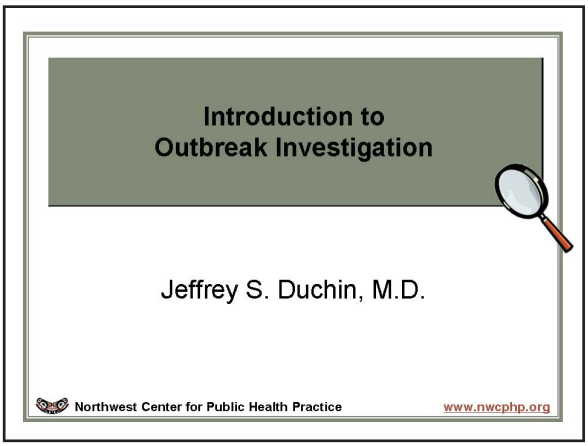
Introduction to Outbreak Investigation

Transcript

Introduction to Outbreak Investigation

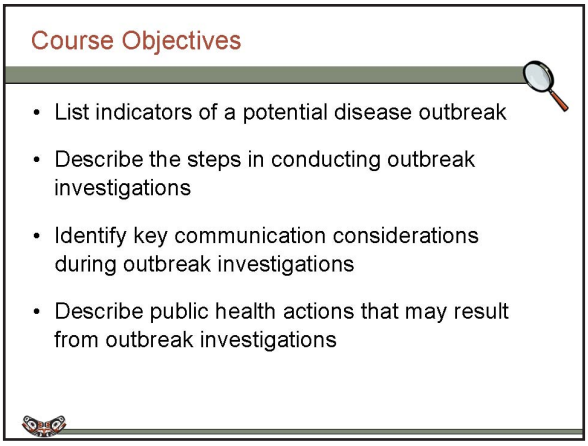
Welcome to Introduction to Outbreak Investigation. I'm Jeff Duchin from the Communicable Disease Control Epidemiology and Immunization Section at Public Health - Seattle & King County.



Course Objectives

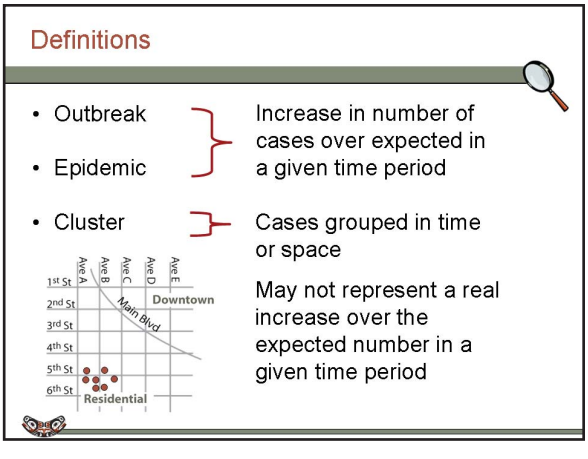
The objectives of our course will be:

- to list indicators of a potential disease outbreak,
- to describe the steps in conducting outbreak investigations,
- to identify key communication considerations during outbreak investigations, and
- to describe public health actions that may result from outbreak investigations.



Definitions

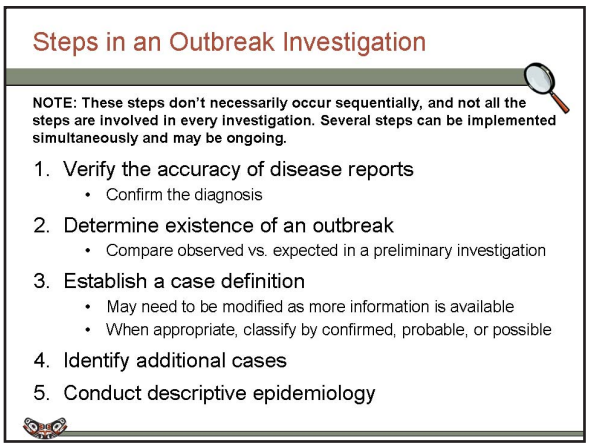
Let's start with a few basic definitions. Outbreak, epidemic, and cluster are terms that are sometimes used interchangeably. However, outbreak and epidemic represent a true increase in the number of cases over what should be expected in a given time period. Clusters are cases that are grouped in time or space but may not represent a real increase over what is expected in a time frame.



Introduction to Outbreak Investigation

Transcript

Steps in an Outbreak Investigation



There are a number of steps involved in an outbreak investigation. These steps don't necessarily occur sequentially, and not all the steps are involved in every investigation.

In addition, several steps are typically implemented simultaneously, and may be ongoing throughout the course of the investigation.

The first step involves verifying the accuracy of disease reports or the data you've received. Frequently, this translates into confirming the diagnosis.

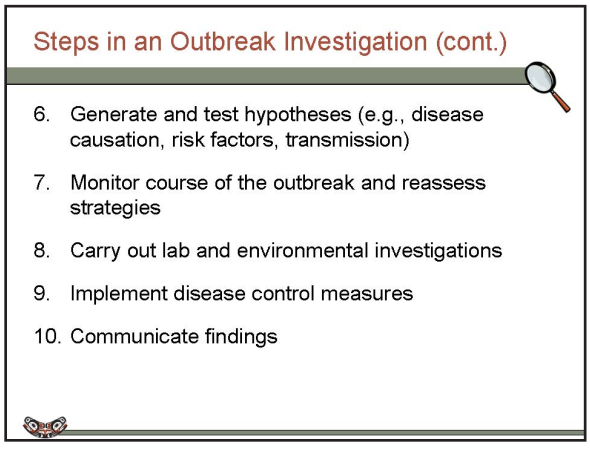
The second step is to determine the existence of an outbreak. In other words, when do the reports you've received represent a real increase in the number of cases occurring in the community? This is done by comparing the number of current cases to the number that would be expected in the same time frame.

The third step is to establish an outbreak case definition. Case definitions may need to be modified as more information becomes available, and when existing definitions are available, they're used to classify cases according to standardized criteria as confirmed, probable, or possible.

Step four involves identifying any additional cases that would meet the case definition criteria established in the previous step. At times, you may wish to consider enhanced surveillance to help identify cases in the community, and we'll talk more about that later.

Step five is gathering data and conducting descriptive epidemiology to summarize the available information and to help communicate that information to others. It's worth re-emphasizing that comparing observed to expected numbers of cases and case incidence rates is a crucial component of all investigations.

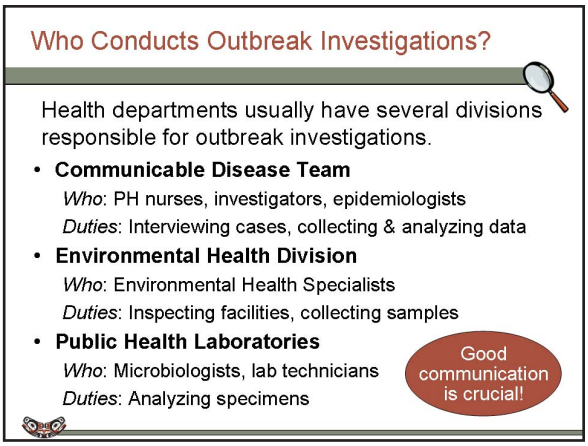
Steps in an Outbreak Investigation (cont.)



Generating and testing hypotheses related to disease causation, risk factors, and transmission are particularly important with new or poorly characterized etiological agents. Monitoring the course of the outbreak allows public health professionals to reassess their intervention strategies over time to ensure that they remain appropriate. Environmental investigations are crucially important in foodborne investigations and others where environmental exposures may occur. The implementation of disease control measures occurs throughout the outbreak investigation and should be continually reassessed. And finally,

it's hard to overestimate the importance of accurate, thorough, and concise communication during all phases of outbreak investigations.

Who Conducts Outbreak Investigations?



Within a pubic health department, different programs may be involved in an outbreak investigation, either working alone or as a collaborative team effort. Early on in the investigation, before the scope and nature of the outbreak are well characterized, the team may be comprised of only one or two individuals, for instance a public health nurse or a disease investigator and an epidemiologist. As the extent of the outbreak is better characterized, additional staff will need to be involved.

The number of staff, the type of staff, and the division titles and programs from which they come may vary, especially between small and large health departments. But there are typically several groups within a department who will take part in the different aspects of the investigation. The communicable disease team will likely involve public health nurses, disease investigators, and epidemiologists. This group takes the lead in interviewing cases and their contacts, collecting patient data from health care providers and hospitals, and analyzing and interpreting epidemiological data.

Environmental health specialists from the environmental health division perform a very important role in inspecting physical facilities such as restaurants that may be implicated in the investigation, interviewing staff at those facilities, obtaining information about commercial products and how foods are prepared and handled at a restaurant or other food facility, and in obtaining samples for testing.

