Community 432 Medicine

11 Outbreak Investigation

Objectives

1. Recognize the importance of investigating reported outbreaks.
2. Understand steps in the investigation of an outbreak.
3. Interpret the Epidemic Curves.

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Why to investigate?

- To identify the source of outbreaks. (Sudden increase in cases in a particular time eg. H1N1)
- To prevent additional cases.
- To increase our knowledge of a disease.
- To prevent future outbreaks.
- To conduct epidemiologic training.

Aspects of outbreak investigations:

- The epidemiologic investigation.
- The environmental investigation.
- The interaction with the public, the press, and, in many instances, the legal system.

For example HIV when there was an outbreak in the early 80's the law said such people are not allowed to mingle with the normal public , then later on this was modified and said prevention and control is possible in such people and they can mingle with public.

Steps of outbreak investigation:

Table 6.2
Steps of an outbreak investigation

1. Prepare for field work
2. Establish the existence of an outbreak
3. Verify the diagnosis
4. Define and identify cases
   a. establish a case definition
   b. identify and count cases
5. Perform descriptive epidemiology
6. Develop hypotheses
7. Evaluate hypotheses
8. As necessary, reconsider/refine hypotheses and execute additional studies
   a. additional epidemiologic studies
   b. other types of studies – laboratory, environmental
9. Implement control and prevention measures
10. Communicate findings

Steps of outbreak investigation (10 steps)

1. Prepare for the fieldwork
2. Establishing the Existence of an Outbreak
3. Verifying the Diagnosis
4. Establishing a Case Definition Performing
5. Descriptive Epidemiology
6. Developing Hypotheses
7. Evaluating Hypotheses
8. Refining Hypotheses
9. Implementing Control & Prevention
10. Communicating the Findings

1. Prepare for the fieldwork	✓ **Team work** (knowledgeable person) ✓ **Administration** ✓ **Supplies** (masks, beds, IV, drugs, labs) ✓ **Literature** ✓ **Transportation**
2.Establishing the Existence of an Outbreak	○ **Is this an epidemic or cluster of cases? (Observed number exceed the expected number)** • **An outbreak:** or an epidemic is the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time. (Such as food poisoning, typhoid, and cholera. Usually there is no cases at all but suddenly all these cases came about 100-200 case. The disease is not expected) • **A cluster:** is an aggregation of cases in a given area over a particular period without regard to whether the number of cases is more than expected. (Occurring together for eg: seasonal influenza we expect every year a limited number. that will come with the flu symptoms. The disease is expected to come every year). ○ **Sources to test the existence of an outbreak:** • **For a notifiable disease:** Use Health Department Surveillance Records. • **For other diseases and conditions:** Find existing data locally. e.g. Hospital Discharge Records , Mortality Statistics , Cancer or Birth Defect Registries. • **If local data are not available:** ➢ Apply rates from neighboring cities or national data OR ➢ Conduct a telephone survey of physicians to find if they have seen more cases than usual OR ➢ Contact senior citizens or conduct a survey of the community to establish the background or historical level of disease.

3. Verifying the Diagnosis

This step is linked to verifying the existence of an outbreak. It is important to ensure that the problem is properly diagnosed and there are no laboratory errors as the basis for increase in cases.

- **Verification is needed because**
  - Diseases can be misdiagnosed (clinic or Laboratory).
  - Case may not be actual but suspected case.
- **Steps of Verification:**

1. Review the clinical findings and laboratory results.
2. Visit several patients suffering from that disease.
3. Summarize clinical findings with frequency distributions

4. Establishing a Case Definition

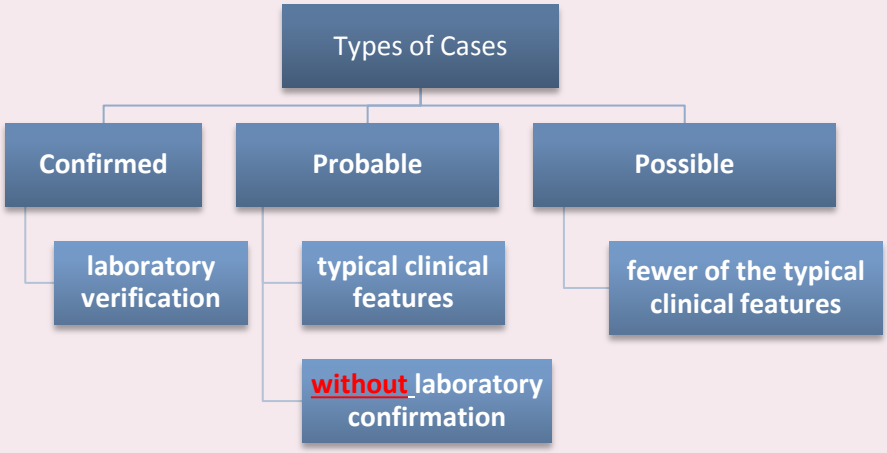
- **What is a Case Definition?**

A standard set of criteria for deciding whether an individual should be classified as having the health condition of interest.

