

Investigation of an Epidemic

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Objectives of Investigation of an epidemic:

- 1-Define magnitude of epidemic (time, person, place) (**When, Whom, Where**).
- 2-Determine factors responsible for epidemic (**Why**).
- 3-Identify cause, sources of infection and modes of transmission (**How**).
- 4-Implement control and preventive measures at commence of epidemic (**Modification**).





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The concept....

Endemic

- ❑ Disease occurring in a population regularly at an usual level
 - Eg Tuberculosis, malaria

Epidemic

- ❑ Unusual occurrence of disease clearly in excess of its normal expectancy.
 - In a geographical location
 - At a given point of time.
 - Eg: Hepatitis, Measles, Typhoid





Outbreak versus epidemic

❑ Epidemic

- Occurrence of cases of illness in excess of the expected numbers

❑ Outbreak

- Limited to a small area, within a district or a few blocks

❑ Epidemic

- Covers larger geographic areas
- Linked to control measure instituted in the district/state



Recent
**Epidemic
Outbreaks**

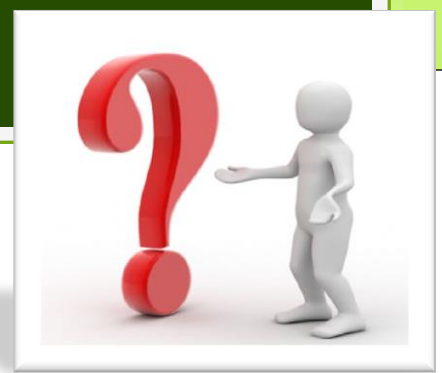
around  the world

Investigating an epidemic...why????



- ❑ Epidemics or outbreaks signals some significant shift between existing balance between agent, host and environment
- ❑ Calls for thorough investigation to uncover the factors responsible and...
.....Institute control measures to prevent further spread of the disease

Investigating an epidemic...why????



- ❑ Role for research into a new laboratory method to diagnose diseases
 - why some are more susceptible, what risk factors do they have?
- ❑ To find out the limiting factor for outbreak of disease for which an existing health programme is there.

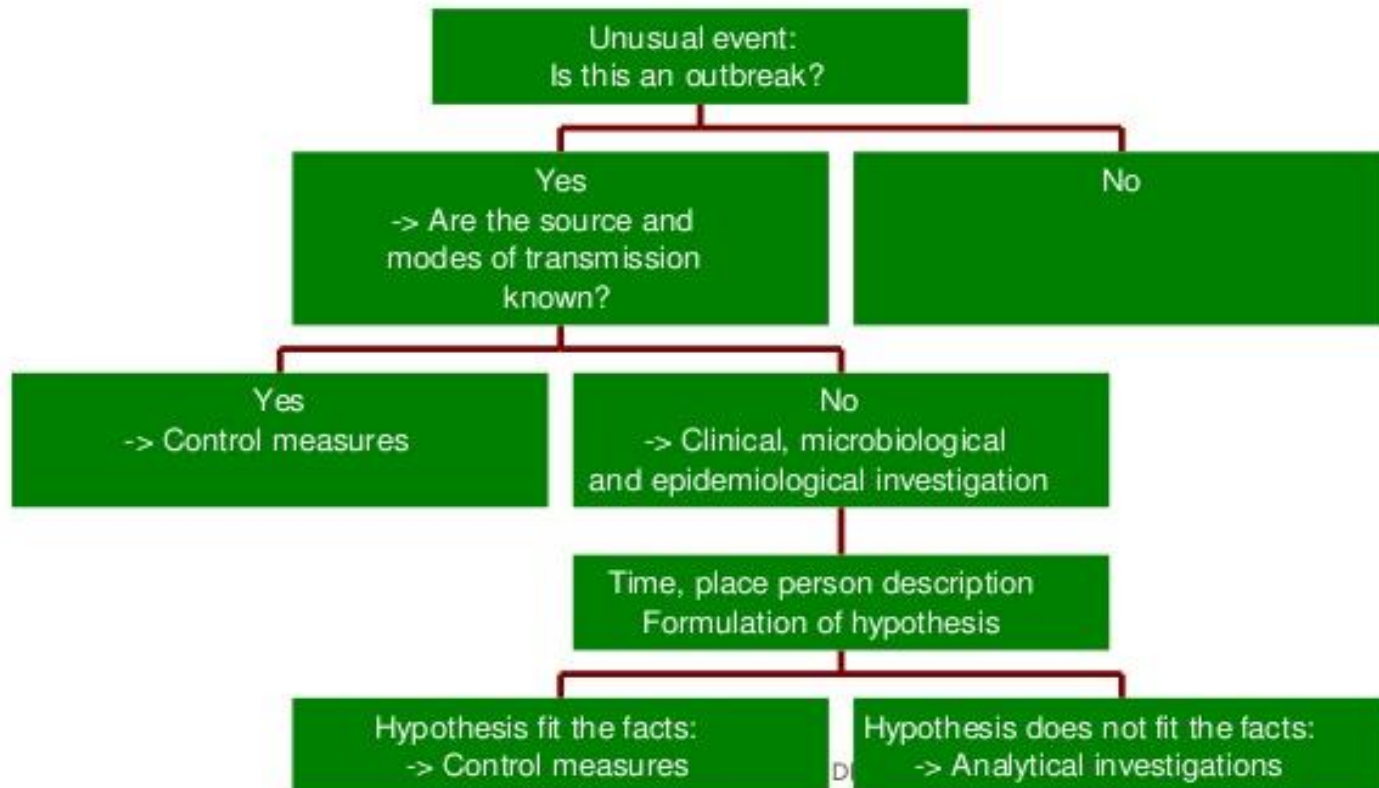
Salient feature of an epidemic investigation

