- **Unexpected** event
- Need to investigate **quickly**
- **Pressure** for answers
- Multiple **agencies**
- **Media** spotlight
- Work carried out in the **field**

Systematic approach

Three-pronged approach

- **Epidemiologic** investigation



- **Laboratory** testing



- **Environmental** assessment



Steps of outbreak investigation

- During an outbreak investigation, we aim to answer the six major investigative questions:
 - **Who?**
 - **What?**
 - **When?**
 - **Where?**
 - **Why?**
 - **How?**
- The very same questions apply to outbreak investigation in veterinary and human health sectors

Steps of outbreak Investigation in animals population (**OIE**)

1. Preparation for field work
2. Coordination with public health competent authorities in case of zoonosis
3. Confirmation of the report triggering the investigation (**WHAT**)
4. Confirmation of diagnosis (**WHAT**)
5. Epidemiological follow-up and tracing (**WHY, HOW**)
6. Collection and analysis of data including the animals involved and the spatial and temporal distribution (**WHO, WHERE, WHEN**)
7. Implementation of control and preventive measures
8. Documentation and reporting

Steps of outbreak Investigation in public health (CDC)

1. Establish the existence of an outbreak
2. Verify the diagnosis (**WHAT**)
3. Prepare for field work
4. Construct a working case definition (**WHAT**)
5. Find cases systematically and record information (**WHO, WHERE, WHEN**)
6. Perform descriptive epidemiology (**WHO, WHERE, WHEN**)
7. Develop hypotheses (**WHY, HOW**)
8. Evaluate hypotheses epidemiologically (**WHY, HOW**)
9. As necessary, reconsider, refine, and re-evaluate hypotheses (**WHY, HOW**)
10. Compare and reconcile with laboratory and/or environmental studies (**WHAT**)
11. Implement control and prevention measures
12. Initiate or maintain surveillance
13. Communicate findings

(adapted from <http://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson6/section2.html>)



Food borne outbreak investigation

Food-borne outbreak investigation (CDC-WHO)

FOOD BORNE DISEASE OUTBREAKS
THE 3 TYPES OF DATA USED TO LINK ILLNESSES TO CONTAMINATED FOODS AND SOLVE OUTBREAKS

Public health and regulatory officials gather 3 types of data during an investigation:
EPIDEMIOLOGIC | TRACEBACK | FOOD & ENVIRONMENTAL TESTING

EPIDEMIOLOGIC

- Patterns in where and when people get sick, and past outbreaks caused by the same germ
- Interviews with sick people to look for foods or other exposures occurring more often than expected
- Discovery of clusters of unrelated sick people who ate at the same restaurant, shopped at the same grocery store, or attended the same event

TRACEBACK

- A common point of contamination in the distribution chain from farm to fork, identified by reviewing records collected from restaurants or stores where sick people ate or shopped
- Inspections in food production facilities, on farms, and in restaurants that identify food safety risks

FOOD & ENVIRONMENTAL TESTING

- The germ that caused illness is found in a food item collected from a sick person's home, a retail location, or in the food production environment
- The same DNA fingerprint linking germs found in foods or production environments to germs found in sick people



FOODBORNE DISEASE OUTBREAKS

Guidelines for Investigation and Control

World Health Organization

<https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/>

http://www.who.int/foodsafety/publications/foodborne-disease/outbreak_guidelines.pdf

1) Preliminary assessment of the situation

- Consider whether or not the cases **have the same illness** (or different manifestations of the same disease).
- Determine whether there is a **real outbreak** by assessing the normal background activity of disease.
- Conduct in-depth **interviews** with initial cases.
- Collect **clinical specimens** from cases.
- Conduct **site investigation** at implicated premises.
- Collect **food specimens** when appropriate.
- Formulate preliminary **hypotheses**.
- Initiate control measures as appropriate.
- Decide whether to convene a formal outbreak control **team**.
- Make a decision about the need for **further investigation**.



