

Disease outbreak investigation

Epidemiology training
Animal health cooperation platform
Embassy of France to the OECS States

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Outbreaks: The basics

Definition

- Occurrence in a region/community of a disease/health-related event clearly in excess of normal expectancy
 - Relative to usual frequency

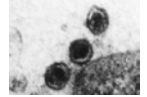
Goals of an outbreak investigation

- To identify the source of illness
- To guide public health intervention



Ways to recognize an outbreak

- Routine surveillance activities
- Reports from veterinarians and laboratories
- Reports from farmers



Why investigate an outbreak?

- Characterize the problem
 - Extent, impact (including economic)
- Identify preventable risk factors
 - New research insights into disease
- Train veterinary service personnel in investigations and emergency response



Steps of an outbreak investigation

- Verify the diagnosis and confirm the outbreak
- Define a case and conduct case finding
- Determine magnitude of the problem: attack risk
- Tabulate and orient data: time, space, animal patterns
- Take immediate control measures
- Analyse data
- Formulate hypotheses
- Plan and execute additional studies
- Implement and evaluate control measures
- Communicate findings

These steps may occur simultaneously or be repeated as new information is received.

1. Verify the diagnosis and confirm the outbreak

- Before launching a full investigation, verify:
 - Signs
 - Symptoms
 - Test results
- Ways to reduce diagnosis error
 - Confirm appropriate lab tests were performed
 - Confirm symptoms were reported accurately
 - Rule out misdiagnoses and laboratory error



1. Verify the diagnosis and confirm the outbreak (cont)

- Cases may present with a known/highly suspected agent E.g. FMD
 - Verify with standard lab test
 - Not every case needs to be lab-confirmed
- Cases may present with an unknown agent but with characteristic symptoms E.g. gastro-intestinal illness
 - Identify probable agent based on:
 - Signs and symptoms
 - Age, season, incubation period
 - Lab results
- No outbreak exists if cases result from different agents

1. Verify the diagnosis and confirm the outbreak (cont)

- If cases have a common link or are the same illness, you can investigate without knowing the agent
- If cases do not appear to be related or share a common exposure, you may not want to proceed with an investigation
- Consider the following factors when deciding whether or not to investigate an outbreak
 - Comparison with expected level
 - It could be "true" outbreak with common cause
 - It could be unrelated cases of the same disease
 - Severity of illness
 - Transmissibility
 - Available resources

2. Define a case and conduct case finding

- A **case definition**
 - Allows a simple, uniform way to identify cases
 - "Standardizes" the investigation
 - Is unique to outbreak but is based on objective criteria
- Develop a specific case definition using:
 - Symptoms or laboratory results
 - Time period
 - Location
 - ➔ Need to be specific enough not to include endemic disease

2. Define a case and conduct case finding (cont)

- Categories of cases
 - Confirmed
 - Symptoms characteristic of the agent
 - Lab test
 - Epidemiologic link
 - Probable
 - Symptoms confirmed
 - No lab or epidemiologic link
 - Suspected
 - Symptoms reported but not confirmed
 - No lab or epidemiologic link

2. Define a case and conduct case finding (cont)

- Can emphasize sensitivity or specificity in case definition
 - Usually emphasize sensitivity early in investigation
 - Can narrow case definition as more information is obtained
- Example: leptospirosis outbreak
 - Animal: has a confirmed MAT
 - Place: St James and St Thomas parishes
 - Time: October 24, 2000-January 1, 2001

2. Define a case and conduct case finding (cont)

- Conduct surveillance using case definition
 - Existing surveillance
 - Active surveillance (e.g. field investigation)
- Interview farmers
 - Recent animal movements
 - Other cases in neighborhood



3. Determine magnitude of the problem

- Attack risk = attack proportion

$$AP = \frac{\text{\# of affected animals}}{\text{Population at risk at start of epidemic}}$$

- Compare to:
 - Expected risk of disease in the population
 - Background level of disease

4. Tabulate and orient data

- Create line listing
- Animal
 - Which ones were infected?
 - What are the species, breed, sex, age, diet...
- Place
 - Where were they infected?
 - Create topographic map with case distribution (interest of geographic information systems)
- Time
 - When were they infected?
 - Create an epidemic curve using various time intervals
 - Determine type of outbreak (point source, propagated)