- **Components of a Case Definition:**

A case definition includes clinical criteria and--particularly in the setting of an outbreak investigation--restrictions by time, place and person. Apply them consistently and without bias to all persons under investigation.

- **Terminology:**



Early in an investigation: may apply 'loose' case definition which includes confirmed, probable and possible cases.

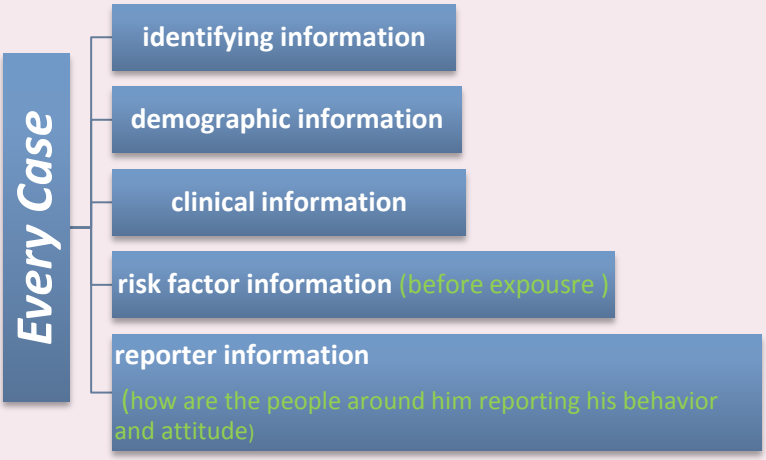
Later when hypotheses take sharp focus, may 'tighten' the case definition by dropping the possible category.

❖ **Example about the confirmed and probable cases:**

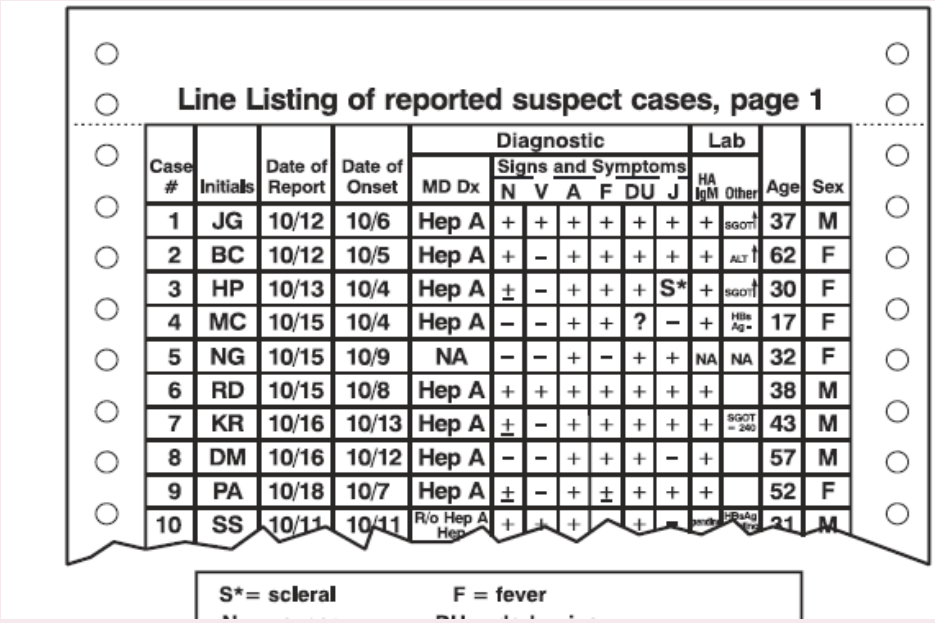
- **Confirmed case:** A person with laboratory confirmation of MERS-CoV infection, irrespective of clinical signs and symptoms.
- **Probable case:** A febrile acute respiratory illness with clinical, radiological, or histopathological evidence of pulmonary parenchymal disease (e.g. pneumonia or Acute Respiratory Distress Syndrome) & Direct epidemiologic link with a confirmed MERS-CoV case & testing for MERS-CoV is unavailable, negative on a single inadequate specimen or inconclusive.