Personnel from the public health laboratory, usually including microbiologists and laboratory technicians, play a critical role in the analysis of both environmental and microbiological specimens collected from food, water, and people. In an outbreak that is likely due to an intentional act, for example biological terrorism, it may be necessary to work collaboratively with law enforcement agencies conducting a criminal investigation.

Anytime more than one group is involved in working on an outbreak investigation, the complexity of the investigation increases. Good communication is crucial. Whenever possible pre-existing understandings, protocols, and procedures related to how investigations will be conducted collaboratively and communication will occur will be very useful.

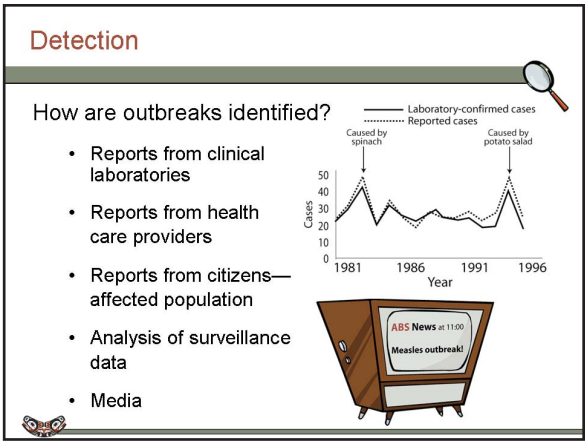
Introduction to Outbreak Investigation

Transcript

Detection

Outbreaks can be recognized through reports from clinical laboratories, or from health care providers, sometimes referred to as astute clinicians, from citizens (or the populations who are actually affected), and sometimes through analysis of routinely submitted notifiable disease surveillance data. It's also not unusual to be notified about health events in the community through media sources.

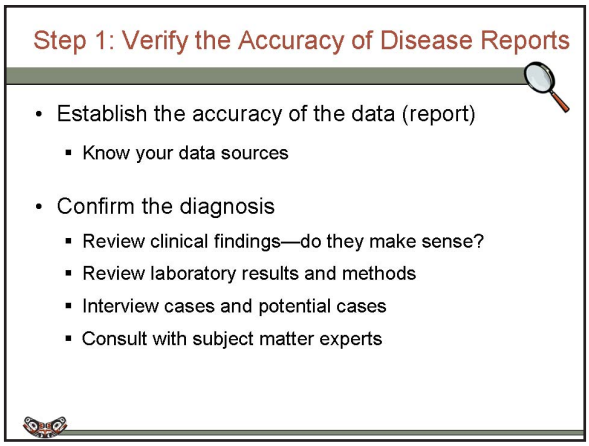
Now we will pause so that you can answer a question about what you have just learned. The exercise can take several seconds to load.



Interactive Exercise 1

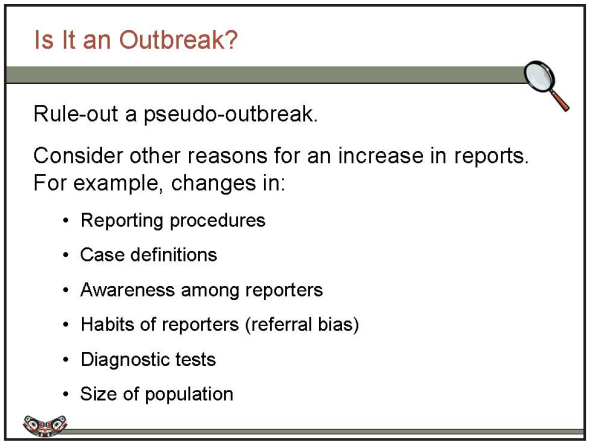
Step 1: Verify the Accuracy of Disease Reports

Establishing the accuracy of the data or report is a crucial first step in any outbreak investigation. Knowing your data sources will facilitate this. The diagnosis must be confirmed through reviewing the clinical findings. Do they make sense for the disease being reported? Review the laboratory results and methods, interview cases and potential cases, and consult with subject matter experts when the disease is unusual or the clinical manifestations or laboratory data are unclear or confusing.



Is It an Outbreak?

Rule out a pseudo-outbreak. Consider other reasons for the increase in case reports besides an outbreak. This may result from changes in reporting procedures; changes in case definitions; changes in the awareness among reporters in your community about a specific disease or condition; changes in habits of your reporters (or referral bias), which may lead to more reports being submitted for the same number of cases that are occurring; changes in diagnostic tests that lead to more or fewer diagnoses being made and hence a change in the number of case reports; and changes in the size of the population, so that more cases are actually occurring.



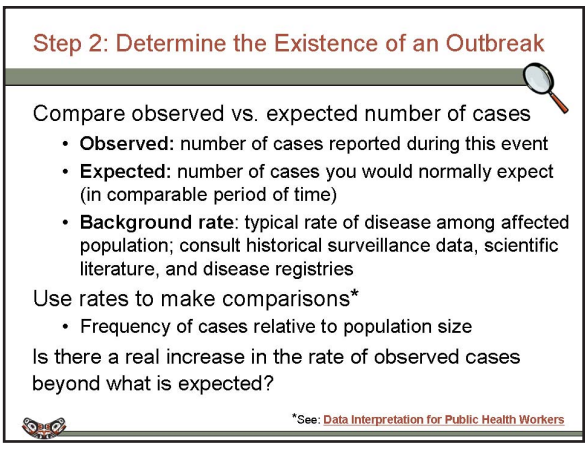
Transcript

Step 2: Determine the Existence of an Outbreak

In order to determine whether newly reported cases constitute an outbreak, you need to make a decision as to whether this number of observed cases exceeds the number you would typically expect to see in a comparable period of time.

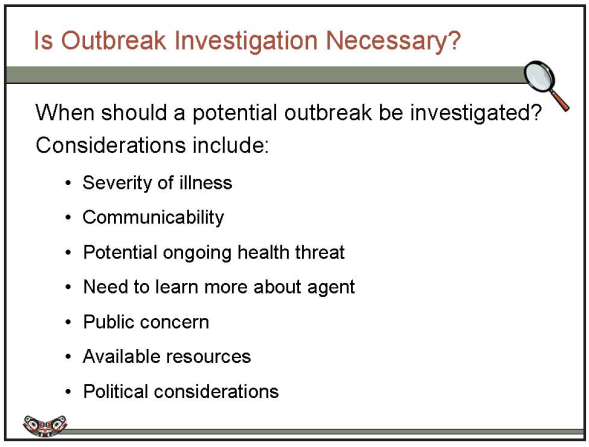
To do this, you must therefore estimate the typical rate of disease among the affected population, also called the background rate. You may need to consult historical surveillance data, scientific literature, or disease registries to obtain this information. It is essential to use rates to make comparisons, as rates describe the frequency of cases relative to the population size within a particular time period. The number of cases, or absolute counts, sometimes referred to as numerator data, do not account for these differences.

Once you've established your observed and expected rates of disease, ask yourself if this represents a real or true increase in the rate of cases over what would be expected in a given time period.



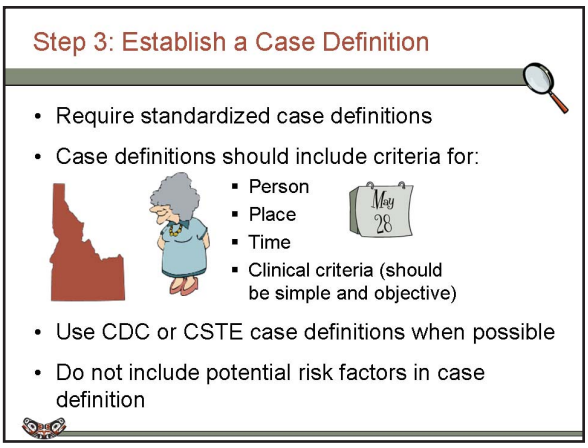
Is Outbreak Investigation Necessary?

Considerations in determining when a potential outbreak should be investigated include the severity of illness, the communicability or ability of the disease to spread in the population, the potential posed for an ongoing health threat, the need to learn more about the agent, the level of concern among the public in your community, the resources you have available to conduct the investigation, and political considerations in your area.



Step 3: Establish a Case Definition

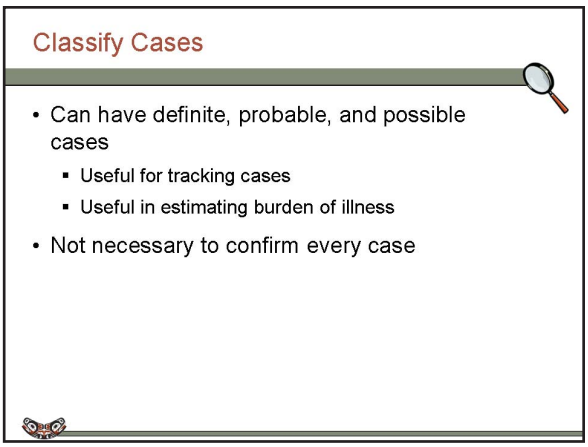
Outbreak investigations require standardized case definitions. These definitions should include criteria for person, place, time, and the clinical features of the illness. The clinical criteria should be simple and objective, and CDC or CSTE standardized case definitions should be used whenever possible. You should not include potential risk factors in your case definition or you may lose the ability to understand whether those potential risk factors are truly risk factors for disease.