5. Take immediate control measures

- If an obvious source of the contamination is identified...institute control measures *immediately!*



6. Analyse data

Factor	# exposed to factor				# not exposed to factor			
	Total	Ill/dead	well	AP1	Total	Ill/dead	well	AP2
Age	a+b	a	b	a/(a+b)				
Sex								
Other potential exposure factors								

- Interpretation of the table should consider the following calculations:
 - Highest & lowest attack risk
 - Greatest difference (attributable risk) $AR = AP1 - AP2$
 - Relative risk $RR = AP1 / AP2$
 - Expected levels disease pattern
 - Etiologic fraction $EF = (AP1 - AP2) / AP1$ (proportion of disease attributed to the risk factor)

7. Formulate hypotheses

- A hypothesis is an educated "guess" about the source of the outbreak
- Generating hypotheses enables the investigators to test these hypotheses in an analytic study
- The success of the investigation depends upon the quality of the hypotheses

7. Formulate hypotheses (cont)

- Ways to approach generating hypotheses about the cause of the outbreak
 - Examine the line listing data
 - Review the existing body of knowledge
 - Administer open-ended hypothesis-generating questionnaire to several farmers
- Specifically, you should determine
 - Kind of epidemic: point source or propagated
 - Source of the epidemic: common source, multiple exposure...
 - Possible mode of spread: contact, vector...

7. Formulate hypotheses (cont)

- **Review the existing body of knowledge** to learn about previous outbreaks caused by the same agent or disease
 - Read veterinary, epidemiology, and microbiology literature
 - Talk to experts in the field
- Literature reviews help identify organisms, risk factors, and sources of exposures that have been observed in the past
 - Example: diarrheal disease
- Some outbreaks are caused by unrecognized agents or through unrecognized modes of transmission
 - Examples: Nipah virus

7. Formulate hypotheses (cont)

- Estimate the maximum incubation period from the illness onset date
- Use interviews to elicit information about exposure during the incubation period
- Test the hypotheses in an analytic study using a structured questionnaire concerning the specific hypotheses

7. Formulate hypotheses (cont)

- General searches on the Internet can also be helpful
 - Example: <http://www.google.com>
 - Not all information on the Internet is accurate: be mindful of the potential credibility of different Internet-based sources
- PubMed allows individuals to search journal abstracts from biomedical literature for free
 - <http://www.ncbi.nlm.nih.gov/PubMed>
 - Contact states or academic institutions who have access to journal abstracts or full-texts
- ProMed is also a good way to review epidemics that have occurred previously in other countries
 - <http://www.promedmail.org>

7. Formulate hypotheses (cont)

- Tip to perform a PubMed search:
 - Choose the appropriate words to limit the search
 - A search for "Salmonella AND eggs OR chicken" will retrieve all articles about Salmonella and eggs as well as all articles about chicken (in general)
 - A search for "Salmonella AND (eggs OR chicken)" will retrieve all articles about Salmonella and eggs as well as all articles about Salmonella and chicken
 - Tips for printing citations or abstracts
 - After performing a search, select "Summary" from the "Display" drop-down bar and "Text" from the "Send to" drop-down bar
 - Click on "Send to" for a printable version of the citations
 - Select the "Abstract" option from the "Display" drop-down bar to print the abstract

8. Plan and execute additional studies

- Intensive follow-up
 - Evaluate in more details clinical, pathological, microbiological & toxicological data
 - Same for previously collected data
- Further epidemiological studies
 - Retrospective cohort study
 - Case-control study
- Environmental sampling
 - Collect appropriate samples
 - Allow epidemiological data to guide testing
 - If analytic study results are conclusive, don't wait for positive samples before implementing prevention



9. Implement and evaluate control measures

- Prevent further exposure and future outbreaks by eliminating or treating the source
- Work with regulators, farmers, and animal health professionals to institute measures
- Create mechanism to evaluate both short- and long-term success



10. Communicate findings

- Identify a single member of the investigation team to interact with **media** and communicate progress and findings
- Summarize investigation, make recommendations, and **disseminate report** to all participants
- **Publication** valorises work (and help other people in similar situations!!)

