DISEASE DETECTIVES (05)
WORKSHOP TRAINING OUTLINE

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INTRODUCTION TO INVESTIGATING A OUTBREAK

Outbreak – (localized epidemic) – more cases of a particular disease than expected in a given area or among a specialized group of people over a particular period of time.

Epidemic – large numbers of people over a wide geographic area affected.

Cluster –an aggregation of cases over a particular period esp. cancer & birth defects closely grouped in time and space regardless of whether the number is more than the expected number. (often the expected number of cases is not known.)

Public Health Surveillance - the systematic collection, analysis, interpretation, and dissemination of health data on an ongoing basis, to gain knowledge of the pattern of disease occurrence and potential in a community, in order to control and prevent disease in the community.

STEPS OF AN OUTBREAK INVESTIGATION: Field investigation of disease or health condition

- Implement control as soon as the source & mode are known!!!!

This is a conceptual order – steps may be done at the same time

Step 1: Prepare for Field Work

1. Research, supplies & equipment – research the disease or situation and gather needed supplies & equipment to conduct the investigation
2. Administrative arrangements – make official administrative and personal travel arrangements
3. Local contacts - follow protocol and contact all parties to determine roles & local contacts

Step 2: Establish the Existence of an Outbreak – consider severity, potential for spread, public concern, and availability of resources

1. Expected # of cases for area – use records as health dept., hospital records, death records, physician records, doctor survey to determine expected # for the area in a given time
2. Other factors in play – numbers may exceed normal due to factors such as better reporting, seasonal fluctuations, population changes

Step 3: Verify the Diagnosis

1. Proper diagnosis- verify the procedures used to diagnose the problem and check methods used for identifying infectious and toxic chemical agents
2. Not lab error – be sure that the increase number of cases are not due to experimental error
3. Commonality – interview several persons who became ill to gain insight concerning possible cause, source, and spread of disease or problem

Step 4: Define and Identify Cases – case definition and line listing

1. Case definition – establish with the 4 components or standard criteria for determining who has the disease or condition
   a. Clinical information – about the disease or condition
   b. Characteristics- of the affected people
   c. Location or place- as specific as possible as restaurant, county, or several specific areas
   d. Time sequence- specific time during which the outbreak or condition occurred

2. Identification of specific cases – kind & number – count specific cases
   a. Confirmed – have diagnosis with case definition plus lab verification
   b. Probable – many factors point to diagnosis but may lack lab verification
   c. Possible – some factors point to diagnosis
   Note: Initial reports may be only a small sampling of the total problem. Be sure to expand search to determine the true size and extent of the problem.

3. Line Listing – chart of specific cases including information about each case

   a. Identifying information- ID or case # - left column + name or initials
   b. Clinical information – diagnosis, symptoms, lab results, hospital – death?
   c. Descriptive: time – date & time of onset + date of report
   d. Descriptive: person – age, sex, occupation, other characteristics
   e. Descriptive: place – street, city or county + specific site
   f. Risk factors & possible causes – specific to situation (disease) and outbreak setting

Sample Line Listing from six case report forms on a wedding reception outbreak

ID #	Initials	Date of Onset	Diagnosis	How Confirmed	Age	Sex	County	Physician	Cleveland-McKay Wedding
1	KR	7/23	probable trichinosis	Not done	29	M	Columbia	Goodman	Yes
2	DM	7/27	trichinosis	Biopsy	33	M	Columbia	Baker	Yes
3	JG	8/14	probable trichinosis	Not done	26	M	Columbia	Gibbs	Yes
4	RD	7/25	trichinosis	Serologia	45	M	King	Webster	Yes
5	NT	8/4	trichinosis	Not done	27	F	Columbia	Stanley	Yes
6	AM	8/11	R/Otrichinosis	Pending	54	F	Clayton	Mason	Yes

Step 5: Describe and Orient the Data in Terms of Time, Place and Person – Descriptive Epidemiology

1. Time, Place and Person – describes disease or health situation
   TIME - Epidemic Curve or Epi curve (Begin early & update often) – a histogram showing the course of the disease or outbreak to identify the source of the exposure (x axis=units of time equal to 1/4 to 1/3 incubation time and y axis = # of cases)

   Note: a single point or source will have only one peak, a plateau will show a continuous common source, several uniform peaks will indicate a propagated outbreak spread from person to person