Transcript

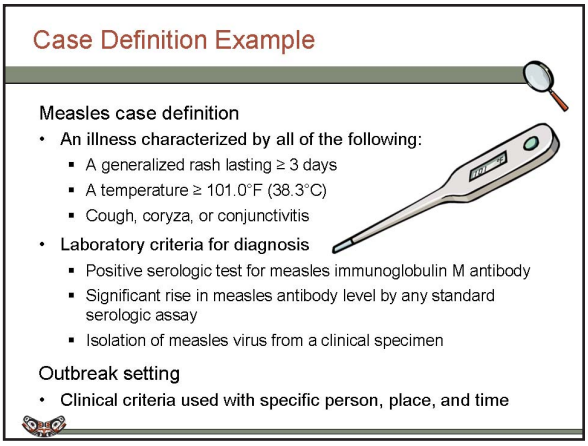
Classify Cases

It may be useful to have definite, probable, and possible case classifications which can help with tracking cases through time and in estimating the burden of illness in the community by knowing the ratio of definite to probable and/or possible cases. It's also not necessary to confirm every case in an outbreak investigation. Only a proportion of cases in a cohort of persons with an illness that meet other criteria, such as the probable or possible case classifications, need to be laboratory confirmed.



Case Definition Example

Here's an example of a case definition for measles. The measles' case definition includes clinical and laboratory criteria. The clinical criteria are an illness characterized by a generalized rash lasting three or more days; a temperature greater than or equal to 101.0°F; and cough, coryza, or conjunctivitis. Laboratory criteria for diagnosis include a positive serologic test for measles IgM antibody; or a significant rise in measles antibody level by any standard serologic assay; or isolation of measles virus from a clinical specimen.

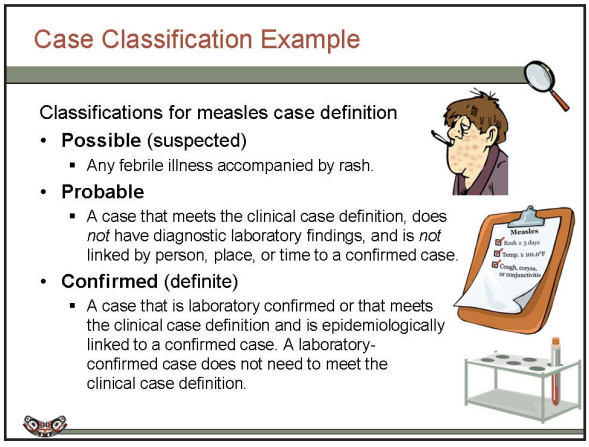


During an outbreak, clinical criteria are used with specific person, place, and time criteria: for instance, residents of town X after March 2006 who present with a generalized rash, temperature, and cough, coryza, or conjunctivitis.

In an outbreak investigators would also classify cases. Let's look at how this would be done.

Case Classification Example

Measles cases are classified as possible, probable, and confirmed. A possible measles case is any febrile illness accompanied by rash. A probable case is one that meets the clinical case definition, does not have diagnostic laboratory findings, and is not linked by person, place, or time to a confirmed case. In other words, it's not epidemiologically linked to a confirmed case. A confirmed case is one that is laboratory confirmed or that meets the clinical case definition and is epidemiologically linked to a confirmed case. A laboratory-confirmed case does not need to meet the clinical case definition.

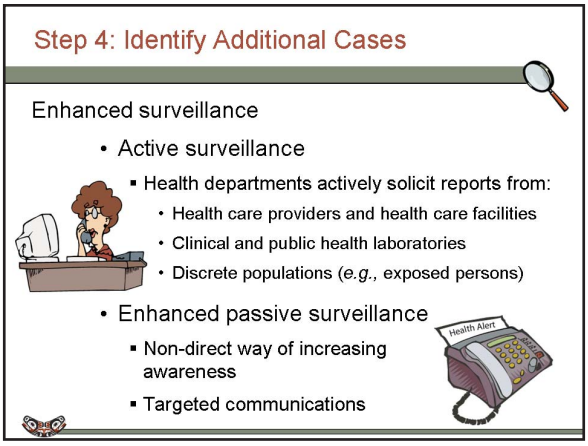


Introduction to Outbreak Investigation

Transcript

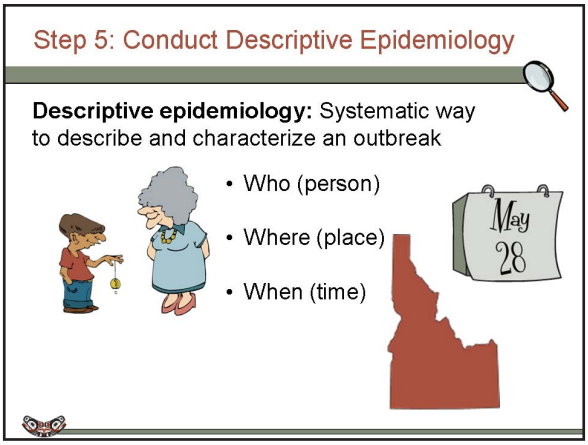
Interactive Exercise 2

Step 4: Identify Additional Cases



Once you suspect an outbreak may be occurring, you will want to find additional cases. Enhanced surveillance can help you do that. This can be through active surveillance, in which the health department is initiating a check in or telephone call to actively solicit reports of new cases with healthcare providers, healthcare facilities, laboratories, or the exposed populations themselves. Passive surveillance refers to case reporting that is initiated by providers, facilities, and labs on their own accord without ongoing active solicitation of reports by health departments. Enhanced passive surveillance is a non-direct way of increasing awareness about a need for providers, labs, and even the general public to report cases to the health department, but without the health department having to actively contact each potential reporting source. This may include targeted communications, such as health alert faxes, and public announcements.

Step 5: Conduct Descriptive Epidemiology



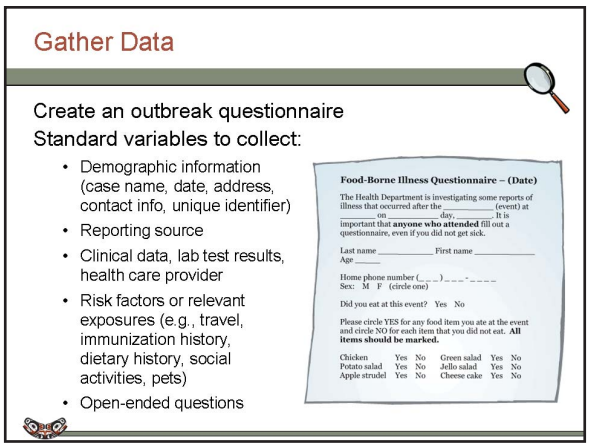
With each case you find, you will need to collect information or data, and you will eventually need to review and analyze the data in order to carry out and conclude the investigation. Descriptive epidemiology is a systematic way to describe and characterize an outbreak according to: who is at risk (person), where the cases are occurring (place), and when the cases happened (time). In order to accurately describe the outbreak or other health event, you will need to ensure that you collect the necessary data during the investigation, and then are able to organize and summarize the data. This is a crucial step, because the descriptive epidemiology results are used to generate hypotheses about the cause of the outbreak and to communicate about the outbreak and the investigation. In this section, we will explore fundamental descriptive epidemiology tools and skills used during an outbreak investigation.

Gather Data

Gathering additional data will allow you to produce a description of the basic characteristics of the outbreak. This can be done through creating an outbreak ques-

Transcript

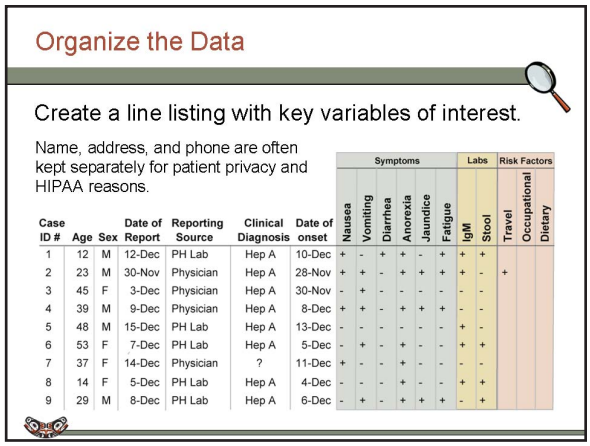
tionnaire. The questionnaire should collect demographic information such as case name, date, the address, contact information, and a unique identifier for analyses purposes; a reporting source; clinical data about the illness; lab test results; the healthcare provider with contact information; risk factor information or other relevant exposures, such as travel, immunization history, dietary history, social activities, pets or other exposure to animals; and open-ended questions that may help you to better ascertain the risk factors for infection.



