Outbreak Investigation

Team notes are in RED

ينصح بدراسة المحاضرة من الكمبيوتر أو طباعتها
بالألوان لأن أغلبها نوتس إضافية للفهم فقط ☺

Team Leaders:

Fatimah Algawahmed & Abdullah Al-Faris

Team members:

Maha Al-Balharith

reference:

slides

lecture notes

http://www.cdc.gov/excite/classroom/outbreak/steps.htm#step1

OBJECTIVES OF THE LECTURE:

- **Importance of investigating reported outbreaks**
- **Steps in the inves0ga0on of an outbreak**
- **Describe epidemic curves**

Definitions :

Outbreak or Epidemic : it's about (person/places/time)

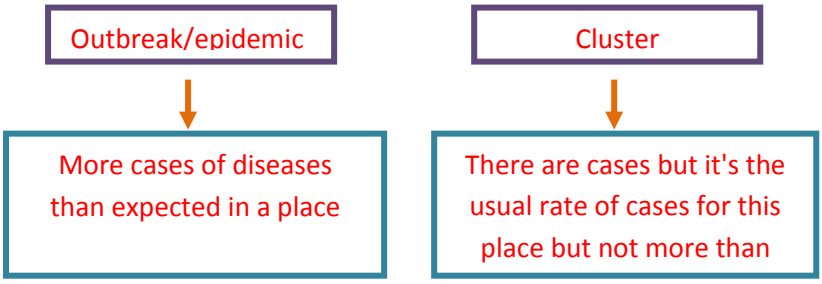
Occurrence of more cases of disease than expected in a given area **(place)** or among a specific group of people **(person)**over a particular period of time **(time)** .

Cluster :

An aggregation of cases in a given area over a particular period without regard to whether the number of cases is more than expected.

What's the difference between an outbreak & a cluster ??

The difference is the number of expected cases



To investigate or Not To? **Just to clear out the importance of investigation (read only *_^)**

"Outbreak investigations, an important and challenging component of epidemiology and public health, can help identify the source of ongoing outbreaks and prevent additional cases. Even when an outbreak is over, a thorough epidemiologic and environmental investigation often can increase our Knowledge of a given disease and prevent future outbreaks. Finally, outbreak investigations provide epidemiologic training and foster cooperation between the clinical and public health communi.es".

Why to investigate?

- Control & Prevention
- Research Opportunities
- Training
- Public/Legal/Political Concerns

Control Vs. Further Investigations:

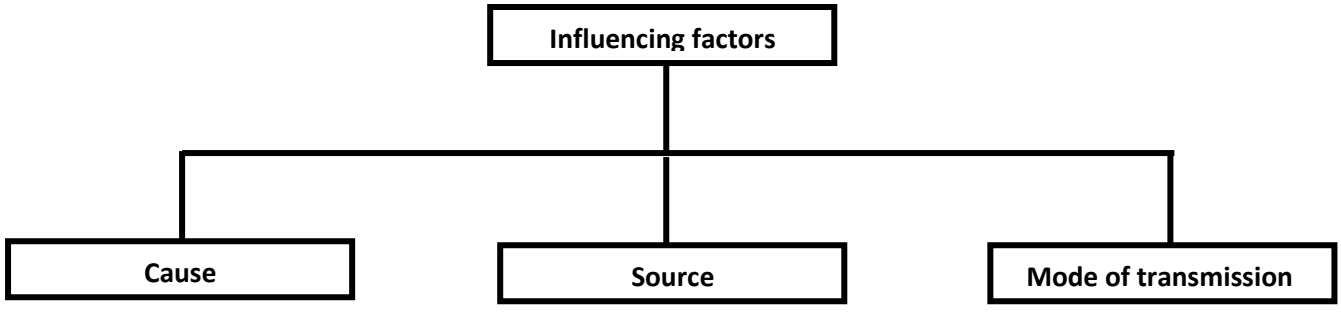


Table 6.1 Relative Priority of Investigative and Control Efforts During an Outbreak, Based on Knowledge of the Source, Mode of Transmission, and Causative Agent

Causative Agent	Source/Mode of Transmission (How people are getting exposed to the agent)	
	Known	Unknown
Known	Investigation + Control +++	Investigation +++ Control +
Unknown	Investigation +++ Control +++	Investigation +++ Control +

+++ = highest priority
+ = lowest priority

Source: Goodman RA, Buehler JW, Koplan JP. The epidemiologic field investigation: science and judgment in public health practice. Am J Epidemiol 1990;132:9–16.