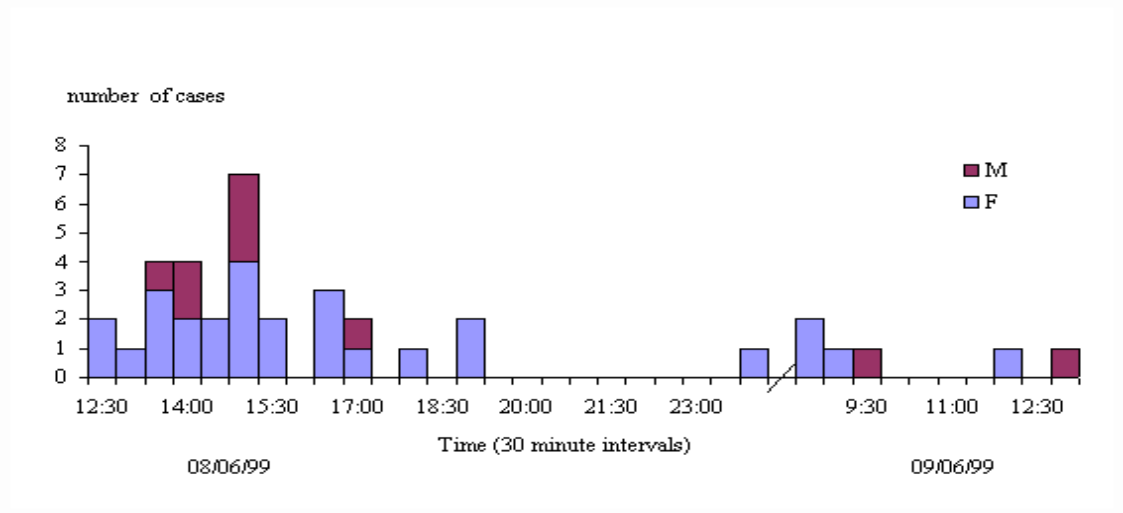
   PLACE – geographic extent plus spot map of cases to identify groups specific to a location or environmental factors

   PERSON – identify the affected population by type of person or by exposures as age, sex, high risk exposure as with AIDS

Sample EPI or Epidemic Curve :

Epidemic Curve

Figure 1 - Cases by time of onset, Coca-Cola related complaints, Bornem school, Belgium, 1999.



2. Types of Descriptive Studies – Study the distribution of a problem by cases or outcome, frequency in population, exposure, time pattern or environmental factor (Studies without a control group can be used for descriptive purposes!)

   a. Case report/case series – case report = detail report of a single patient from one or more doctors while case series = characteristics of several patients
   b. Correlative studies – correlates general characteristics of the population with health problem frequency with several groups during the same period of time
      Time series analysis – correlate within the same population at different point in time
      Ecologic relations – correlate relative to specific ecologic factors as diet
   c. Cross sectional - a survey of a population where participants are selected irrespective of exposure or disease status

Step 6: Develop Hypotheses (Agent/host/environment triad) = chain of transmission

1. Agent /host /environment = agent capable of causing disease & its source + host or persons susceptible to agent + environment allowing them to get together
2. Testable – hypothesis must be in a form that is testable
3. Current knowledge & background – it should be based upon current knowledge and be updated or modified as new information is uncovered!!!

Step 7: Evaluate Hypotheses – Analytical studies ** Must have a control group**

1. Compare with established fact – these are used when evidence is strong and clear cut
2. Observational Studies: (Study determinants of health problems – how & why)

a. **Cohort** – Based upon ***exposure status*** whether or not they have outcome (illness); used with a small well-defined population and moves forward from exposure.
Both groups have a known exposure and are checked for future outcomes or illness.
retrospective:(historic cohort) starts at exposure in past & moves forward to outcome
prospective: starts a present exposure and moves forward in time to outcome

Calculations = attack rate and relative risk

Sample using 2 X 2 table: 400 people attended a special awards dinner.
Some persons became ill. The suspected culprit was the potato salad.
The population at the dinner was then surveyed to determine who became ill.

	Disease Yes	**Disease No**
Exposed (Ate salad)	150 (a)	(b) 30
Unexposed (no salad)	50 (c)	(d) 170

Attack rate – the rate that a group experienced an outcome or illness
= number sick ÷ total in that group
(Look for high attack rate in exposed & low rate in unexposed)

exposed = a ÷ (a+b) = 150 ÷ 180 = 80%
unexposed = c ÷ (c + d) = 50 ÷ 220 = 20%

Relative risk = [a ÷ (a+b)] / [c ÷ (c+d)] = 80% ÷ 20% = 4

Relative risk estimates the extent of the association between an exposure and a disease. It estimates the likelihood of developing the disease in the exposed group as compared to the unexposed group.