○ Sources for Identifying Cases:

○ Information Collected:



○ Line Listing (Counting Cases):



Line Listing of reported suspect cases, page 1

Case #	Initials	Date of Report	Date of Onset	Diagnostic: MD Dx	Signs and Symptoms: N	V	A	F	DU	J	Lab: HA IgM	Other	Age	Sex
1	JG	10/12	10/6	Hep A	+	+	+	+	+	+	+	SGOT↑	37	M
2	BC	10/12	10/5	Hep A	+	–	+	+	+	+	+	ALT↑	62	F
3	HP	10/13	10/4	Hep A	±	–	+	+	+	S*	+	SGOT↑	30	F
4	MC	10/15	10/4	Hep A	–	–	+	+	?	–	+	Hbs Ag -	17	F
5	NG	10/15	10/9	NA	–	–	+	–	+	+	NA	NA	32	F
6	RD	10/15	10/8	Hep A	+	+	+	+	+	+	+		38	M
7	KR	10/16	10/13	Hep A	±	–	+	+	+	+	+	SGOT = 240	43	M
8	DM	10/16	10/12	Hep A	–	–	+	+	+	–	+		57	M
9	PA	10/18	10/7	Hep A	±	–	+	±	+	+	+		52	F
10	SS	10/11	10/11	R/o Hep A Hep	+	+	+		+	–			31	M

S*= scleral F = fever

(This is a standard way of collecting data that is called line listing. it contains demographics, date of report, date of onset, diagnosis, and lab results).

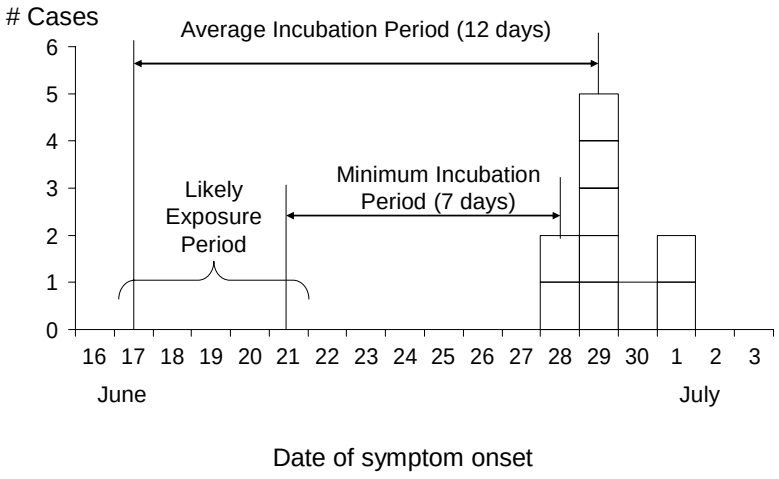
5. Performing Descriptive Epidemiology	From page 5 to page 8

Why to Perform Step 5:

- To be Familiar with the Data
- To find TRENDS – over time, across population, across areas
- To develop HYPOTHESIS To Identify LIKELY PERIOD OF EXPOSURE from Epidemic Curve:

1. Look up the average and minimum incubation periods of the disease. This information can be found in Control of Communicable Diseases in *Manual.*
2. Identify the *peak of the outbreak* or the *median case* and count back on the *x*-axis one average incubation period.
3. Note the date Start at *the earliest case* of the epidemic and count back the minimum incubation period, and note this date as well.

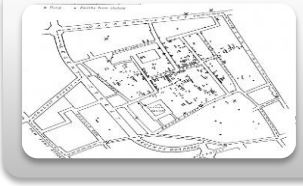
An outbreak of an acute respiratory disease (epidemic curve):



The small boxes represent the number of cases that have occurred between 28 of June and 1st of July. The incubation period is also obtained from timeline.

Time

- What is the exact period of the outbreak?
- What is the probable period of exposure?
- Is the outbreak likely common source or propagated?