Organize the Data

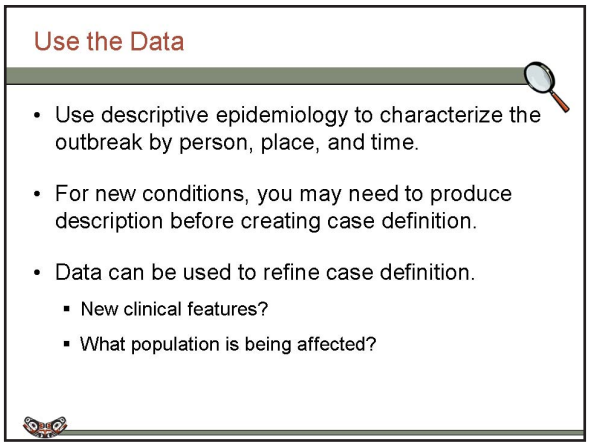
Once you've collected data, you'll want to organize it, so that it can be analyzed and used to communicate information to others.

A useful way to organize data during outbreak investigations is to create a line listing with key variables of interest. Visualizing the data in this format can help generate hypothesis regarding the etiologic agent or risk factors for infection.



Use the Data

Using descriptive epidemiology, the data you've collected is used to characterize the outbreak as to person, place, and time. For new conditions, you may need to produce this description before you can create a case definition. This information can also be used to refine your case definition. For example, you may need to do some investigation to understand what the clinical features are of a new or previously undefined illness. You may also need to do some investigation to understand what population is being affected in order to create a standardized case definition.



Review of Descriptive Epidemiology Terms

Let's pause to briefly review the definitions of some important terms in descriptive epidemiology.

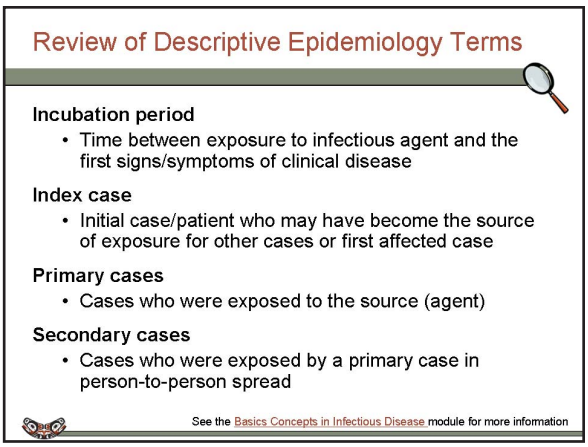
Transcript

Incubation period refers to the time between exposure to an infectious agent and the onset of the first signs or symptoms of the clinical disease in the exposed person.

Epidemiologists refer to the initial case, or patient, in an outbreak as the index case. This first case may be the source of exposure for other cases involved in the outbreak or may be the first affected in a common source exposure.

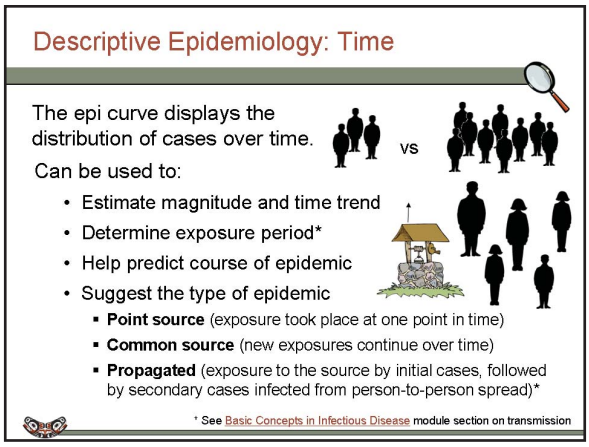
Primary cases are those who first became diseased as a result of an exposure to the source or agent in a particular setting, for instance in a family group; whereas secondary cases are cases who are exposed to the primary case and subsequently developed the disease as a result of person-to-person spread.

In large outbreaks, many generations of cases are possible.



Descriptive Epidemiology: Time

An epidemic curve, or epi curve, is a great tool for reviewing the time component of your descriptive epi data. Epi curves show the distribution of cases over time, typically according to the case onset date, or case diagnosis date. The epi curve can be used to estimate the magnitude of an epidemic; determine the exposure period; help predict the course of an outbreak; and suggest the type of epidemic.

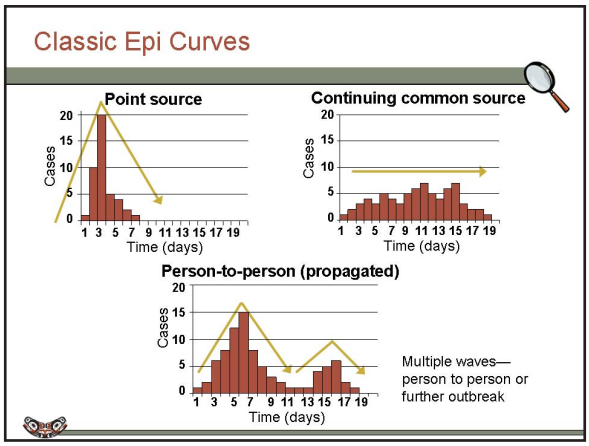


The type of epidemic refers to how the cases were exposed. In a point source epidemic, exposures take place at one time from one source. In a common source outbreak, there is still only one source, but new exposures continue to occur over time. A propagated epidemic is one in which the initial cases are exposed to the source, and secondary cases result from person-to-person transmission.

Let's take a closer look at what epi curves for these types of outbreaks look like.

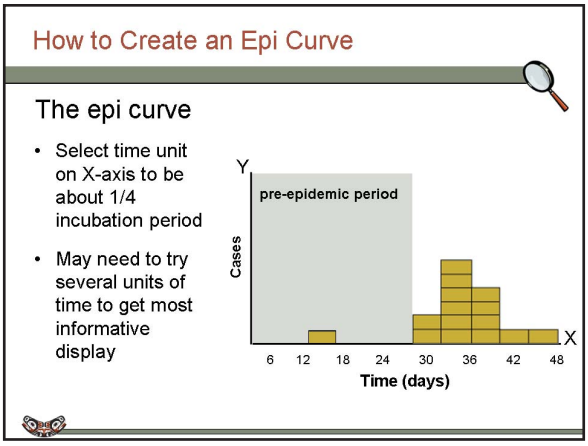
Classic Epi Curves

Here are some classic epi curves that tend to suggest what type of outbreak may be occurring. A point-source outbreak results in a precipitous rise in the number of cases and a fairly steep decline. A continuing common source outbreak results in a relatively stable number of cases as long as the exposure is ongoing. Person-to-person transmission is characterized by an upsurge during the



initial cases, a lull during the incubation period, and then another upswing during the time that the secondary cases become ill.

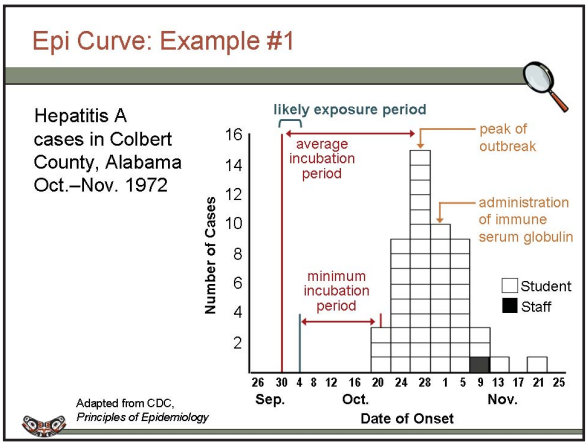
How to Create an Epi Curve



An epi curve is constructed by selecting the time unit that will be used on the X, or horizontal, axis of the graph. A good first choice for this scale is one-fourth the time of the incubation period. However, you may need to adjust and try other options until you find the time unit that provides the most informative display of the time information. In some cases, the incubation period may not be known when you're constructing your initial epi curve. In a later slide, we will look at how you can gain or lose information by adjusting this scale.

Be sure to always show the pre-epidemic period in your epi curve. This is useful in estimating the exposure period, identifying the index case, and in determining whether historical cases may or may not be part of the current epidemic. It is crucial to pay attention to outliers, cases whose onset of illness is much earlier or later than the majority. You will need to assess how, or if, these cases are related to the epidemic, and why they are presenting differently than the others. These outliers often provide clues about the etiology or mode of transmission.