A relative risk = 1.0 indicates that the incidence rates of disease in the exposed group is equal to the incidence rates in unexposed group. Therefore the data does not provide evidence for an association.

A relative risk >1.0 indicates a positive association or an increased risk. This risk increases in strength as the magnitude of the relative risk increases.

The data indicates a negative association or decreased risk (possible protective effect) if the relative risk is between 0 and 1.0. Relative risk is not expressed in negative numbers.

b. **Case-Control** - Works ***backward from effect or illness*** to suspected cause. Control group is a selected group who has similar characteristics to the sick group but is not ill. They are then checked for similar exposures. It is often hard to select the control group for this type of study.

Odds Ratio is calculated to evaluate the possible agents & vehicles of transmission.

Odds Ratio = Odds of exposure in cases = a/c = ad
Odds of exposure in controls b/d bc

a = # of case patients exposed
b = # of control exposed
c = # of case patients unexposed
d = # of control unexposed

Sample: Several patients were diagnosed with Hepatitis A. The local Restaurant A was thought to be the source of the infection. 40 case patients and a similar disease free group or control were contacted to determine if they **ate** at Restaurant A.

2 X 2 table of data:

	Case patients	Controls	Total
Yes	a = 30	b = 36	66
No	c = 10	d = 70	86
Total	40	106	146

The odds ratio for Restaurant A is thus 30 × 70 / 36 × 10 = 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: Refine Hypotheses and Carry Out Additional Studies

1. No confirmation of hypothesis - where analytical studies do not confirm hypothesis May need to look for a new vehicle or mode of transmission
2. More specific – May need to be more specific in make up of case patients & controls
3. Verify with environmental/laboratory studies - verification with very control conditions is very important.

Step 9: Implement Control and Prevention Measures – as soon as possible!!

1. As soon as source is known – people are sick or hurting and need help; must know agent & source of agent + susceptibility of host+ chain of transmission
2. Aim at chain of agent-source-host – break the chain of transmission at any of its three points
3. May interrupt transmission or exposure – with vehicles as isolation
4. May reduce susceptibility – with immunization, legal issues and/or education

Step 10: Communicate Findings (see * on page 6 for conclusion criteria)**

1. Oral briefing – inform local health officials or other need-to-know groups as soon as information is available
2. Written report – usually done in scientific format for future reference, legal issues, and education

*****Criteria to Draw Conclusions about Cause and Effect Relations:**

1. Temporality – cause/exposure must precede effect/outcome

2. Consistency – observation of association must be repeatable in different populations at different times
3. Coherence, 1-1 relationship – exposure is always associated with outcome/ outcome is always caused by the specific exposure
4. Strength of association – relationship is clear and risk estimate is high
5. Biological plausibility – biological explanation makes sense
6. Dose/response (biologic gradient) – increasing risk is associated with increasing exposure

Internet Resources from CDC

Disease Detectives Event
http://www.cdc.gov/excite/disease_detectives/index.htm
Steps of an Outbreak from CDC
http://www.cdc.gov/excite/classroom/outbreak_steps.htm#steps
Outbreak Exercises from CDC
http://www.cdc.gov/excite/classroom/outbreak_exercises.htm
Glossary of Terms for Epidemiology ,Teacher Resources, & Teaching Notes (file can be downloaded by clicking on download materials)
http://www.cdc.gov/excite
Resource Library – Excite
http://www.cdc.gov/excite/library/index.htm

Other Similar On-line Dictionaries and Glossaries:

Clinical Epidemiology Definitions (University of Alberta Evidence Based Medicine Tool Kit)
http://www.med.ualberta.ca/ebm/define.htm

A Dictionary of Epidemiology (short definitions, University of Cambridge)
http://epidem13.plantsci.cam.ac.uk/~js/glossary/gloss98.html

Glossary (CDC Excite - *Excellence in Curriculum Integration through Teaching Epidemiology* Program)
http://www.cdc.gov/excite/library/glossary.htm

Other Resources:

Most state health departments and medical schools have epidemiology information on their web sites. Some have sample problems. A good textbook on epidemiology is also very helpful.