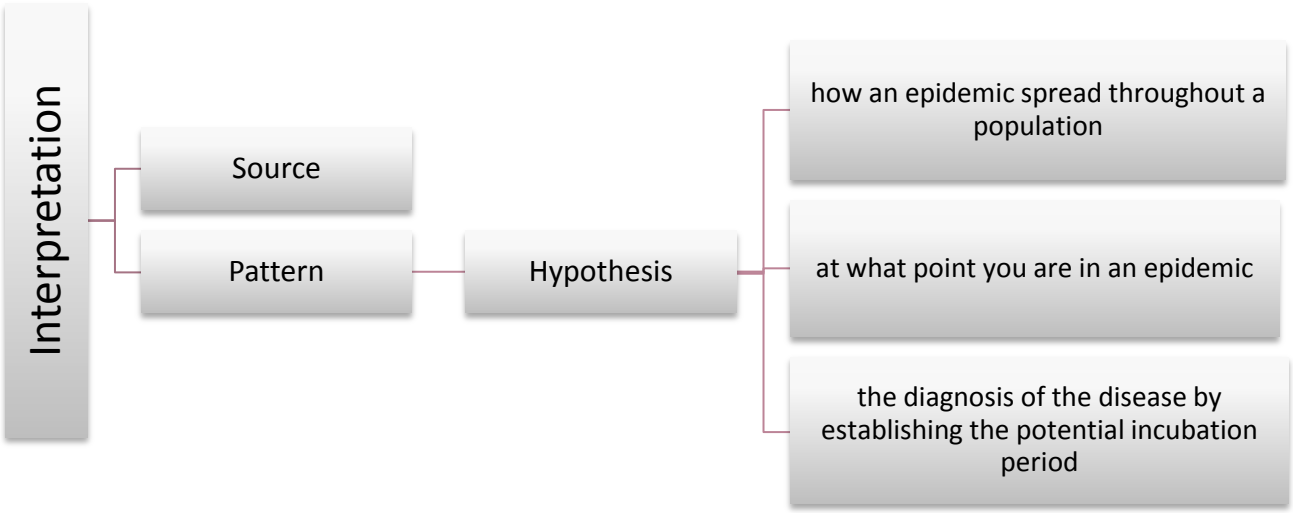
Place

- What is the most significant geographic distribution of cases? Place of residence? Workplace?
- What are the attack rates?

Person

- What were the age and gender specific attack rates?
- What age and gender groups are at highest and lowest risk if illness?
- In what other ways do the characteristics of the cases differ significantly from those of the general population?

Interpreting an Epidemic Curve:



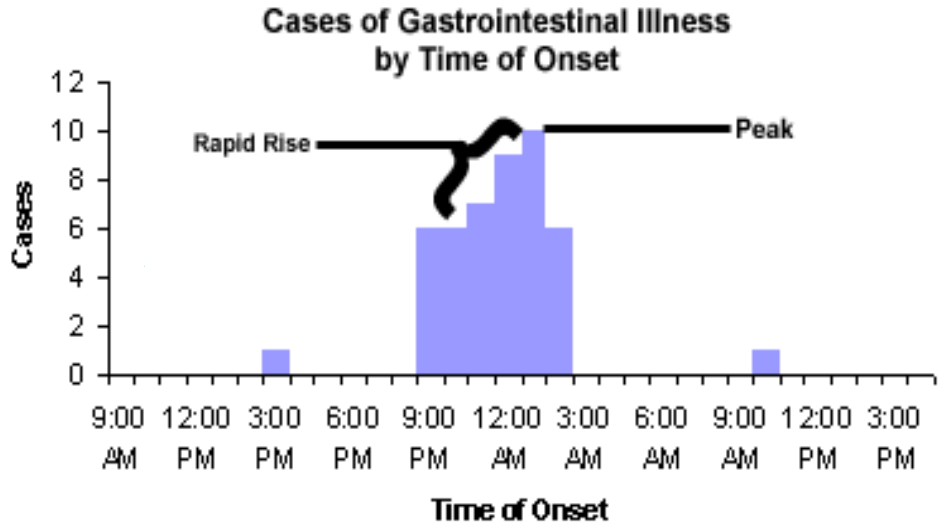
Epidemic patterns:

Common and propagated.

