

How To Investigate A Communicable Disease Outbreak

By

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Transmission

- Fecal-oral
- Water or Food (Ingestion)
- Airborne
- Vector Borne
- Perinatal
- Contact

Patterns of Spread

- Point source
- Common Source
- Propagated

Epidemic Curves

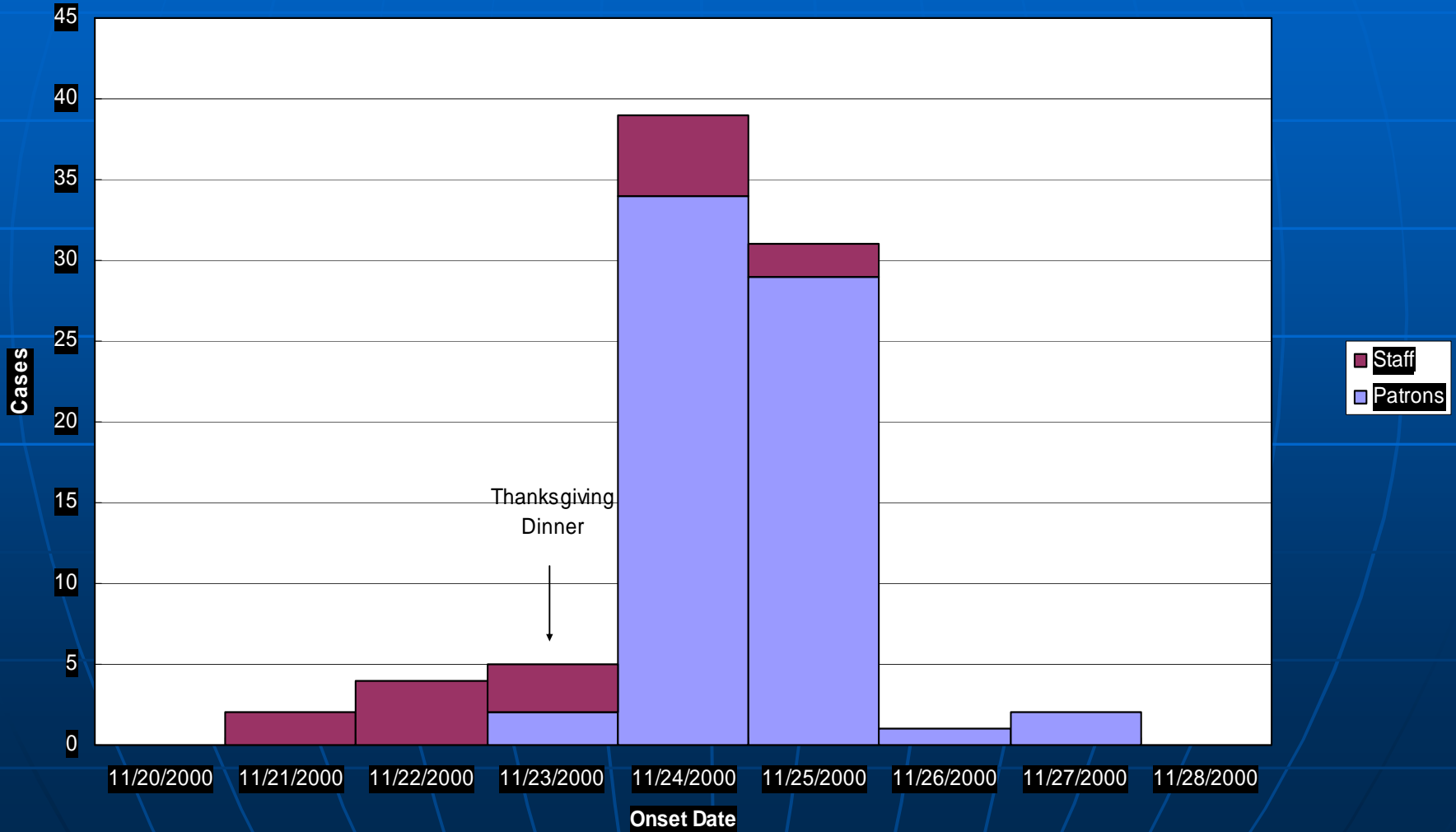
- Plot number of cases by onset date
- Index case: first case of outbreak, can be source of outbreak
- Estimate median incubation time from time of exposure to peak of curve
- Indicate whether outbreak has ended