- Epidemic investigation is meant for **Description** as well as **Intervention**.
- Generally investigations are done at the peak of the epidemic....hence largely **Retrospective**
- The steps for investigation are not necessary to be undertaken in the same sequence.....

it is quite possible that a number of steps may be addressed simultaneously

Investigating an outbreak

15



Steps of an outbreak investigation

1. Field work preparation
2. Confirm the existence of an epidemic
3. Verify the diagnosis
4. Define and identify case
5. Describe data by time ,place &persons
6. Formulate hypothesis
7. Analytic study to testing hypotheses
8. Carry out additional studies
9. Follow-up the control implementations
10. Writing epidemic investigation Report

Step 1: Field work preparation

- Knowledge of the disease
- Team
 - Epidemiologist
 - Health educator
 - Laboratory technician
 - Specialist
- Coordinate with local authorities



1. Prepare for Field Work

18

Preparations can be grouped into three categories:

(a) *Activities to Begin*

- Researching the disease
- Identifying team members
- Assign duties
- Determine local contacts
- Activate department protocol

(b) Equipment for the Field

- Laptop
- Cell Phone
- Camera
- Specimen Collection kits
- interview forms
- Infectious Disease Manual

(c) Possible Team Members

- Epidemiologist
- Clinicians
- Lab Personnel
- Sanitarians
- Infection Control Staff
- Administrators (large outbreaks)

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Step 2: Confirm the existence of an outbreak:

- When reports of illness begin to surface, it is important to determine if an outbreak is truly occurring.
- A true outbreak may be occurring or it may be **periodic** and **unrelated cases** of the same disease or even unrelated cases of similar, but different diseases.



Step 2: Confirm the existence of an outbreak:

- Step 1: To decide whether the observed number of cases exceeds the expected numbers we need to first determine the expected number of cases before deciding if the observed number exceeds the expected



Step 2: Confirm the existence of an outbreak:

- Step 2: Collect data of expected values using surveillance records, hospital discharge data, disease registries, mortality statistics, lab data, other agencies, health care providers & community surveys.



Step 2: Confirm the existence of an outbreak:

- Compare the current number of cases with the number from the previous few weeks or months or from a comparable period during the previous few years.
- **Before launching a full investigation, verify signs, symptoms & test results**

Step 3 : Verify the diagnosis and determine the etiology

- Verification of diagnosis
 - clinical findings
 - laboratory results
 - Investigator should visit several patients with the disease.

In case if a sound clinical background is not known than a qualified physician can be taken for the investigation.

Step 3 : Verify the diagnosis and determine the etiology

- Certain questions can be asked to the patients to reach to a diagnosis
- What were their exposures before becoming ill?
- What do they think caused their illness?
- Do they know anyone else with the disease?
- Do they have anything in common with others who have the disease?