Epi Curve: Example #1

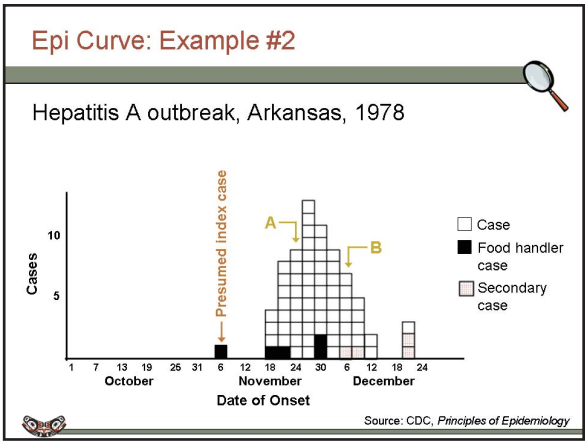


Here's an epi curve illustrating an outbreak of acute hepatitis A in Alabama in 1972 taken from the excellent reference Principles of Epidemiology, published by the CDC. This epi curve illustrates cases on the y-axis and the date of onset on the x-axis. The likely exposure period can be calculated by back-calculating the average incubation period from the peak of the outbreak and the minimum incubation period from the earliest cases of the outbreak. The interval between these two points is the likely exposure period. The epi curve also allows you to illustrate different types of patients. For instance, students here are represented by a white box and staff members in a facility by the colored box. The epi curve also allows indication of when public health interventions were implemented: here, the administration of immune serum globulin.

Transcript

Epi Curve: Example #2

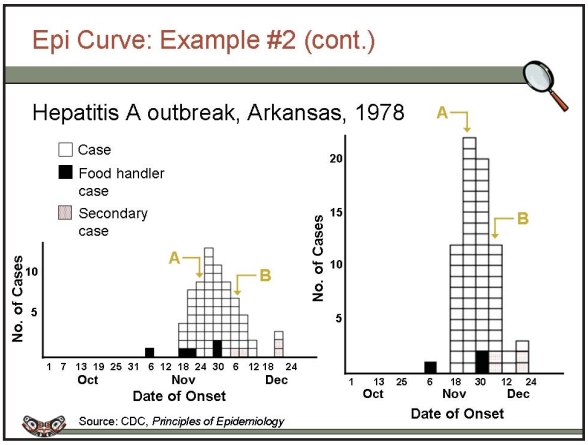
Here's another epi curve from CDC's Principles of Epidemiology. This curve shows cases with a white box, food handler cases with black box, and secondary cases with a stippled box. This curve shows an outlier, a presumed index case occurring on the 6 of November approximately two weeks before the majority of cases. Careful scrutiny of such outliers frequently can hold the key to an outbreak investigation. This curve also shows point A on the upslope, in which cases are actively occurring and it's impossible to predict when the outbreak will level off or begin to wane. Point B, however, on the downslope, confirms that the outbreak is in the waning phases.



Epi Curve: Example #2 (cont.)

Here's the data from the same epi curve you just saw, constructed using a different x-axis. Notice how this epi curve is much more compressed and doesn't illustrate the characteristic features of the outbreak as well as the previous curve. This illustrates the importance of selecting the appropriate x-axis interval.

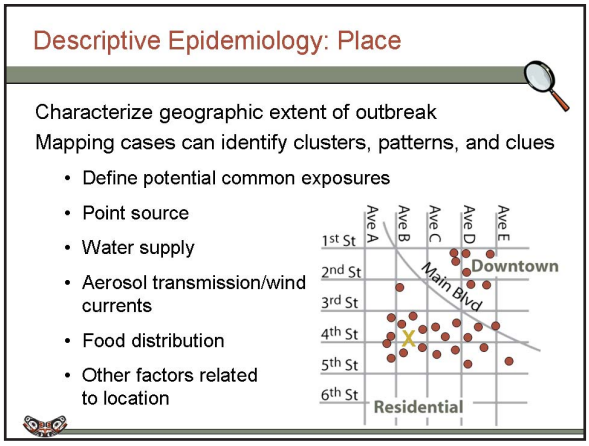
Now we will pause so that you can answer a few questions about what you have just learned. The exercise can take several seconds to load.



Interactive Exercise 3

Descriptive Epidemiology: Place

Describing place refers to characterizing the geographic extent and location of cases involved in the outbreak. Mapping cases can help identify clusters and patterns that provide clues to the etiology or exposure locations. Mapping the work, residential, and recreational activities of cases can help define potential common exposures. These may be associated with a point source exposure, for instance, a contaminated recreational water facility or a decorative fountain that can transmit Legionnaire's Disease. Cases may also fall into the distribution of a water supply or water distribution system. In the context of biological terrorism, aerosol transmission and wind

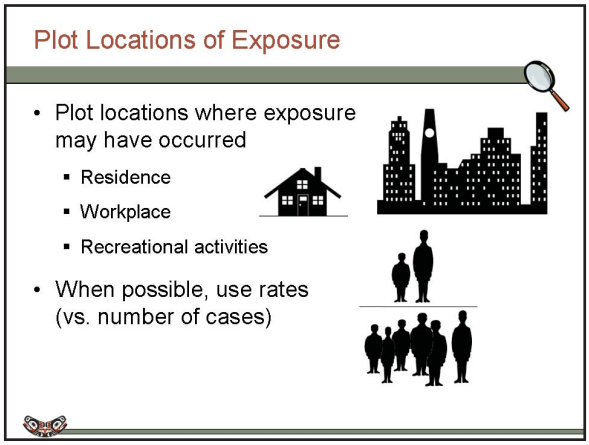


currents may be relevant. The location of cases in the context of the distribution patterns of commercially distributed food products may support or rule out an association with such products.

Finally, mapping the location of cases may lead the investigators to consider other factors, which may be relevant and which haven't yet been considered.

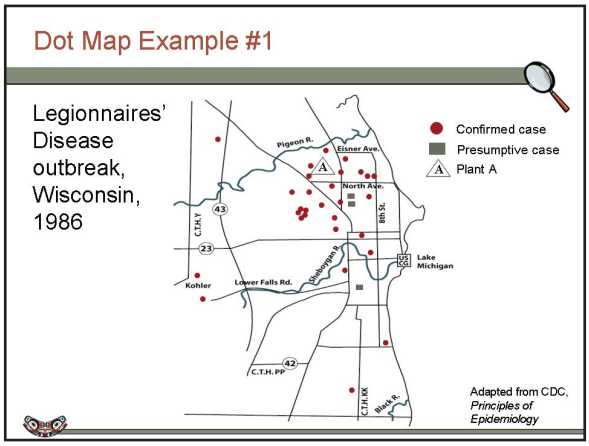
Plot Locations of Exposure

As alluded to in the previous slide, residential, workplace, and recreational activities where exposure may have occurred should be plotted. Whenever possible rates, in addition to the number of cases at each location, should be described.



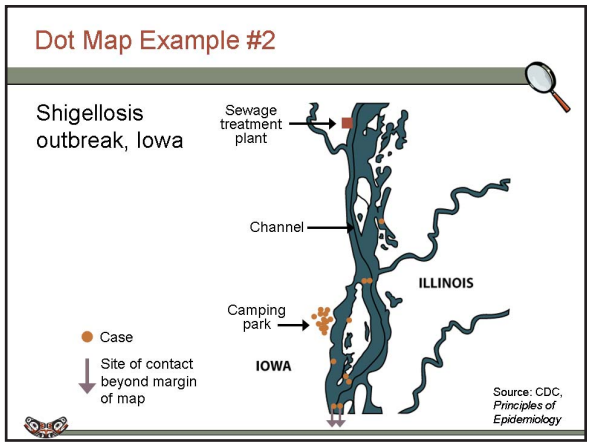
Dot Map Example #1

This dot map from CDC's Principles of Epidemiology depicts the home residences of patients with Legionnaire's Disease from an outbreak in Wisconsin in 1986. The map shows confirmed and presumptive cases in relation to plant A, where a contaminated cooling tower disseminated legionella into the environment.



Dot Map Example #2

This map from Principles of Epidemiology describes an outbreak of shigellosis and shows 22 culture-positive cases that swam within three days of onset of illness, in relation to a sewer treatment plant that's upstream from the swimming location. Maps such as these can be useful both in generating hypotheses about potential exposures and in communicating information that substantiates the conclusions of the investigation.

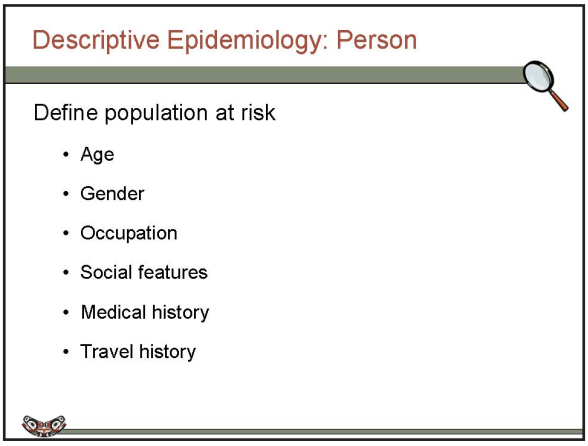


Transcript

Descriptive Epidemiology: Person

The next component of descriptive epidemiology is person, in which the cases are defined as completely as possible to characterize the population at risk. This includes age, gender, occupation, relevant social features, the medical history that might increase susceptibility to infection, and travel history, and other relevant risk factors that you hypothesize might be associated with infection.