Ps: we control from further damage and not for elimination

MCQ :
If the investigation and mode of transmission is unknown then the priority for (investigation) .

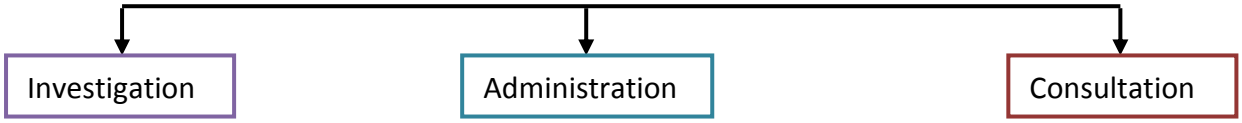
Once a decision is made to investigate an outbreak:

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

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

Step 1: Prepare for field work :



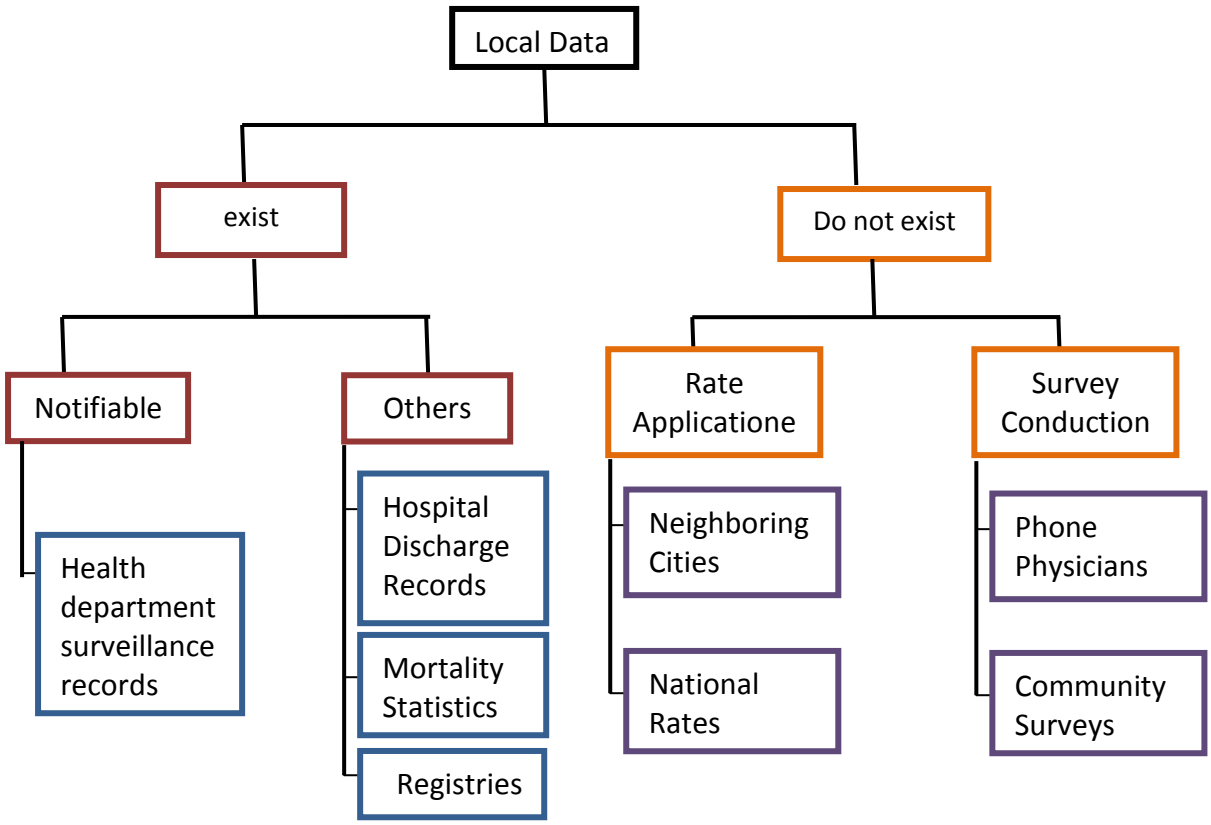
Before leaving for the field, you should:

- Research the disease and gather the supplies and equipment you will need
- Make necessary administrative and personal arrangements for such things as travel, and
- Consult with all parties to determine your role in the investigation and who your local contacts will be once you arrive on the scene.

Step 2: Establish the existence of an outbreak :

Is This an epidemic or cluster of cases? (observed Number exceed the expected number)

Sources for step 2 :



- For a notifiable disease: use health department surveillance records.
- For other diseases and conditions: find existing data locally—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, alternatively, conduct a telephone survey of physicians to determine whether they have seen more cases of the disease than usual.
- Finally, conduct a survey of the community to establish the background or historical level of disease.

Step 3: Verify the diagnosis

- closely linked to verifying the existence of an outbreak

Importance of Step 3:

- To ensure that the problem has been properly diagnosed
- To rule out laboratory errors as the basis for the increase in diagnosed cases

Steps of Verification:

① Review the clinical findings and laboratory results.
② Visit several patients with the disease.
③ summarize the clinical findings with frequency distributions

Why step 3 ?

- Diseases can be misdiagnosed.
- Case may not be actual case, but rather suspected case.
- Information from non-cases must be excluded from the case information used to confirm the presence or absence of an epidemic.

- ***Step 4 (a): Establishing a Case Definition***

  (b): Identifying and Counting Cases

Step 4 (a):

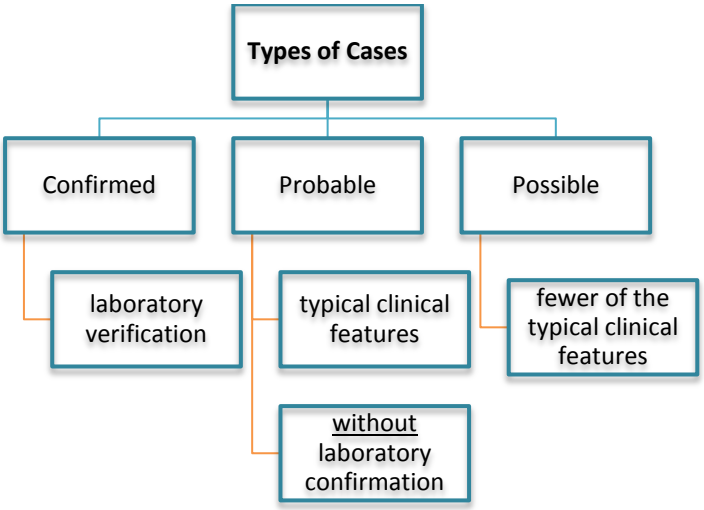
- ***What is a Case Definition?***

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*** :



Examples of each type :

- **Confirmed case:** *E. coli* O157:H7 isolated from a stool culture or development of hemolytic-uremic syndrome in a school-aged child resident of the county and who had gastrointestinal symptoms beginning between Nov. 3 and Nov. 8, 1990;
- **Probable case:** Bloody diarrhea (but no culture), with the same person, place, and time restrictions;
- **Possible case:** Abdominal cramps and diarrhea (at least three stools in a 24-hour period) in a school-age child resident of the county with onset during the same period (CDC, unpublished data, 1991).