Step 4. Define and Identify Cases

- Epidemiologists establish a **case definition**: a standard set of criteria for deciding whether a person should be classified as having the disease or condition under study.
- **Usually includes :**
 1. Clinical information about the disease
 2. Characteristics about the people who are affected
 3. Information about the location or place
 4. A specification of time during which the outbreak occurred.

Step 4. Define and Identify Cases

Investigators often classify cases as one of the following:

- **Confirmed:** usually has laboratory verification
- **Probable:** usually has clinical features without lab verification
- **Possible:** usually has fewer of typical clinical features

Example case definition

- **Possible or suspect**
 - Patient with severe diarrhoea
- **Probable**
 - Patient older than 5 years with severe dehydration or dying of acute watery diarrhoea in town “x” between 1 June and 20 July 1998
- **Confirmed**
 - Isolation of *Vibrio cholerae* from stool of patient

A disease...



a contagious disease...

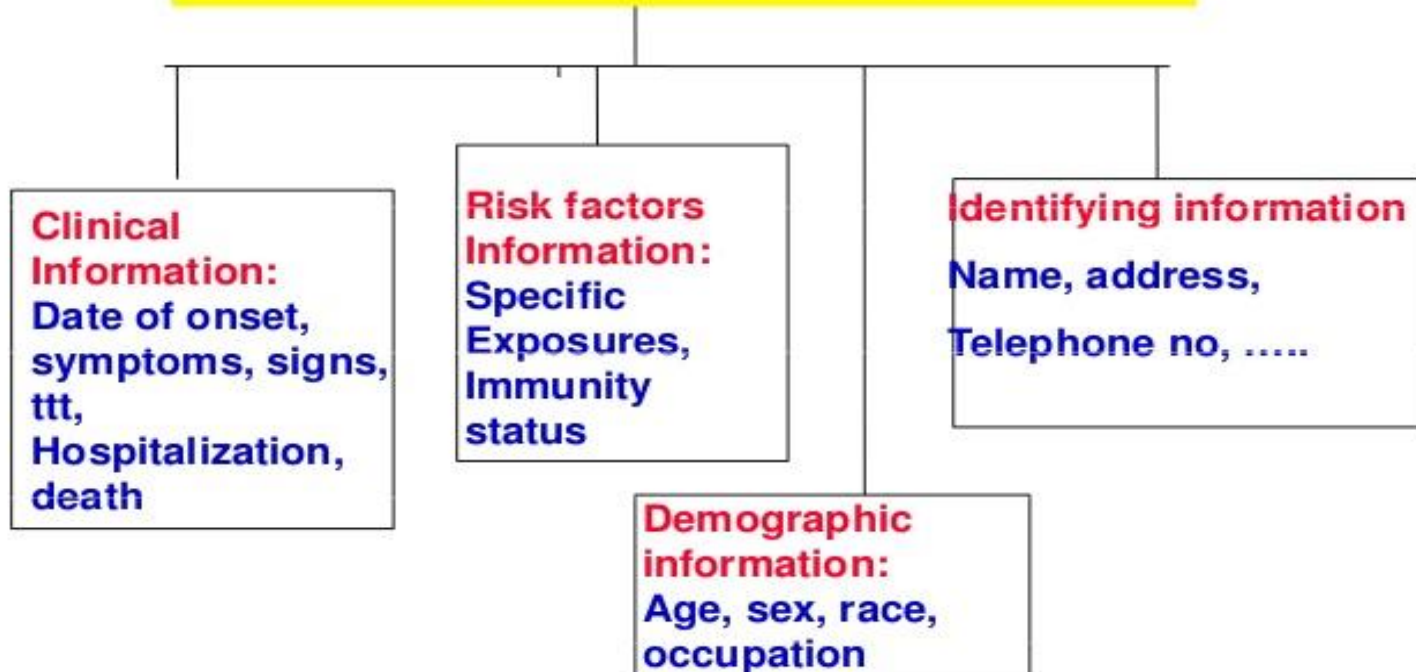


an epidemic



Step 4. Define and Identify Cases

The following information is collected:



Step 5: Describe data by time, person, place

a) Time

- Epidemic curve designed and **time clustering of cases sought out**

Step 5: Describe data by time, person, place

□ Epidemic curve

- Confirming the existence of an epidemic
- Forecasting of the further evolution of the epidemic
- Identifying the mode of transmission
- Determining the possible period of exposure and/or the incubation period of the disease under investigation
- Identifying outliers in terms of onset of illness, which might provide important clues as to the source.