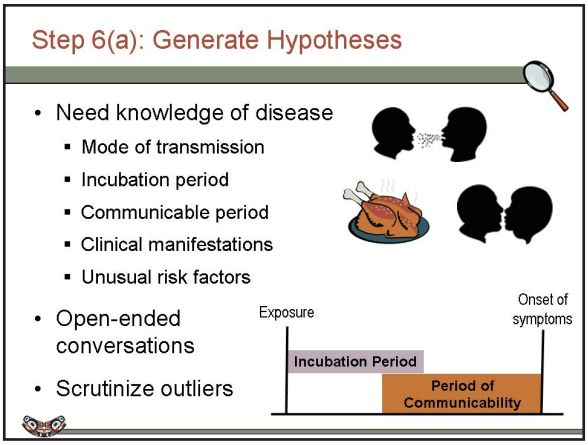
Now we will pause so that you can answer a question about what you have just learned. The exercise can take several seconds to load.



Interactive Exercise 4

Step 6 (a): Generate Hypotheses

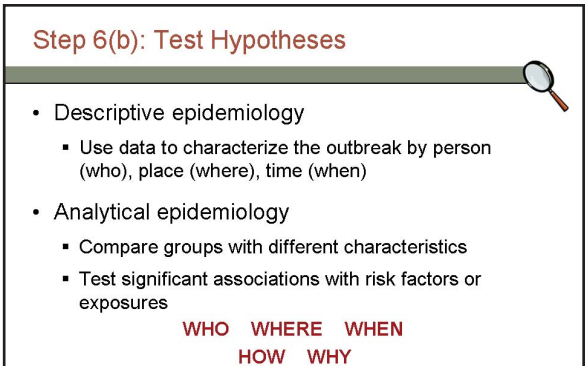
After the basic descriptive epidemiology is collected, the data's summarized and hypotheses can be generated. In order to generate the most useful hypotheses about the etiology of an outbreak, or potential sources of exposure, or mechanisms of transmission, it's useful to know as much as possible about the diseases under consideration. This includes the modes of transmission: Is it airborne? Is it respiratory droplet? Is it contact? Is it foodborne?; the incubation period and communicable periods; the clinical manifestations of disease; and any unusual risk factors that are associated with particular diseases. For instance, the relationship between leptospirosis and adventure travel that's currently being described with increasing frequency. When the etiology and risk factors are unclear, open-ended conversations with the cases is frequently productive. I've found it useful to ask cases where they think they were exposed or what they think is causing the problem. Frequently, the patient themself can tell you the answer. And finally, the importance of scrutinizing outliers cannot be overestimated. Cases that are part of an outbreak, that have little in common with many of the other cases frequently can hold the clue as to the etiology or mode of transmission.



Step 6 (b): Test Hypotheses

Testing hypotheses employs a more advanced type of epidemiology. In the descriptive epidemiology section, we reviewed how to use the data collected to characterize the outbreak by person, place, and time. After generating hypotheses from

the clues provided by this information, we can now use analytical epidemiology to test these hypotheses by comparing groups with different characteristics to test whether there are significant associations with particular risk factors or exposures. In this part of the investigation, we shift our focus from who, where, and when, to asking how and why as we search for the cause of an outbreak.



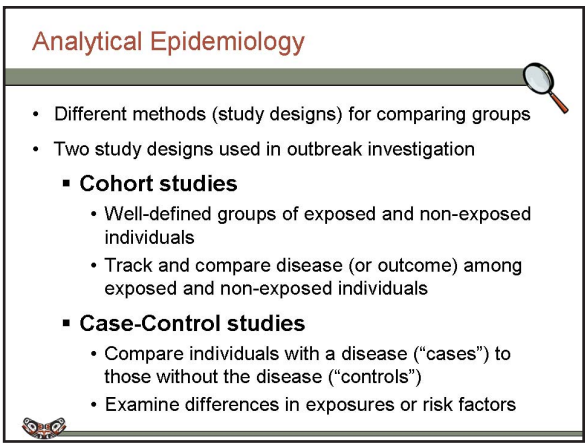
Analytical Epidemiology

Within analytical epidemiology there are different methods, or study designs, for comparing groups and making conclusions about risk factors. Let's take a moment to look at just two study designs, both of which are commonly used in outbreak investigations.

Cohort studies involve well-defined groups of exposed and non-exposed persons. In this study design, epidemiologists track and compare rates of disease among the two separate exposure groups.

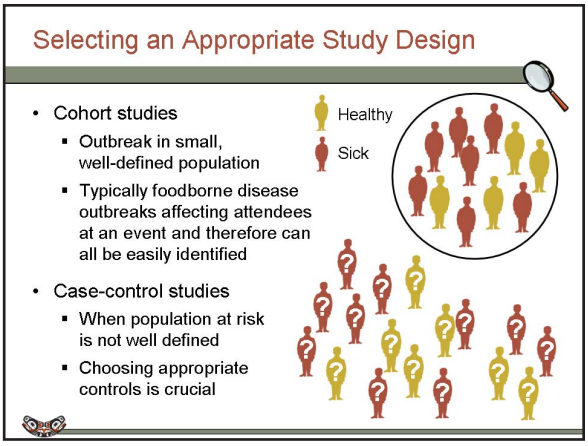
In case-control studies, we start by assigning individuals to groups according to disease status. Persons with disease, called cases, are grouped separately from persons without disease, who are called controls. Epidemiologists make comparisons between cases and controls, examining the difference in rates of certain suspected exposures or risk factors between the groups.

Now let's take a closer look at how these two study designs are used in outbreak investigations.



Selecting an Appropriate Study Design

Cohort studies are classically done when the outbreak involves a relatively small well-defined population. Frequently, these are foodborne disease outbreaks that affect attendees at a particular time or place, such as a wedding or picnic. In these studies people can all be identified for interview or questionnaire administration to determine who ate what and whether they subsequently became ill.

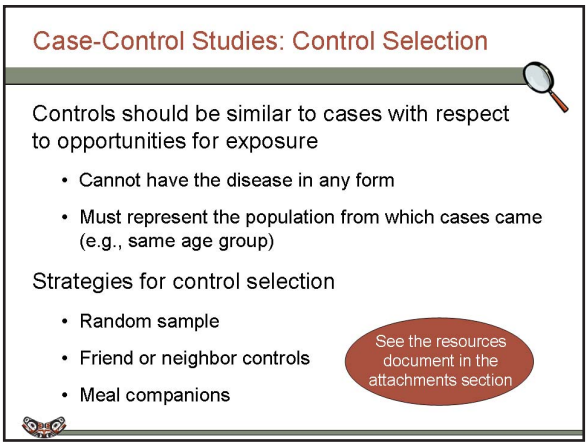


Case-control studies are done when the entire population at risk is not well defined, and all those exposed are not identified, such as a county fair, where there is no registration or attendance list. Sometimes, you might not even have a common place of exposure. For instance, in the 1996 national outbreak of *E. coli* 0157H7, due to

commercially distributed unpasteurized apple juice, cases were reported around the country and eventually linked to juice that was purchased in various cafes and grocery stores, and produced by one company.

In case-control studies, choosing the appropriate controls is crucial. Let's take a closer look at strategies for control selection.

Case-Control Studies: Control Selection

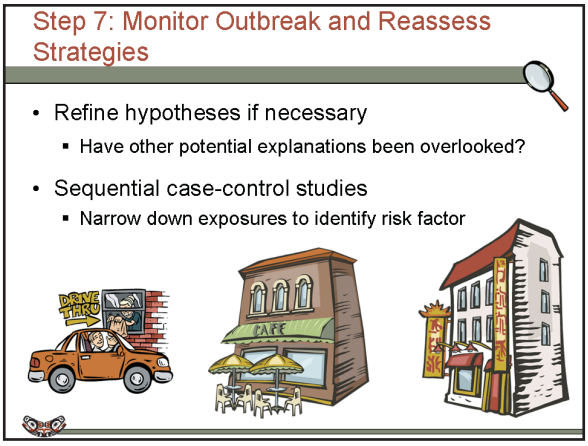


The controls should be as similar to the cases as possible with respect to opportunities for exposure. It's also important that controls do not have the disease in any form. If persons with unrecognized mild or asymptomatic disease are included as control subjects, they're actually misclassified cases and will decrease your likelihood of finding an association that actually does exist.

Controls should represent the population from which the cases came. For example, an outbreak among preschoolers should be investigated by using controls in that same age group. It would be inappropriate to use older children or teenagers who might not have the same opportunities for exposure to an etiologic agent as preschoolers have.