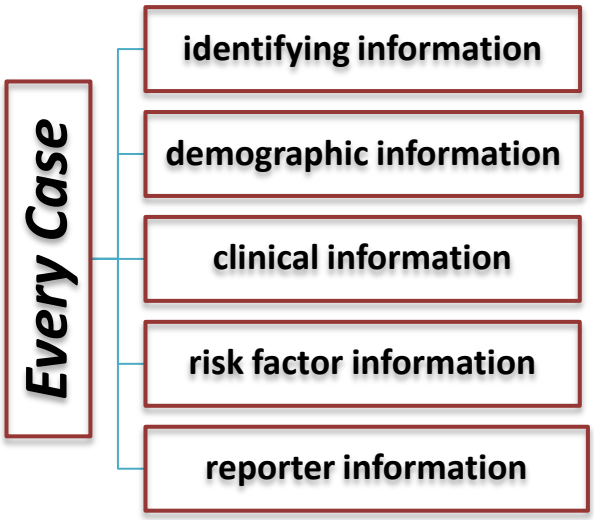
- ***Remember!***

Early in an investigation, investigators often use a sensitive or "loose" case definition which includes confirmed, probable, and even possible cases. Later on, when hypotheses have come into sharper focus, the investigator may "tighten" the case definition by dropping the possible category.

Step 4 (b):

- ***Sources for Identifying Cases***

- ***Information* Collected**

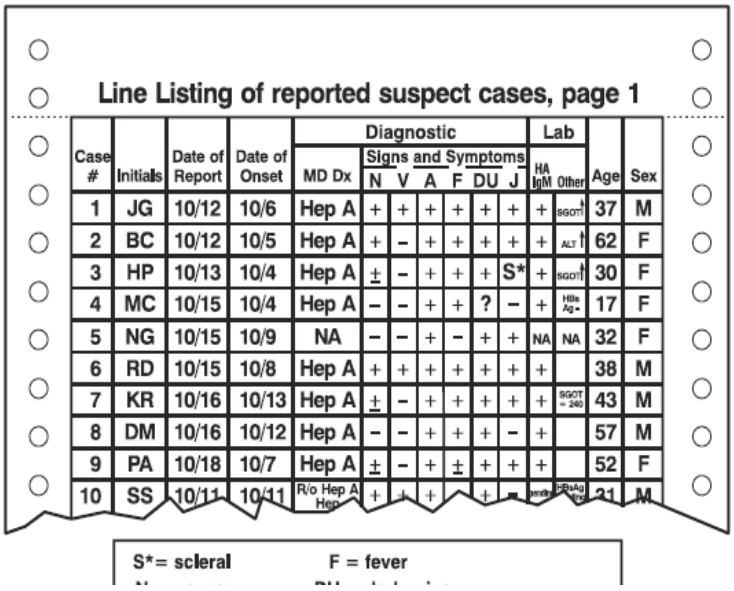


- **Identifying information:** This may include name, address, and telephone number and allows you and other investigators to contact patients for additional questions and to notify them of laboratory results and the outcome of the investigation. Addresses also allow you to map the geographic extent of the problem.
- **Demographic information:** This may include age, sex, race, and occupation and provides the details that you need to characterize the population at risk.
- **Clinical information:** This information allows you to verify that the case definition has been met. Date of onset allows you to create a graph of the outbreak. Supplementary clinical information may include whether the person was hospitalized or died and will help you describe the spectrum of illness.
- **Risk factor information:** Information about risk factors will allow you to tailor your investigation to the specific disease in question. For example, in an investigation of hepatitis A, you would look at exposure to food and water sources.

- **Line Listing (Counting Cases)**

What is "Line listing"?

— It is a table that helps identify number of diagnosed cases and information relevant to disease outbreak. The columns represent specific patient information and the rows represent each case.



Line Listing of reported suspect cases, page 1

Case #	Initials	Date of Report	Date of Onset	Diagnostic								Lab		Age	Sex
				MD Dx	Signs and Symptoms							HA IgM	Other		
					N	V	A	F	DU	J					
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	+	+	+	–	+	–	[illegible]		HBsAg Pos	21	M

S*= scleral F = fever

Step 5: Performing Descriptive Epidemiology

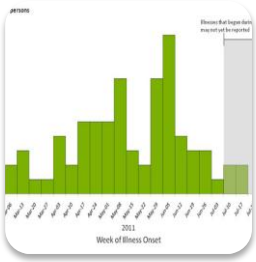
where you describe and orient data to characterize an outbreak by time, place, and person.

Why we need to perform step 5?