2) Descriptive epidemiology

- Establish **case definitions** for confirmed and probable cases.
- Identify as **many cases** as possible.
- Collect data from affected persons on a standardized **questionnaire**.
- Categorize cases by time, place and person.
- Determine who is **at risk of becoming ill**.



Case ID	Age	Sex	Residence	Occupation	Onset	Rash	Fever	Diarrhea
L. Roberts	27	F	Village A	Teacher	2-Feb-11	Y	N	Y
J. Nepil	6	F	Village B	N/A	5-Feb-11	Y	N	N
K. Josephs	6	F	Village B	N/A	5-Feb-11	Y	Y	Y
R. Oterre	5	F	Village B	N/A	6-Feb-11	Y	N	N
S. Sagut	6	F	Village B	N/A	6-Feb-11	Y	N	N
A. Smith	6	F	Village B	N/A	7-Feb-11	Y	Y	N
G. Woodson	5	F	Village B	N/A	7-Feb-11	Y	Y	Y
B. Otango	40	F	Village C	Nurse	11-Feb-11	Y	Y	N
N. Cabule	5	F	Village B	N/A	12-Feb-11	Y	Y	Y
P. Smith	12	M	Village B	N/A	12-Feb-11	Y	Y	N
M. Smith	33	M	Village B	Office worker	15-Feb-11	Y	N	N

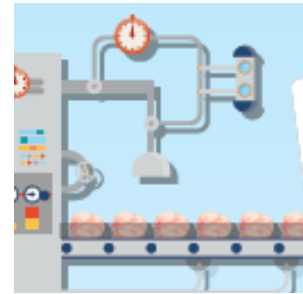
3) Communication

- Consider the best routes of **communication** with colleagues, patients and the public.
- Ensure accuracy and timeliness. Include all those who need to know.
- Use **mass media** constructively.



4) Food and environmental investigations

- Inspect structural and operational hygiene in **implicated food premises**.
- Assess procedures undergone by a suspect food.
- Take appropriate food and environmental samples.



5) Analysis and interpretation

- Review all existing data.
- Develop explanatory **hypotheses**.
- Carry out analytical studies to test hypotheses as required.
- Collect further clinical and food specimens for laboratory tests as required.



6) Control measures

- Control the source: animal, human or environmental.
- Control transmission.
- Protect persons at risk.
- Declare the outbreak over when the number of new cases has returned to background levels.
- Consider strengthening or instituting continuous surveillance.