Types of epidemics

- Common source epidemics
- Propagated source epidemics

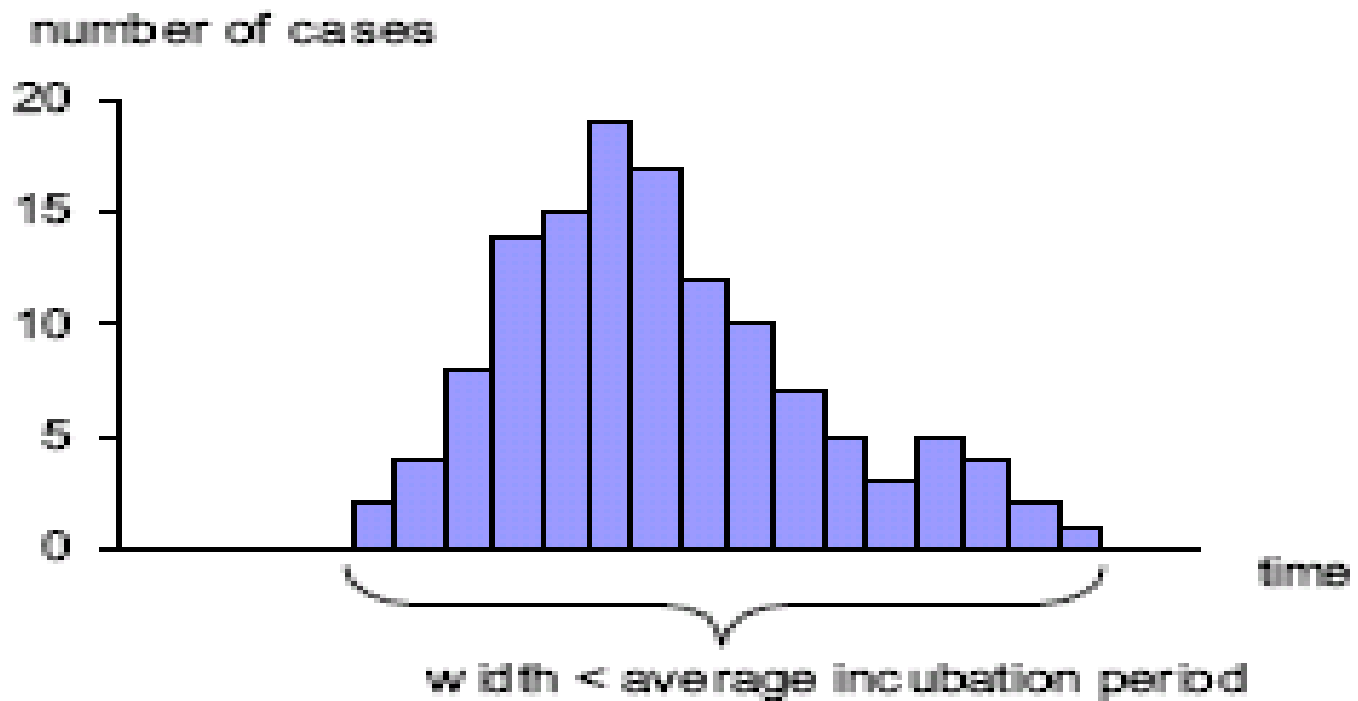
1.Common source outbreak: This outbreak occurs when people gets the infection by exposure to the same source of infection. These are two types

A. Point common source: When there is single source that exists for the short time and all cases have common exposure to it in that same particular period.