Become familiar with the data

- By inspecting and looking carefully at them

you learn what information is reliable and informative (e.g., the same unusual exposure reported by many of the people affected) and what may not be as reliable (e.g., many missing or "don't know" responses to a particular question).



Trend of the disease

provide a comprehensive description of an outbreak by:

- portraying its trend over time
- its geographic extent (place)
- the populations (persons) affected by the disease

Hypotheses Development

- Assess description of the outbreak in light of what is known about the disease (usual source, mode of transmission, risk factors and populations affected, etc.)

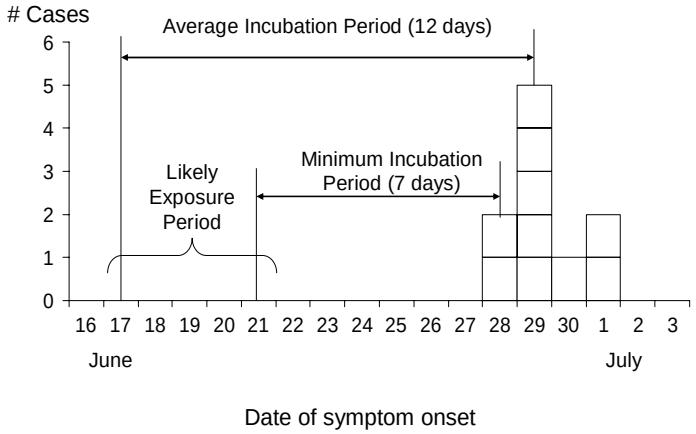
To identify the likely period of exposure from an epidemic curve

epidemic curve is a graph of the number of cases by their date of onset, which gives a simple visual display of the outbreak's magnitude and time trend.

- **To identify the likely period of exposure from an 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. Note the date
3. Start at *the earliest case* of the epidemic and count back the minimum incubation period, and note this date as well.

***Example of an outbreak of an acute respiratory disease*:**



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?

provide clues to the identity and origins of the problem.