Companies recall contaminated products



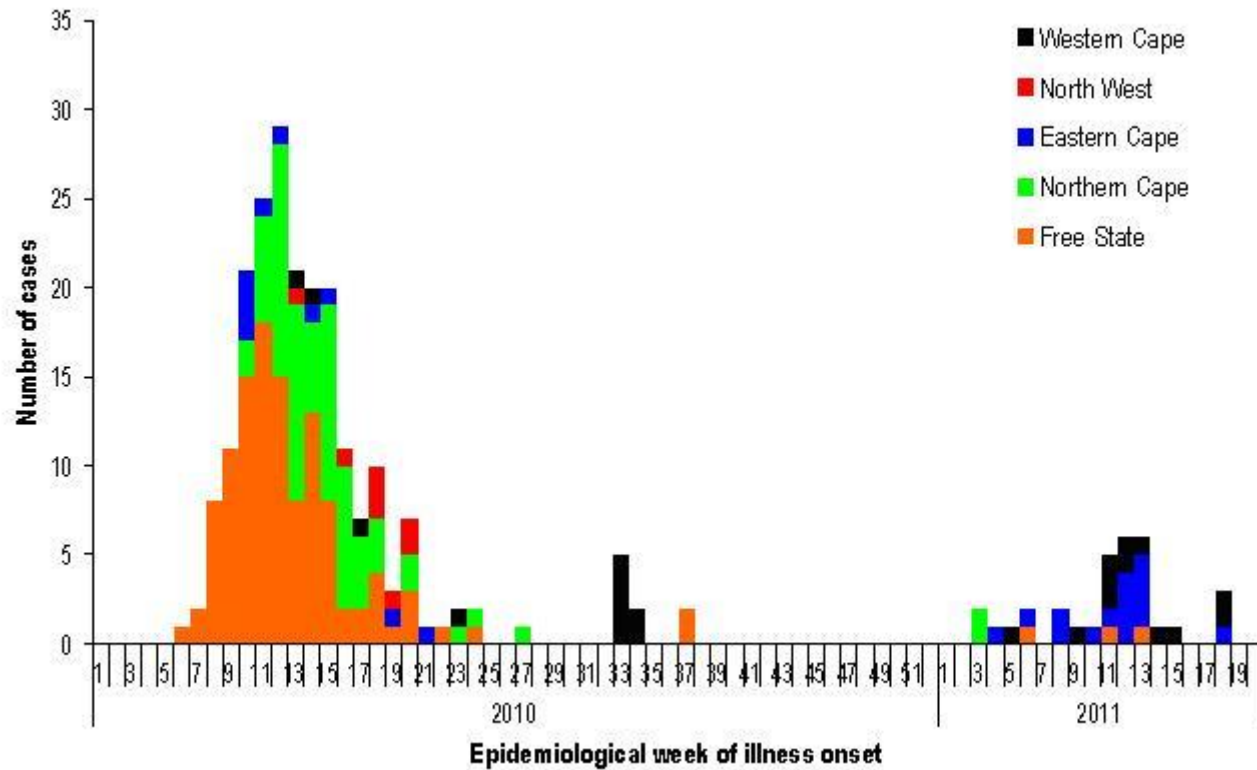
7) Further studies

- Conduct further analytical (case-control, cohort) studies.
- Conduct further food and microbiological investigations.
- Make recommendations for the prevention of recurrences of similar outbreaks.
- Determine remaining questions or areas for future research identified through this investigation.
- Share information with public health colleagues in order to promote awareness and possibly prevent similar outbreaks in the future.



Epidemic curve

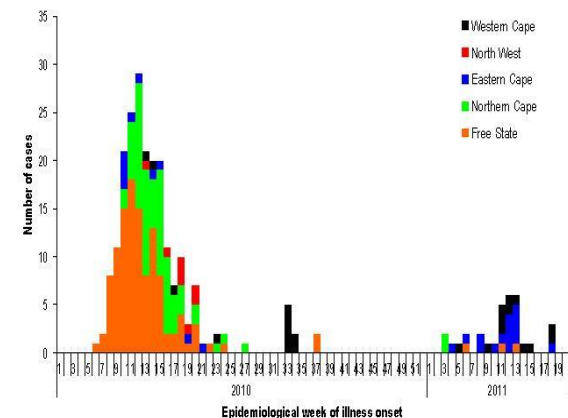
Categorize cases by time, place and person



Epidemic curve

The **shape of the curve** and the **time scale** depend on:

- Incubation period of the disease
- Infectivity of the pathogen
- Proportion of susceptible individuals (humans, animals) in the population
- Transmission route (e.g. food borne disease, vector borne disease, etc.)
- Contact pattern between individuals (e.g. density of humans/animals)



Epi-Curves: Mode of Transmission

- The shape of an epi-curve can indicate the following modes of transmission:
 - **Common source**
 - C. point source
 - C. continuous source
 - C. intermittent source
 - **Propagated (person-to-person)** with clearly defined secondary cases
 - **Propagated** with overlapping secondary cases