Common source outbreak



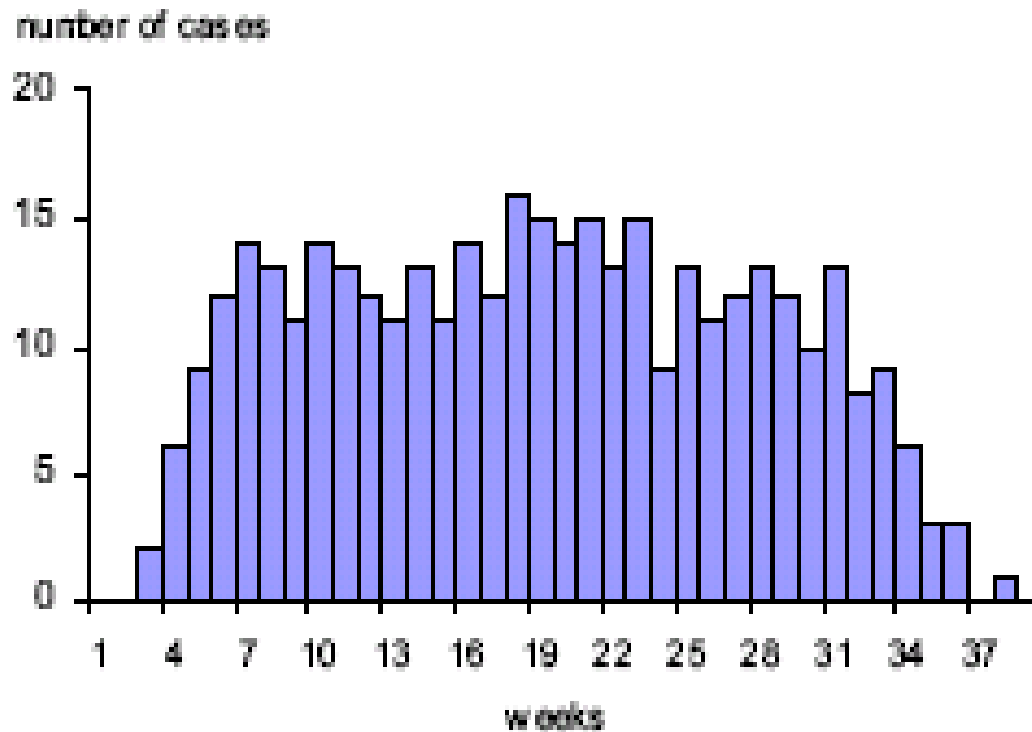
A. Point source



Common source epidemics

- B. Continuous common source: The epidemic curve shows an abrupt increase in number of cases but instead of having a peak decline within incubation period, new cases persist for a longer time with a plateau shape instead of peak before decreasing.