Control selection can be time-consuming. In actual practice during an outbreak investigation, practical considerations frequently drive the control selection. Controls frequently have to be identified very quickly during an outbreak investigation in order to identify the etiologic agent, mode of exposure, or contaminated food product as quickly as possible. Random samples of controls can be drawn from populations which are thought to have similar opportunities for exposure to the etiologic agent. In other circumstances, friend or neighbor controls or meal companions are appropriate to use. I encourage you to read more about control selection in textbooks of epidemiologic methods.

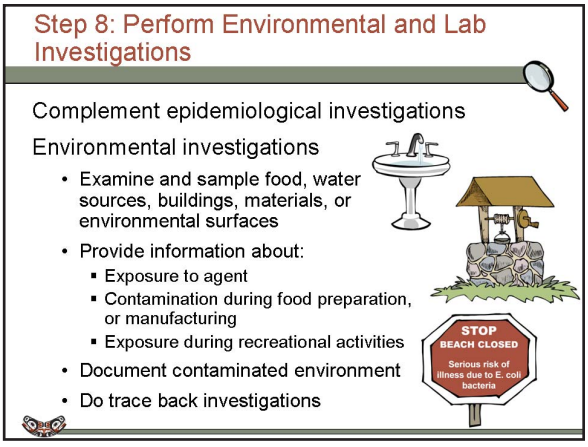
Step 7: Monitor Outbreak and Reassess Strategies



At times, hypotheses will need to be refined or additional studies undertaken to find a definitive answer. If your current hypotheses aren't bearing fruit, it's a good idea to reevaluate and see if other potential explanations have been overlooked. Sequential case-control studies may be needed to narrow down exposures and identify definitively the risk factor responsible for disease. For example, in a foodborne outbreak, your initial study might implicate

customers who frequent a particular food establishment. At this point, additional case control studies might be useful to identify particular foods or other associated factors.

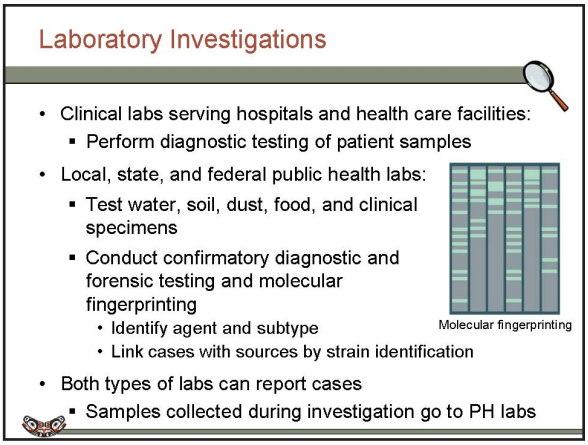
Step 8: Perform Environmental and Lab Investigations



Both environmental and laboratory teams provide crucial information during the outbreak investigation. These functions typically occur simultaneously with the epidemiological investigation and are important to complement the epidemiological data.

The environmental health team inspects facilities, observes operations and production processes, and can obtain samples from food products, water sources, environmental surfaces and materials, and even animals that can be tested in the laboratory for etiologic agents. Environmental investigations also can provide information about opportunities for exposure to an etiologic agent or contamination with a disease-causing agent during such activities as food-preparation, manufacturing, or during recreational activities. In certain diseases, environmental investigations will be useful to document contamination of the environment in which illness occurred. This might involve tracing back through the production and distribution chain of a commercially prepared food product to identify the contamination incident, or sampling the water supply or water distribution system or cooling tower in an investigation of Legionnaire's disease.

Laboratory Investigations



The laboratory also provides useful supportive information during an epi investigation.

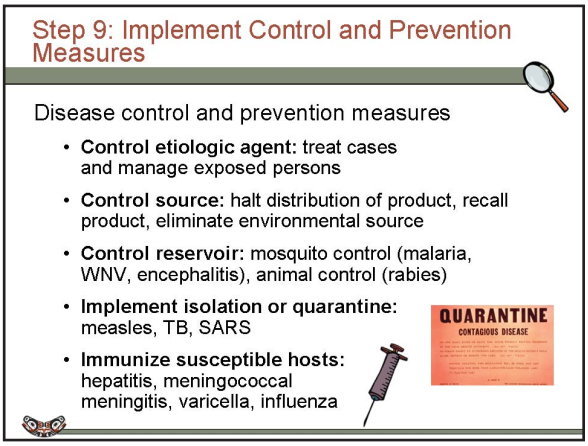
Clinical laboratories that serve hospitals and medical clinics test specimens from patients for diagnostic purposes.

Public health labs have a much bigger role in analyzing specimens during outbreak investigations. These labs can test environmental samples and clinical specimens. They conduct confirmatory diagnostic testing and can be involved in forensic analysis of specimens. Their role is to identify the specific agent and subtype. Molecular "fingerprinting" methods, when used in outbreak investigations, are frequently referred to as molecular epidemiology. Molecular epidemiology results may also help you sort out which persons among many with a common infection can be potentially linked

to a common source by identifying those whose isolates have the same fingerprint. Public health laboratories keep records of results and can access national electronic archives, such as the PulseNet foodborne pathogen DNA fingerprinting library, for comparing results with other isolates from local, regional, and national databases.

Both public health and clinical labs can report cases to health departments. Samples obtained by the environmental team are sent to public health labs for further analyses.

Step 9: Implement Control and Prevention Measures



When the results of your investigations are available, they can be used to implement disease control and prevention measures. This may involve recommending appropriate treatment based on the etiologic agent that was identified, or recommending treatment, post-exposure prophylaxis, or infection control measures for exposed persons to prevent additional cases of disease. Treatment and prophylaxis can be administered by health department clinical staff or by the patient's own healthcare provider. Addressing the source of the infections is critical, whether it be a contaminated food product, in which distribution can be halted; an existing product not yet consumed, recalled; or an environmental source that can be eliminated or decontaminated, such as a cooling tower, infected swimming pool or water supply, or other contaminated items that are shared between or among individuals. The environmental investigation findings can help guide these control measures. Likewise, the environmental team plays a role in controlling zoonotic diseases transmitted by animal vectors. In these cases, control of the zoonotic reservoir is relevant, such as mosquito control for malaria and West Nile virus and arboviral encephalitities, or animal control and surveillance activities for rabies. For certain diseases, implementation of isolation and/or quarantine may be relevant; for instance, measles, tuberculosis, and SARS. Local, state, and federal laws and regulations address isolation and quarantine measures, but you should consult your local health officer to find out about specific regulations in your location. And finally, lasting preventive measures such as immunization of susceptible persons against diseases such as hepatitis, meningococcal meningitis, varicella, and influenza are common and effective public health interventions.

Implement Control and Prevention Policies

Results of outbreak investigations can be used both to inform policy development as well as facilitate implementation of policies to protect the public health and prevent infections as well as other adverse health conditions.

In foodborne outbreaks, policy changes may include specific guidance on food

processing and manufacturing procedures, handling of food by food workers, or ensuring foods are properly cooked at adequate temperatures to kill any remaining bacteria. One good example is the changes in the fast food industry that occurred after the *E. coli* outbreak in 1993, due to under cooked contaminated beef. Similar changes have been made requiring either pasteurization or prominent labeling of unpasteurized fresh fruit juice products, after outbreaks documented contamination of those products resulting in disease.

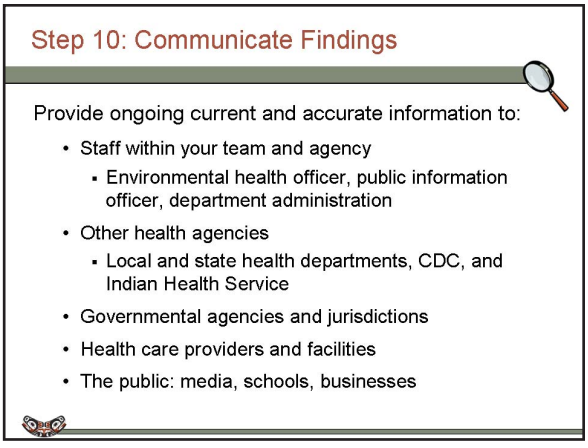
In respiratory or enteric disease outbreaks, results from investigations can be used in establishing policies around exclusion of ill children from daycare settings, specifically the duration during which children may be able to transmit an infection to others in the setting.

Results from outbreak investigations can help us understand the circumstances under which isolation and quarantine should best be used and in establishing recommendations for immunizations of persons who are at risk for exposure to infectious agents.

Now we will pause so that you can answer a few questions about what you have just learned. The exercise can take several seconds to load.