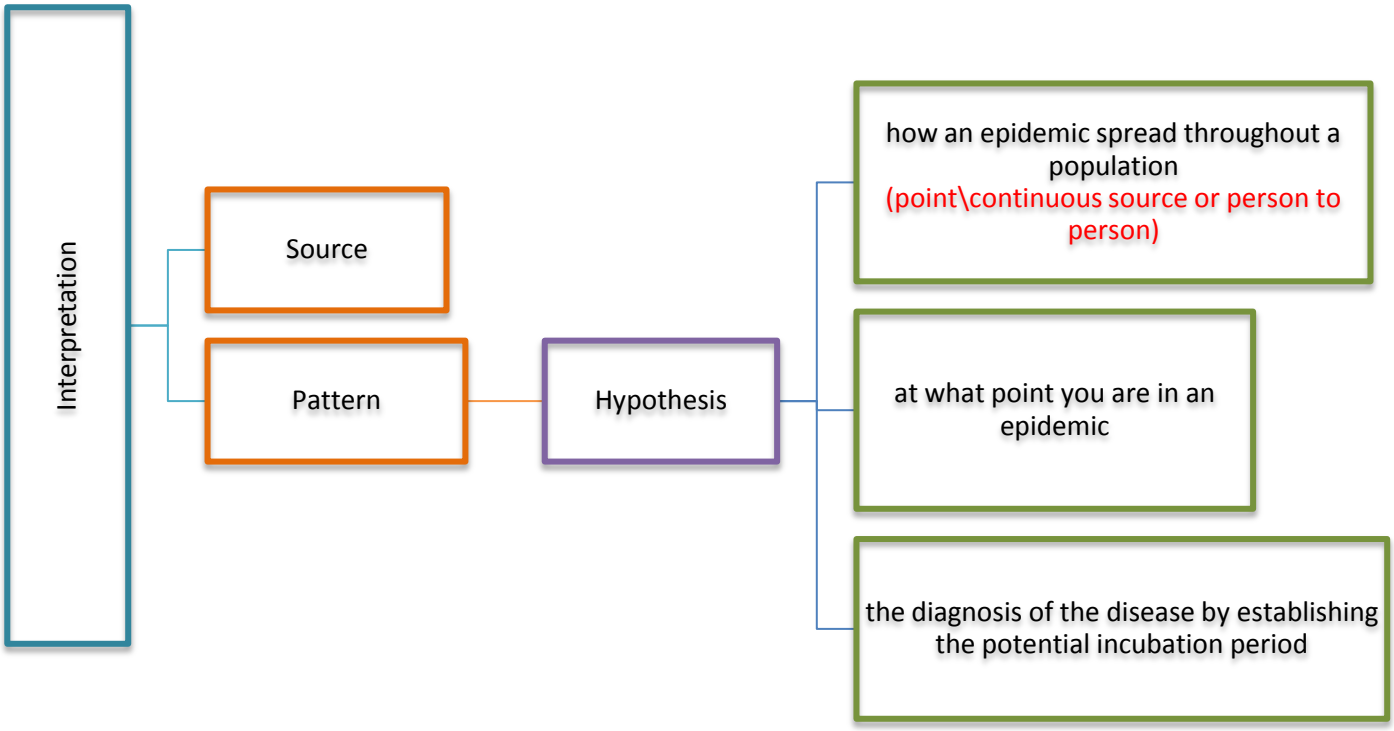
Person

determine what populations are at risk for the disease

- 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?

These factors are important because they may be related to susceptibility to the disease and to opportunities for exposure.

Interpreting an Epidemic Curve:



- **Remember!**

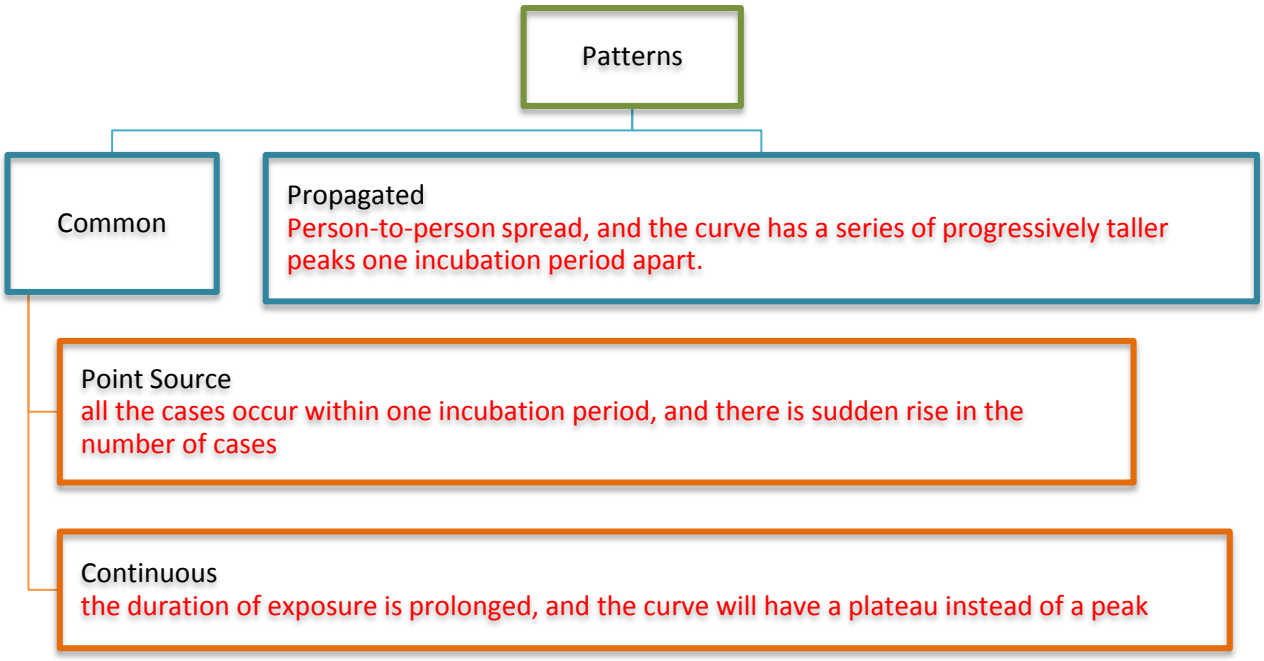
When analyzing an epidemic curve, it is important to consider the following factors to assist in interpreting an outbreak:

➔ The overall pattern of the epidemic

➔ The time period when the persons were exposed

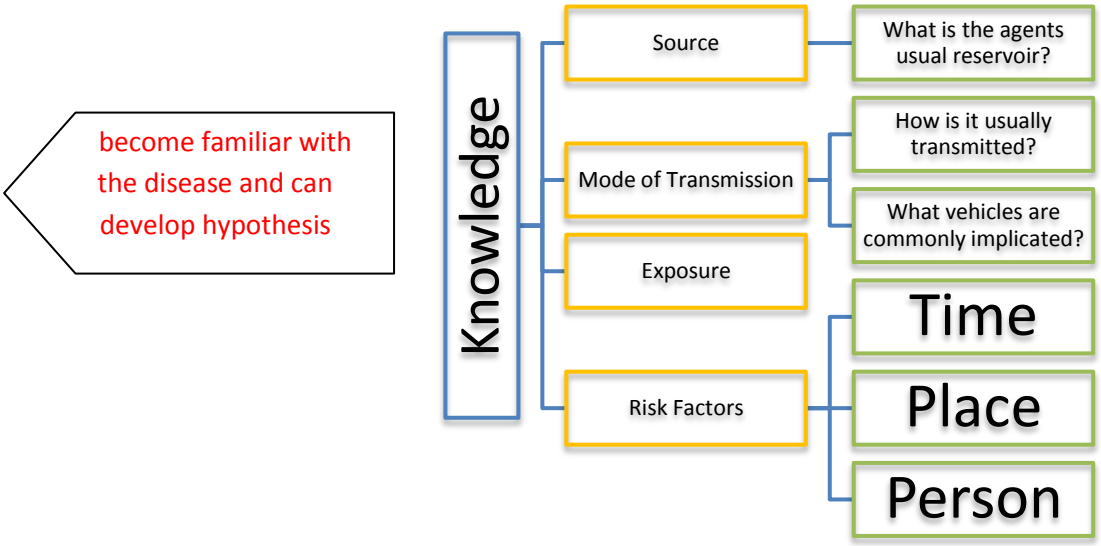
➔ If there are any outliers (Cases that stand apart)

Epidemic Patterns :



- ***Step 6: Developing Hypotheses***

At this stage hypotheses will be sharpened and more accurately focused and should address the source of the agent, the mode (vehicle or vector) of transmission, and the exposures that caused the disease. Also, the hypotheses should be proposed in a way that can be tested.

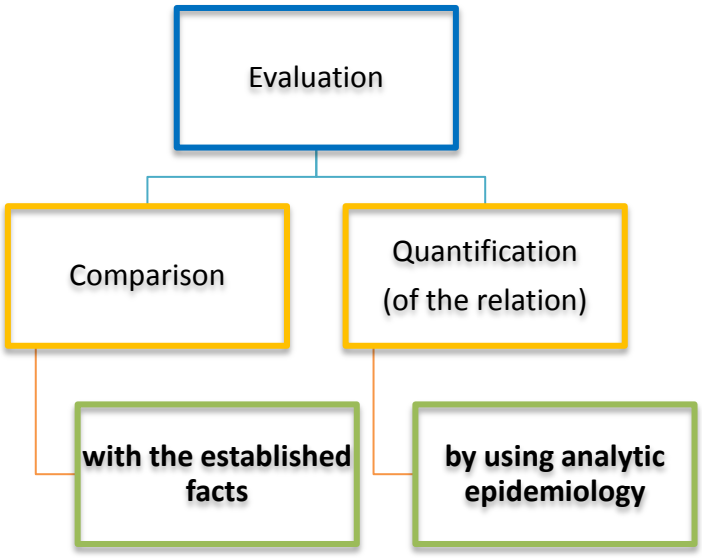


Hypotheses Development:

- ***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.***

- ***Step 7: Evaluating Hypotheses***

There are two approaches you can use, depending on the nature of your data: 1) **comparison of the hypotheses with the established facts** and 2) **Quantification (analytic epidemiology**), which allows you to test your hypotheses.