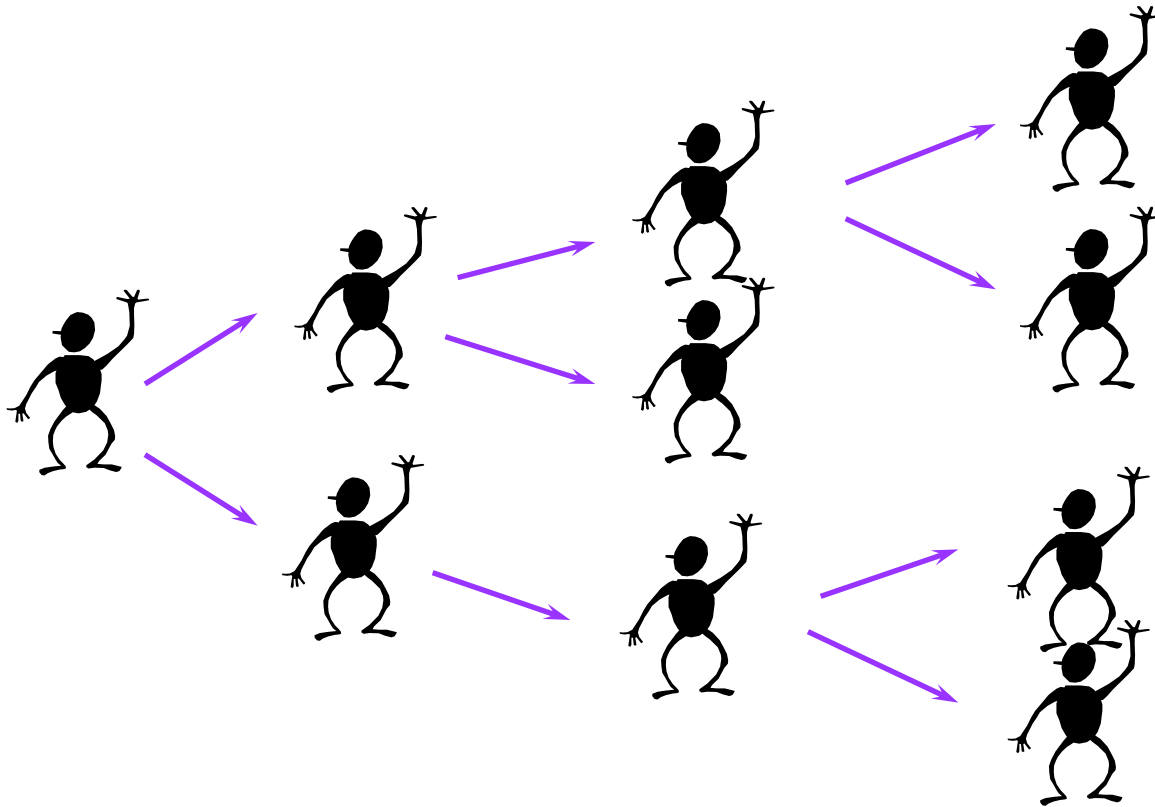
C. Continuous common source



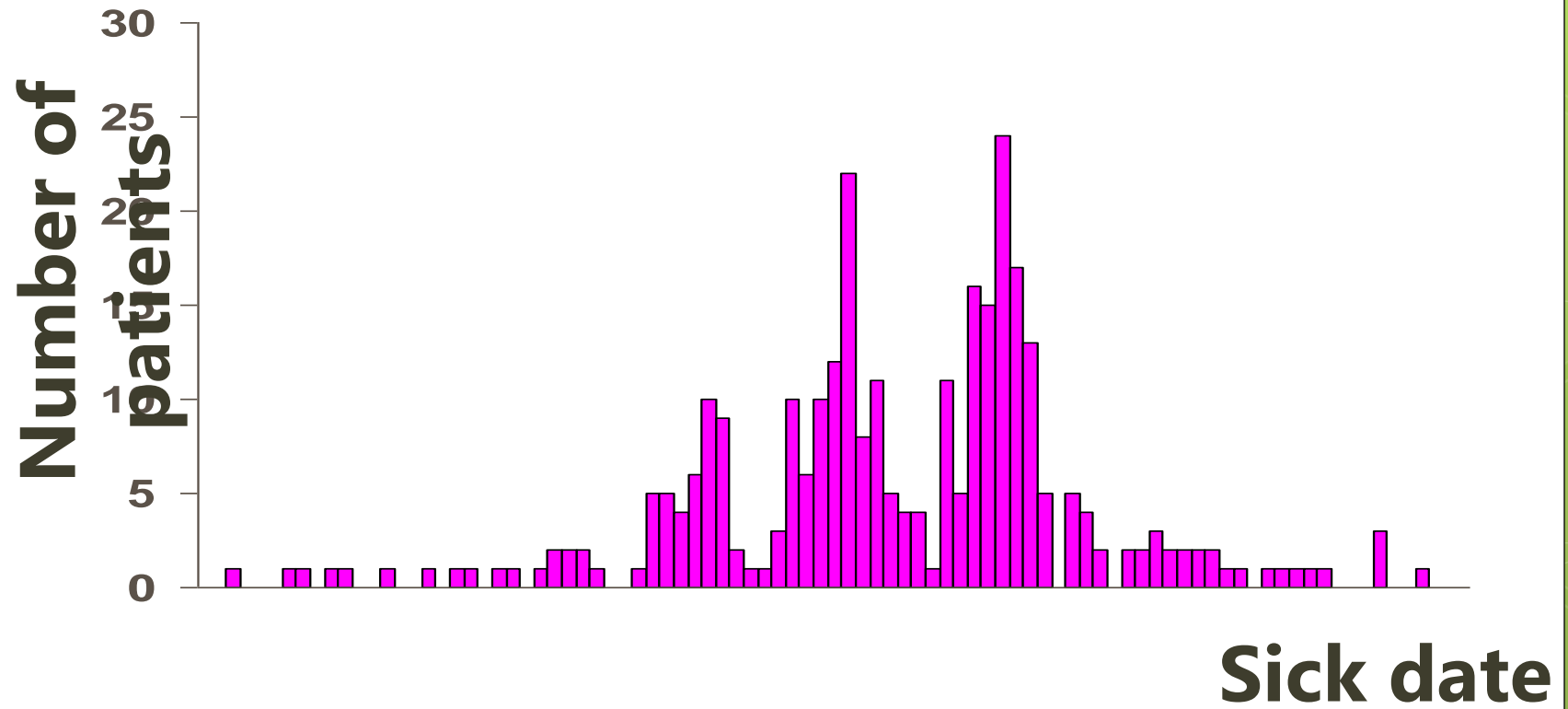
Propagated source epidemics

- This type of outbreak is caused by a **transmission from one person to another person** which requires **direct contact** such as touching, bite, sexual contact
- **Slow increase in number of cases with progressive peaks approximately one incubation period apart.** The span of 1st and last case will also last longer than several incubation period e.g HIV