Point Source Outbreaks

- All exposed at one time
- Cases occur suddenly after minimum incubation time
- Continue to occur throughout incubation period range
- Outbreak stops unless secondary spread
- Curves have steep upslope, more gradual downslope

Point Source Curve

Onset Dates of Illness
Shelby County, 2000

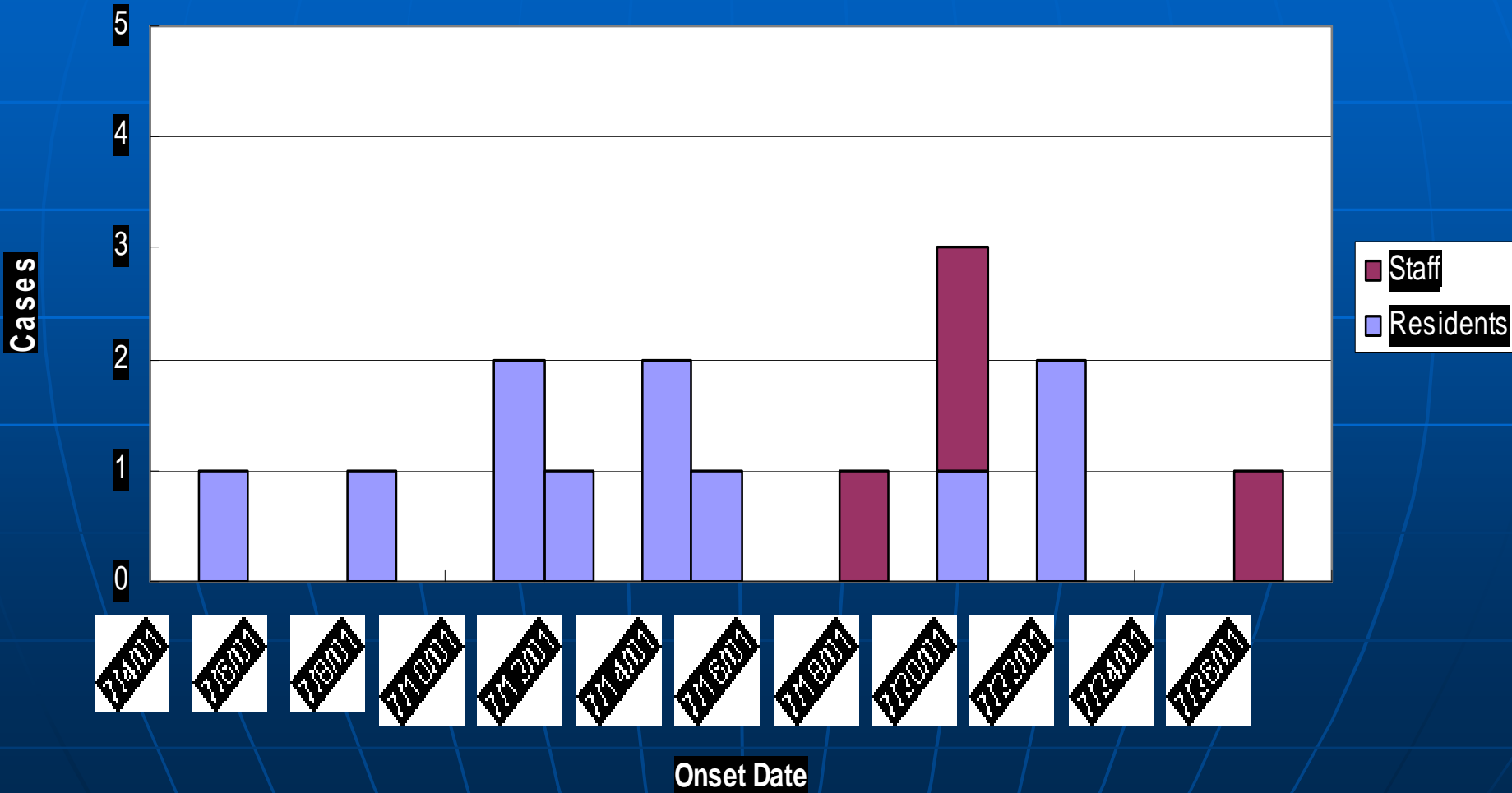


Common Source Outbreak

- May begin suddenly or gradually
- Cases do not disappear because of secondary exposure
- Cases trail off very gradually until population immune or control measures effective
- Common source curves have gradual or steep upslope, trickling downslope