Which One to Use?

- **Comparison**

when the clinical, laboratory, environmental, and/or epidemiologic evidence so obviously supports the hypotheses, so formal hypothesis testing is unnecessarily : (when your evidence is so strong so no further analysis is needed)

- **Quantification** (analytic epidemiology)

When the circumstances are not as straight forward. In those instances, you should use analytic epidemiology to test your hypotheses. The key feature of analytic epidemiology is a *comparison* group (to quantify relationships between various exposures and the disease.)

\ Cohort studies compare groups of people who have been exposed to suspected risk factors with groups who have not been exposed. Case-control studies compare people with a disease (case-patients) with a group of people without the disease (controls).

Types of Analytic Epidemiology:
The nature of the outbreak determines which of these studies you will use.

- **Retrospective Cohort Study** (compare groups of people who have been exposed to suspected risk factors with groups who have not been exposed).

1. Study of choice for an outbreak in a small, well-defined population (e.g. Wedding)
2. Exposure / Outcome of each member of the cohort: (you would ask each attendee the same set of questions about potential exposures and whether he or she had become ill).
3. Calculate Attack Rates and Relative Risk (Risk Ratio): calculate an attack rate for people who were exposed and an attack rate for those who were not exposed.

And by the division of the two values of (attack rates) you get the Relative

- **Case – Control Study** (compare people with a disease (case-patients) with a group of people without the disease (controls))

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: (to quantify the relationship between exposure and disease. This method does not prove that a particular exposure caused a disease, but it is very helpful and effective in evaluating possible vehicles of disease).

the controls should be from the same population as the case-patients, but do not have the disease.

Retrospective cohort:

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	

AR : Attack Rate
RR: Relative Risk \ Risk Ratio

Case control:

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

The odds ratio is calculated as ad/bc. The odds ratio for Restaurant A is thus 30 × 70 / 36 × 10, or 5.8. This means that people who ate at Restaurant A were 5.8 times more likely to develop hepatitis A than were people who did not eat there.

- ***Step 8: Refining Hypotheses & Executing Additional Studies***

✓ **Epidemiologic studies**

(When analytic epidemiological studies do not confirm your hypotheses, you need to reconsider your hypotheses and look for new vehicles or modes of transmission).

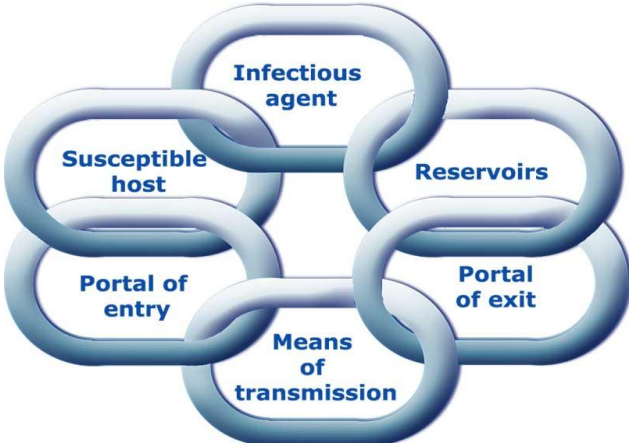
✓ **Laboratory and environmental studies**

(laboratory evidence can clinch the findings, and environmental studies often help explain why an outbreak occurred).

- ***Step 9: Implementing Control and Prevention Measures***

Chain of Infection

(Control measures can be implemented early if you know the source of an outbreak, and should be aimed at specific links in the chain of infection).



- ***Step 10: Communicating the Findings***

(communicate your findings to others who need to know)

✓ **Oral Report**

(brief to describe what you did, what you found, and what you think should be done about it).

✓ **Written Report**

(follows the usual scientific format of introduction, background, methods, results, discussion, and recommendations. By formally presenting recommendations. It provides a blueprint for action, a record of performance, a document for potential legal issues, and a reference if the health department encounters a similar situation in the future).

Good Luck ^_^