1-Common:

A. Point Source:

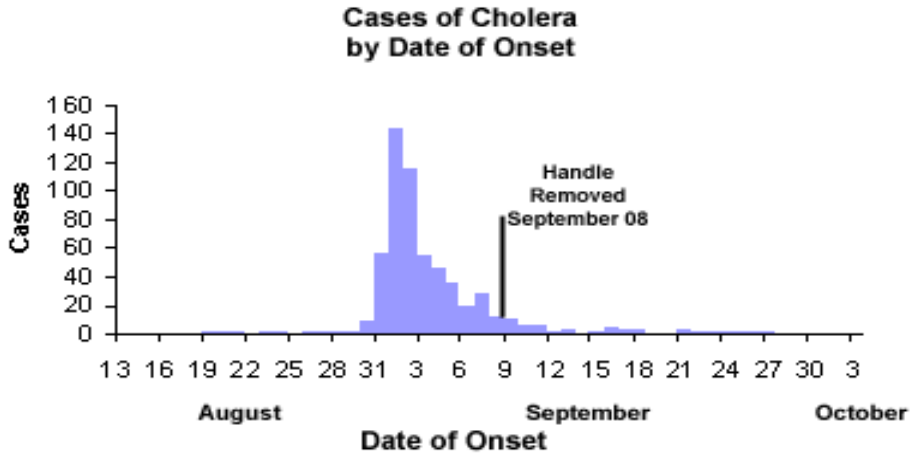
In a point source epidemic, persons are exposed to the same exposure over a limited, defined period of time, usually within one incubation period. The shape of this curve commonly rises rapidly and contains a definite peak at the top, followed by a gradual decline.



The graph above illustrates an outbreak of gastrointestinal illness from a single exposure. While there are outliers to this dataset, it is clear that there is an outbreak over a limited period of time, and the shape of the curve is characteristic of one source of exposure.

B. Continuous common source

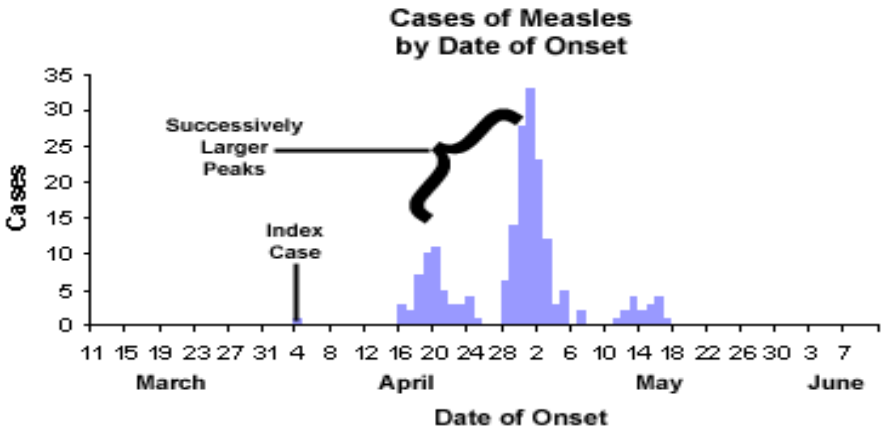
In a continuous common source epidemic, exposure to the source is prolonged over an extended period of time and may occur over more than one incubation period (incubation period that differ between each case and the other) .The down slope of the curve may be very sharp if the common source is removed or gradual if the outbreak is allowed to exhaust itself.



The data above is from the well-known outbreak of cholera in London that was investigated by the "father of epidemiology," John Snow. Cholera spread from a water source for an extended period of time. Note that the typical incubation period for cholera is 1--3 days that the duration of this outbreak was more than 1 month.

2-Propagated:

A propagated (progressive source) epidemic occurs when a case of disease serves as a source of infection for subsequent cases and those subsequent cases, in turn, serve as sources for later cases. The shape of the curve usually contains a series of successively larger peaks, reflective of the increasing number of cases caused by person-to-person contact, until the pool of susceptible is exhausted or control measures are implemented.