Common Source Curve

ONSET DATES OF ILLNESS
JULY 2001

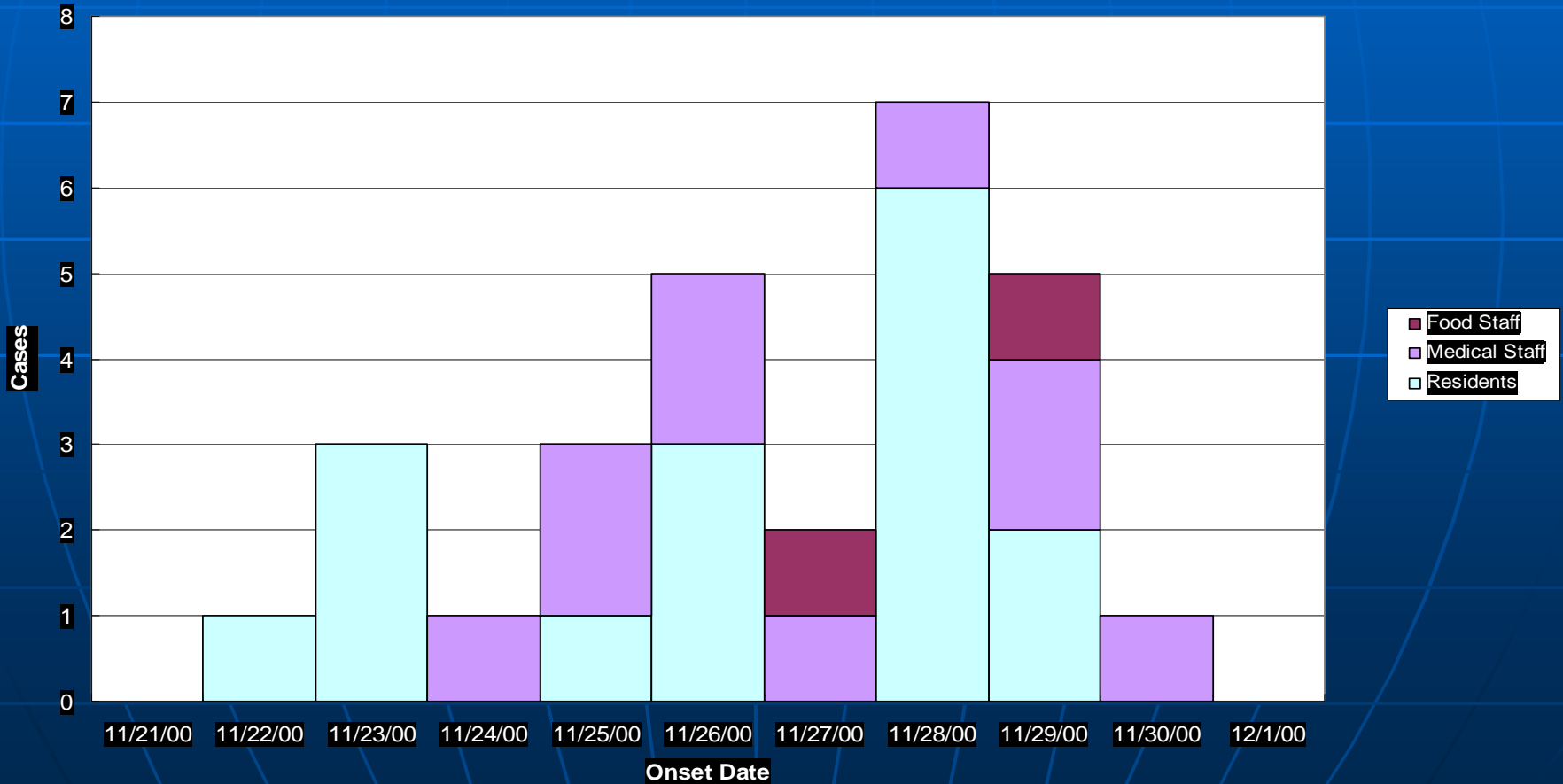


Propagated Outbreak

- Typical of community wide outbreaks
- Increase in cases after first exposure then cases decline until all first exposed immune
- Secondary cases appear one incubation period after peak of first wave from secondary spread
- Propagated curves have successive "waves" of cases separated by incubation period

Propagated Outbreak Curve

**Onset Dates of Illness
Indianapolis, 2000**



Incubation Period

- The amount of time between the initial contact with the agent and the onset of symptoms

Generation Period

- The amount of time between “humps” in a propagated spread infectious disease outbreak – an estimate of the incubation period

Herd Immunity

- The inability of the population group to sustain an infectious disease outbreak because most of the people have either had the disease or have immunity to it.

Attack Rate

- The proportion of individuals with a specific characteristic or exposure who became ill.

$$\frac{\text{Number ill}}{\text{Number ill} + \text{Number well}}$$

Secondary Attack Rate

- An index of the spread of disease in a family, household, dwelling unit, dormitory or similar circumscribed group.
- A measure of contagiousness.
- Useful in evaluating control measures.

Steps Of An Outbreak Investigation

- Prepare for field work
- Establish the existence of an outbreak
- Verify the diagnosis
- Define and identify cases
 - Establish a case definition
 - Identify and count cases
- Perform descriptive epidemiology

Outbreak Investigation Continued

- Develop hypotheses
- Evaluate hypotheses
- As necessary, reconsider/refine hypotheses and execute additional studies
- Implement control and prevention measures
- Communicate findings

Investigating Disease Outbreaks are Challenging and Stimulating

- The cause and source of the outbreak are typically unknown
- Potentially large numbers of people can be involved
- People in the community fear that other people, including themselves and their families, may be stricken with the illness unless the cause of the illness is found soon

Why Investigate a Disease Outbreak?

- Health departments investigate suspected outbreaks for many reasons including to:
 - Establish control and prevention measures
 - Learn new information about the causes and sources of disease
 - Address public, political, and legal concerns
 - Evaluate the effectiveness of prevention/control programs

Step 1: Preparing for Field Work

- A field investigator must have the knowledge, supplies, and equipment necessary to carry out the investigation
- Know what your role will be and who your primary contacts are

Identify Team

- Epidemiologist
- Laboratorians
- Environmental health specialists
- Public information officers
- Local health department
- Other state agencies
- Federal agencies

Step 1: Preparing for Field Work

- If you are a novice at this type of work, you should contact someone knowledgeable about the disease and about field investigations
- Review the applicable literature and web sites to assemble useful resources such as journal articles and sample questionnaires

Step 1: Preparing for Field Work

- Consult with laboratory staff to make sure you have the knowledge and equipment necessary to properly collect, store, and transport samples
- Arrange for a computer, camera, tape recorder, and other supplies needed during the investigation

Collect Preliminary Information

- Basic clinical data
 - signs and symptoms
 - onset dates
 - common exposures
- Foodborne outbreaks
 - obtain menu
 - secure leftovers
 - three-day food history

Step 2: Establishing the Existence of an Outbreak

- 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

Step 2: Establishing the Existence of an Outbreak

- Most outbreaks come to the attention of health departments through the routine analysis of surveillance data or through calls from local health care providers who know of “cases” of illness

Requirements To Become A Case

- Occurrence of Clinical illness
- Sufficient severity to seek medical care
- Availability of medical care
- Capability of physician to diagnose illness
- Laboratory to support diagnosis
- Reporting of disease to health department
- Collection and analysis of data by health department

Alleged Outbreaks Will Turn Out To Be

- True outbreaks with a common cause
- Sporadic and unrelated cases of the same disease
- Unrelated cases of similar but unrelated diseases