Propagated source epidemics

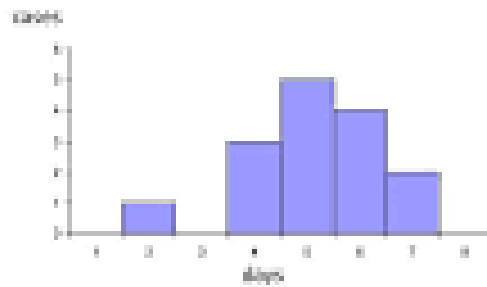


Propagated source epidemics

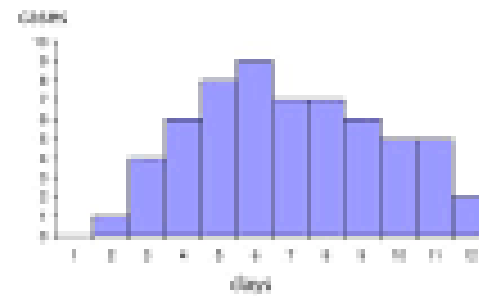


Types of epidemic curves

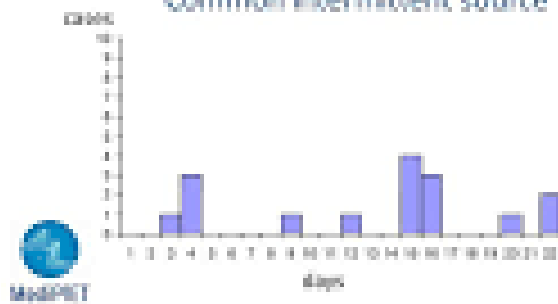
Point source



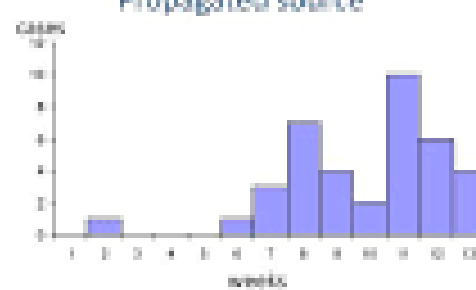
Common continuous source



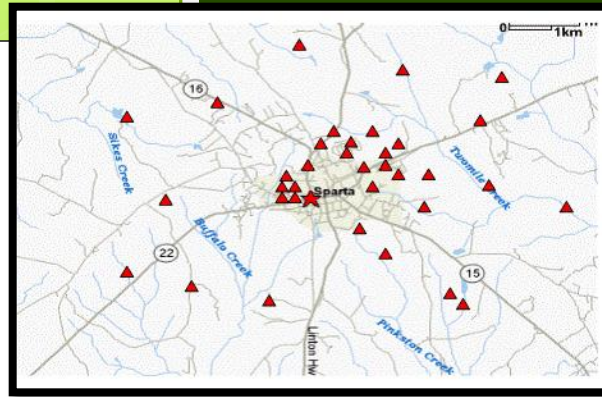
Common intermittent source



Propagated source



Cont...



b) Place

- “Spot maps” prepared and if possible their relation to the source of infection eg. Water supply
- Geographic distribution (clustering) of cases suggests source and spread of disease.

Cont...

c) Person

- ❑ Analysis of data according to age, sex, occupation etc. is suggestive of susceptibility.
- ❑ Attack rates/ case fatality rates for exposed and non-exposed determined according to the host factors

Step 6: Formulation of hypothesis

❑ On the basis of **Time-Place-Person** distribution or...