Epidemic curve: common source epidemic

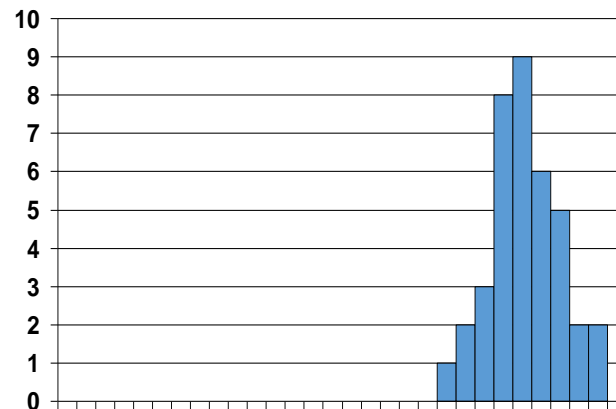
All cases are infected from a source that is common to all individuals

1) Common point source epidemic

Interpretation: Individuals (people, animals) are exposed to the same source over a relatively brief period

Shape of the curve: a steep up slope, a peak and a gradual down-slope

Example: food poisoning outbreak with a single batch of food contaminated



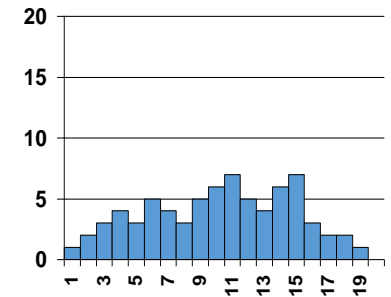
Epidemic curve: common source epidemic

2) Common continuous source epidemic

Interpretation: Individuals (people, animals) are exposed to the same source over an extended period

Shape of the curve: curve will have a plateau instead of a peak

Example: contamination of the public drinking water with chemicals (e.g. insecticide)

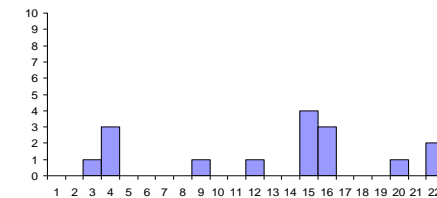


3) Common intermittent source epidemic

Interpretation: Individuals (people, animals) are exposed to the same source over an extended period but intermittently

Shape of the curve: cases continue to come up sporadically over time, but without continuity.

Example: contamination of the same public drinking water with chemicals (e.g. insecticide) but intermittently



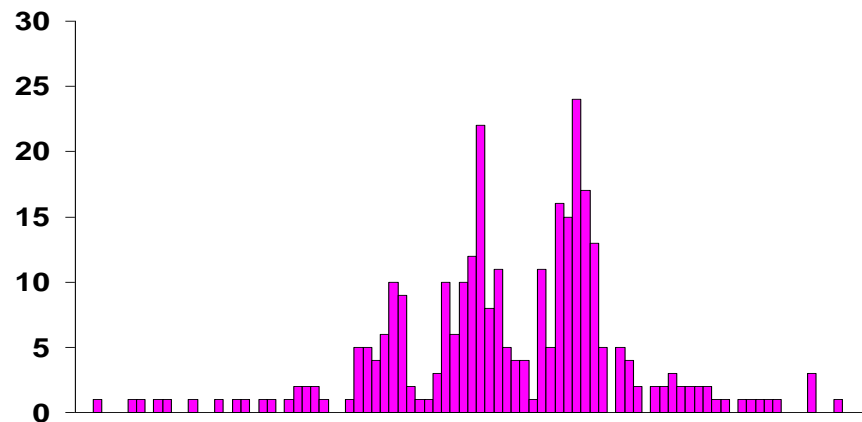
Epidemic curve: propagating epidemic

4) Propagating epidemic

Interpretation: individual-to-individual spread. This is caused by an infectious agent in which initial (i.e. **primary**) cases excrete the agent, and thus infect susceptible individuals, which constitutes **secondary cases**. One of the primary case is frequently the **index case**, that is, the first case in a defined group to come to the attention of investigators

Shape of the curve: a series of progressively taller peaks

Example: HPAI outbreak in
poultry populations;
Seasonal influenza in
human population





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Questions?

Thanks