Step 2: Establishing an Outbreak

- You must determine the expected number of cases before deciding whether the observed number of cases exceeds the expected number, i.e. whether the cluster is an outbreak
- Even if the current number of reported cases exceeds the expected number, the excess may not necessarily indicate an outbreak

Possible Reasons for Increased Numbers of Cases of Illness

- Reporting may rise because of changes in local reporting procedures, changes in the case definition, increased interest because of local/national awareness, or improvements in diagnostic procedures
- A new physician, infection control nurse, or health care facility may report more cases

Possible Reasons for Increased Numbers of Cases of Illness

- Some communities may experience sudden changes in population size
- For these towns a change in the numerator may simply reflect a change in the denominator

Factors to Consider When Deciding To Investigate An Apparent Problem

- Number of cases involved
- Severity of the Illness
- Potential for spread throughout the community
- Political considerations and public relations
- Resources available

Step 3: Verifying the Diagnosis

- The goals in verifying the diagnosis are to:
 - Ensure that the problem has been properly diagnosed
 - Rule out laboratory error as the basis for the increase in diagnosed cases

Step 3: Verifying the Diagnosis

- Review the clinical findings and laboratory results
- Summarize clinical findings with frequency distributions

Step 4: Establishing A Case Definition

- A case definition is a standard set of criteria for deciding whether an individual should be classified as having the health condition of interest

Formulate Case Definition

- Initial case definition includes
 - time, place and person descriptions
 - hallmark clinical signs
 - mode of transmission (if known)
- Can change as investigation progresses
- Keep focus relatively open

Step 4: Establishing A Case Definition

- A “confirmed” case usually must have laboratory verification
- A “probable” case usually has clinical features of the disease without laboratory confirmation
- A “possible” cases usually has fewer than typical clinical features

Step 4: Identifying and Counting Cases

- The “reported” cases that prompted the concern about a potential outbreak are only a small and non-representative fraction of the total number of cases
- You must “cast a wide net” to determine the geographic extent of the problem and the population affected by it.

Step 4: Identifying and Counting Cases

- Sources of information to identify cases include:
 - health care facilities such as hospitals, doctor's offices, clinics, and laboratories
 - Input from the public
 - Results from a questionnaire developed by the health department
 - Asking patients if they know anyone else with the same condition

Sources of Data

- Mortality reports
- Morbidity reports
- Epidemic reports
- Reports of laboratory utilization
- Reports of individual case investigations
- Special surveys (hospital admissions or disease registries)
- Environmental data
- Information on animal reservoirs and vectors
- Demographic data

Identify Population At Risk

- Survey hospitals, ERs, physicians
- Review existing surveillance data
- Question known cases to identify others
- Guest lists
- Enrollment records
- Cases: meet case definition
- Controls: at risk but not ill

Types of Information To Be Collected

- Identifying information
 - Name, address, and telephone number
- Demographic information
 - Age, race, sex, and occupation
 - Provides the person characteristics of descriptive epidemiology

Types of Information To Be Collected

- Clinical information
 - Allows you to verify that the case definition has been met
 - Date of onset allows you to chart the time course of the outbreak
- Risk factor information
 - You must tailor the risk factor information to the specific disease in question

Types of Information To Be Collected

- Reporter information
 - By identifying the person who provided the case report, you will be able to seek additional clinical information or report back the results of your investigation

Step 5: Describe Cases

- Data collected during an investigation will enable you to describe cases by:
 - Person patterns
 - Place patterns
 - Time patterns

Cohort Studies

- Known number of persons exposed
- Can contact all in timely manner
- Demographics, attack rates, rate ratios

Cohort Design

- A group of people free from a disease is assembled according to a variety of exposures.
- The group (cohort) is followed over a period of time for development of disease.

Case-Control Design

- A type of design that compares persons who have a disease (cases) with those who are free from the disease (controls).
- This design explores whether differences between cases and controls result from exposures to risk factors.