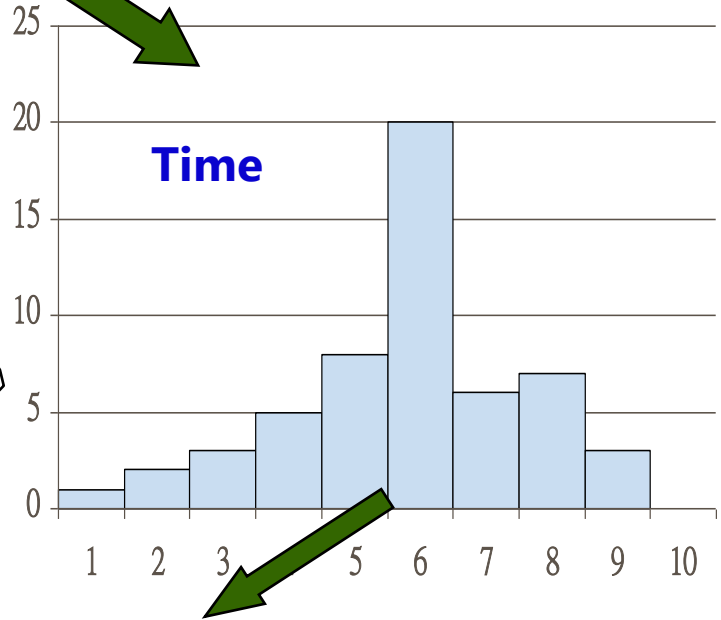
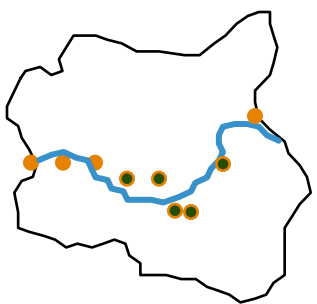
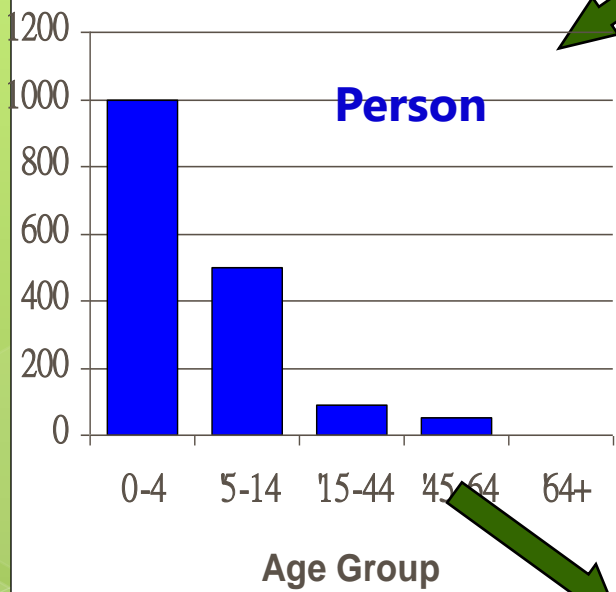
Agent-Host-Environment model hypothesis is formulated to explain....

- ✓ **Possible source**
- ✓ **Causative agent**
- ✓ **Environmental factors responsible**



**Formulation of tentative hypothesis
guides further investigations**

Cases



Evaluate information

Source?

Pathogen?

Transmission?

Hypothesis setup: from all the data

Step 7 : Testing of hypothesis



- ❑ All reasonable hypothesis should be considered and weighed comparing attack rates with each suspected factor
- ❑ This helps to ascertain the hypothesis most consistent with all known facts
- ❑ Divergent hypothesis should also be checked out.

Step 7 : Testing of hypothesis



philipmarino

- Hypothesis can be tested by comparing the hypothesis with the established facts or by using analytical epidemiology to quantify relationship & explore the role of chance.
- Analytical studies like-cohort & case-control studies.

Step 7 : Testing of hypothesis



- Do necessary environmental or other studies to supplement the epidemiological study:
- Although an analytical study might be able to confirm the hypothesis ,the investigator still needs to find environment or other evidence to support and explain the epidemiological evidence

Step 8: Carry Out Additional Studies

- When analytic epidemiological studies do not confirm our hypotheses, we need to reconsider our hypotheses and look for new vehicles or modes of transmission.
- Even when your analytic study identifies an association between an exposure and a disease, **you need to obtain more specific exposure histories** or a more specific control group.

Step 9. Implementing Control and Prevention Measures

- Remove source of contamination
- Remove persons from exposure
- Isolate and/or treat infected persons
- Interrupt transmission
- Eliminate the susceptibility of individuals by vaccination or prophylactic



Step 10 :Writing epidemic investigation Report



- ❑ The report should be complete and convincing.
- ❑ Final reporting should be done under following headings:

Background

Historical data

Methodology of investigation

Analysis of data

Control measures