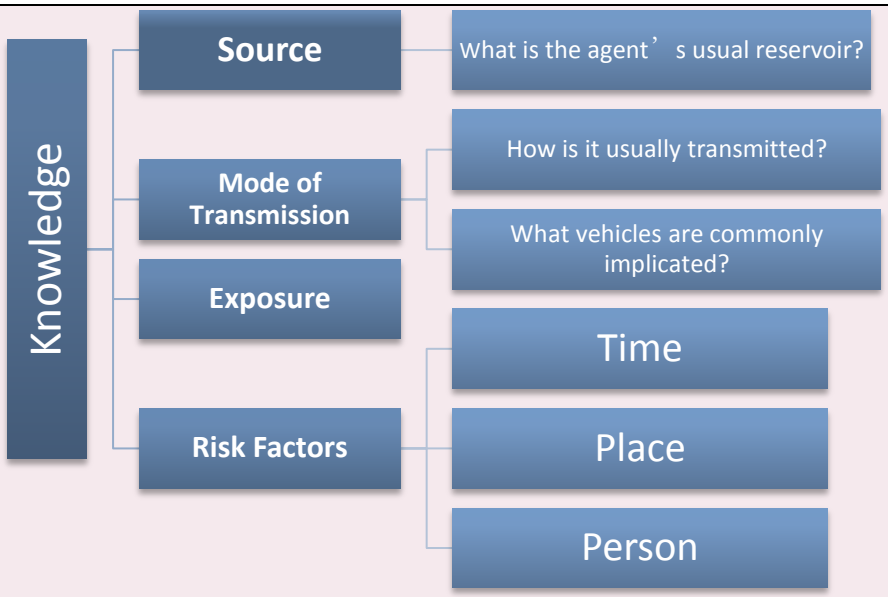
The graph above illustrates an outbreak of measles. The graph shows a single common source (the index case), and the cases appear to increase exponentially. Measles is caused by person-to-person contact. Its incubation period is typically 10 days but may be 7--18 days.

Common Source Questions	Propagated Source Questions
-Is the outbreak from a single source or common source? -Is the disease spread from person to person? -Is there continued exposure to a single source?	-Is the outbreak from multiple sources or exposures? -Is the outbreak airborne, behaviorally or chemically caused and does it involve multiple events? -Are the sources of infection from unapparent sources? -Is there a vector or animal reservoir involved?

Duration of an Epidemic (depends on):

1. The number of susceptible persons who are exposed to a source of infection and become infected.
2. Period of time over which susceptible persons are exposed to the source.
3. Minimum and maximum incubation periods for the disease.

6.Developing Hypotheses



Another useful way you can generate hypotheses is to talk to a few of the case-patients.
In addition, investigators have sometimes found it useful to visit the homes of case-patients and look through their refrigerators and shelves for clues.

7. Evaluating Hypotheses

1. **Comparison:**

With the established facts.

- When to use it?

When the clinical, laboratory, environmental, and/or epidemiologic evidence so obviously supports the hypotheses that formal hypothesis testing is unnecessarily

2. **Quantification (of the relation):**

By using analytic epidemiology.

- **When to use it?**

When the circumstances are not as straightforward. In those instances, you should use analytic epidemiology to test your hypotheses. The key feature of analytic epidemiology is a *comparison* group.

Analytic Epidemiology:

A. **Retrospective Cohort Study:**

- Study of choice for an outbreak in a small, well-defined population (e.g. Wedding).
- Exposure/Outcome of each member of the cohort.
- Calculate Attack Rates and Relative Risk (Risk Ratio
- Example: next page

Retrospective Cohort Study Example:

Food	ate			Did not eat			
	Ill	well	AR	Ill	well	AR	RR
meat	29	17	63	17	12	59	
spinach	26	17	60	20	12	62	
potato	23	14	62	23	14	62	
salad	13	11	54	28	19	60	
Ice cream	43	11	80	3	18	14	

B. Case control study:

- The population is not well defined (e.g. A city)
- The investigator asks both case-patients and
- a comparison group of persons without disease ("controls") about their exposures.
- Calculate Odds Ratio
- Example:

Exposure		Case	Control	Total
Ate at restaurant A	Yes	30	36	66
	No	10	70	80
Total		40	106	146

✓ The key feature of analytic epidemiology is a comparison group. The comparison group allows epidemiologists to compare the **observed** pattern among case-patients or a group of exposed persons with the **expected** pattern among non-cases or unexposed persons.

8. Refining Hypotheses

- Epidemiologic studies
- Laboratory and environmental studies

9.Implementing Control & Prevention	As discussed earlier in the lectures covering chain of infection and control measures
10.Communicating the Findings	Oral or written reports should include Investigation methods, findings, prevention and control methods applied, effectiveness of control methods, and recommendations for future surveillance and control

MCQ

Q1: Which one of the following is a good example of an Outbreak?
A: Food poisoning
B: seasonal Influenza
C: Cholera
D: A & C

Answer is D

Community medicine team leader :

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If you find any Mistakes please contact me:

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