Case-Control Studies

- Large events or exposed population unknown
- Quick to assemble
- Controls
 - selected from exposed or baseline cohort
 - matched or unmatched
- Odds ratios

Questionnaires

- Used to collect complete, uniform histories
- Includes initial case definition, clinical information, exposure history and related venues
- Specificity depends on information known
- Varies from outbreak to outbreak

Questionnaires

- Administer as soon as possible
- Disseminate or interview personally
- Interview **both** cases and controls
- Recall bias
- May include more specific questionnaires later for different groups

Step 6: Develop Hypotheses

- Using community information
 - Water supply
 - Group functions
 - Reports by health care providers

Step 7: Test Hypotheses

- Descriptive Statistics
- Calculating Rates
 - Attack rates
 - Odds Ratios/Rate Ratios
 - Rate Differences

Descriptive Statistics

- Calculations used to statistically describe illness rate and time, link exposure to illness

Rate Ratios

- Used with cohort studies
- Compare rate of illness in the exposed to the rate of illness in the non-exposed
 - rate ratio of 1.0 means identical risk
 - rate ratio > 1.0 means increased risk
 - rate ratio < 1.0 means decreased risk ("protective")

Rate Ratios

- 2 x 2 table

	ill	well
exposed	A	B
not exposed	C	D

- Rate ratio = $\frac{a / (a + b)}{c / (c + d)} =$

attack rate of exposed
attack rate of non-exposed

Rate Differences

- Rate of illness in the exposed minus the rate of illness in the unexposed

$$I_{re} - I_{rue} = \text{Rate Difference (RD)}$$

I_{re} = Incidence rate exposed

I_{rue} = Incident rate in Unexposed

RD also called "Attributable Risk"

Odds Ratios

- Used with case-control studies
- Compare chances or “odds” of becoming ill after exposure
 - odds ratio of 1.0 means odds equal to chance
 - odds ratio > 1.0 means greater likelihood
 - odds ratio < 1.0 means lesser likelihood “protective”

Odds Ratios

- 2 x 2 table

	ill	well
exposed	A	B
not exposed	C	D

- Odds ratio = $\frac{A * D}{B * C}$

cross multiply 2 x 2 table

Step 8: Implement an Intervention Plan and Evaluate It

- Change the process
- Educate
- Monitor Illness/Contamination

Possible Options

- Post-exposure prophylaxis/treatment
- Recalling/destroying food
- Providing educational information
- Closing an establishment
- Exclusion from work, daycare or school
- Making public announcements

Exclusion (Diarrheal Illness)

Symptomatic persons shall be excluded from employment involving food handling or direct care of children or hospitalized or institutionalized patients

Symptomatic persons shall be excluded from day cares and schools

Return to Work

- LHD verifies asymptomatic and counsels employee/student about transmission
- LHD contact employer to emphasize hygiene compliance
- Negative stool cultures obtained (if required) after completion of any therapy
- May restrict work until results obtained

Step 9: Communication of Findings - Media Calls

- Confirm investigation underway
- Provide only **confirmed or statistically proven** information
- Be careful mentioning businesses-- get input
- Never speculate
- Never provide any identifying information
- Remain calm and do not be rushed

Step 9: Communication of Findings - Report Writing

- State the purpose of the investigation
- Describe the outbreak and data collected
- Identify disease agent and source
- Describe intervention and monitoring plans

Investigation Report

- Outlines investigation, inspections, laboratory results
- Purpose
 - prevent similar outbreaks
 - identify trends/causal factors
 - justify resources used
 - serves as public record

Report Format

- Agency developing/analyzing questionnaires writes report
- Cover page in memo format
 - addressed to county health officer
 - includes problem, date, place, initial contact, others contacted
 - copies forwarded to all parties

Report Format

- Background
 - who made initial contact and when
 - short description of event
- Epidemiologic investigation
 - case definition
 - questionnaire responses
 - clinical information and specimens collected
 - food items associated with illness

Report Format

- Environmental assessment
 - Inspections
 - Begins when suspected mode of transmission identified
 - Identifies vehicle of transmission
- Samples: food, water, air
- Foodborne
 - HACCP analysis
 - food preparation and serving
 - food handler illness
- Laboratory results
 - clinical
 - environmental

Report Format

- Conclusions:
 - confirmation of outbreak
 - number ill and key symptoms
 - why transmission occurred
 - food vehicle
 - agent
 - clinical data and laboratory results

Report Format

- Conclusions:
 - route of food contamination
 - transmission of agent
 - prevention methods
 - recommendations/guidelines

SOLVED!