Interactive Exercise 5

Communicate Findings

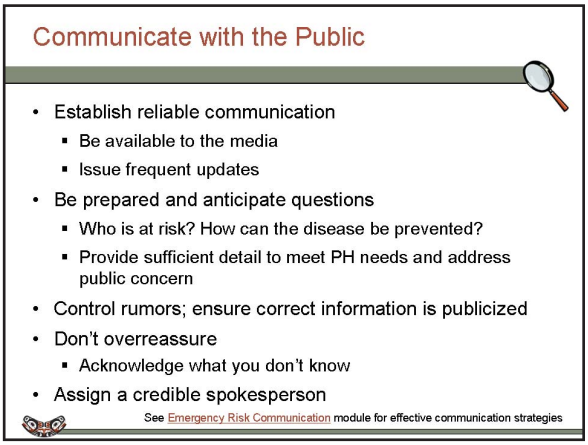


Good communication is crucial during all aspects of outbreak investigations, including while the investigation is ongoing, as well as once the investigation is complete. Timely and accurate information needs to be provided frequently, both to your team working on the investigation with you, to others in your agency, including other programs who may be involved in the outbreak response, the public information officer, and the department administration, as well as with other health agencies, for example, local health jurisdictions in your region and your state health department. If at the state level, then also with the federal Centers for Disease Control and Prevention and when appropriate Indian Health Service. At times, it may be important to brief local elected public health officials or other representatives from governmental agencies. Healthcare providers in the community should be kept up to speed on what's happening while an outbreak is occurring, as well as after an outbreak has subsided, regarding the findings of your investigation and implications for disease prevention in the future. In order to

comply with your recommendations for assistance or management of cases during the outbreak, healthcare facilities and laboratories should be kept well-informed on an ongoing basis.

Particularly for large or unusual outbreaks, it's important to keep the public informed.

Communicate with the Public

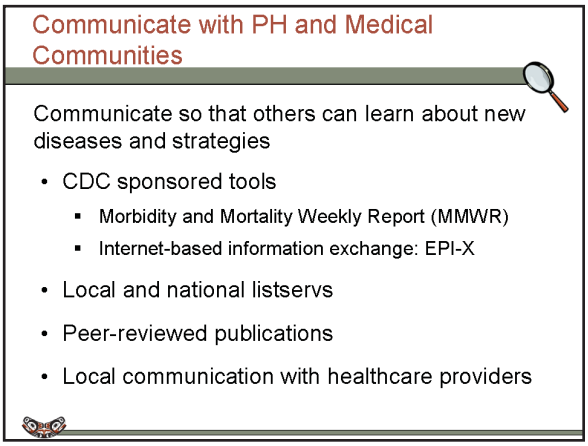


Communicating with the public is typically done through the media, but also through schools and at times businesses, particularly when they are directly impacted.

Establishing relationships and reliable communication mechanisms with these partners is very useful before an outbreak occurs. During an outbreak, information needs to be communicated rapidly. It's generally best to be available to the media on a regular basis and issue frequent updates. Be prepared with background information and anticipate questions, such as how serious is the problem, who is at risk, and how the disease can be prevented. Provide sufficient detail to meet public health needs and address public concern, but keep confidentiality in mind. Note that despite your best efforts, rumors may circulate and it's important to correct these mistakes by publicizing accurate information. Another important tip is not to over reassure and acknowledge what you don't know.

Assign a credible spokesperson. You should get your public information officer and communications specialists involved early on.

Communicate with PH and Medical Communities



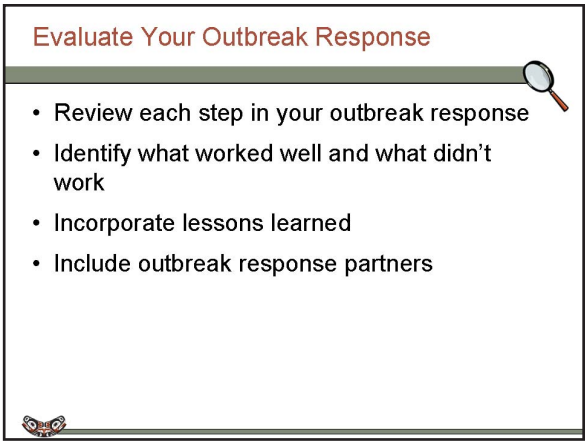
Communication with the public health and medical community is also very important so that other health professionals can learn about new diseases, findings, and control strategies. Some of the best ways to do this are by submitting reports to the Centers for Disease Control and Prevention's Morbidity and Mortality Weekly Report (MMWR) and their internet-based information exchange methods, such as EPI-X. Local and national listservs are another good method to communicate with public health and medical professionals. Peer-reviewed publications can be used both to disseminate the results of outbreak investigations and new findings and to discuss relevant policy implications.

Use your local communication methods, such as broadcast fax and internet listservs to get information to healthcare providers and facilities.

Transcript

Evaluate Your Outbreak Response

After your investigation has closed or settled down and you can make some time available, it is important to evaluate your outbreak response. Review each step that was taken during the outbreak response with your entire team, and identify what worked well and what didn't. Incorporate the lessons learned into your procedures for future outbreak investigations. It's also important to include your outbreak response partners in the evaluation and assessment of what worked and what didn't to identify ways to work better together in the future.



Best Practices for Outbreak Investigations

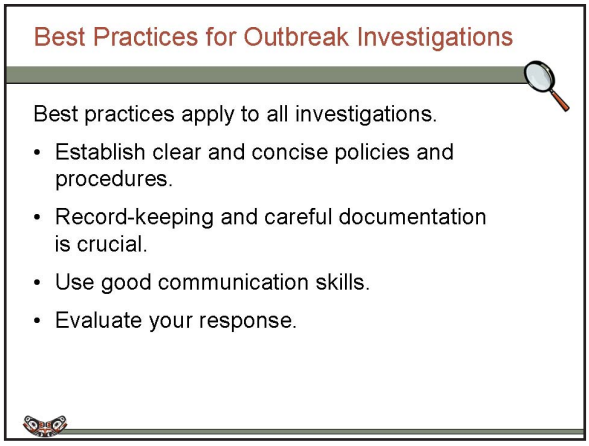
Each outbreak investigation is unique. However, there are some best practices that apply to all investigations. These "best practice" tips do not necessarily fall into a specific step in an outbreak investigation, but from a practical standpoint they are good to keep in mind throughout the investigation.

It's always important to establish clear and concise policies and procedures that correspond to the roles and responsibilities of all the teams involved in the response.

Thorough record-keeping and careful documentation, including what you did, when, and why, are useful in reviewing your response for lessons learned and in explaining your actions to others, and for legal purposes.

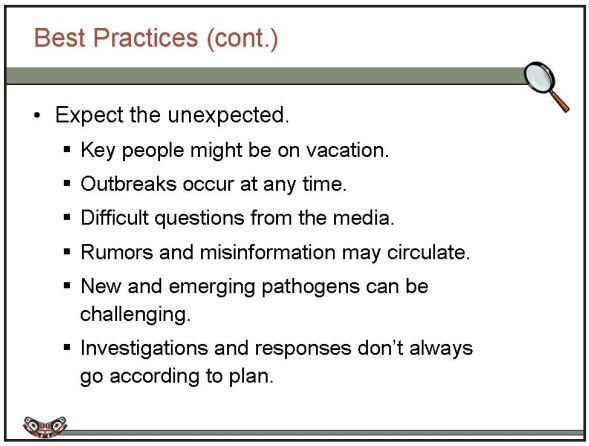
Use good risk communication skills.

And, evaluate your response and integrate lessons learned into practice.



Best Practices (cont.)

Be prepared for the unexpected. Key staff might be on vacation when an outbreak strikes, or important communication systems or equipment might break down, so it's important to have back up plans. Outbreaks don't always occur during a work week; they frequently happen on Fridays or holidays. The media can often ask difficult, unanticipated questions. Rumors and misinformation can circulate, and these can potentially bias your cases and interviewees and affect your ability to conduct disease control measures. New and emerging pathogens can challenge your traditional thinking and response plans.



Introduction to Outbreak Investigation

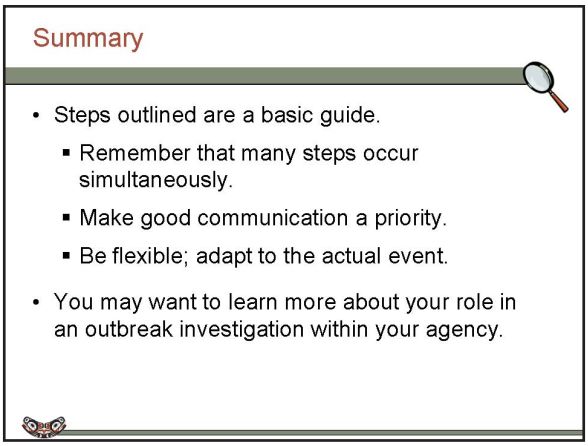
Transcript

Investigations don't always go according to plan, so keep these potential difficulties and tips in mind and be prepared to be flexible in your response.

Summary

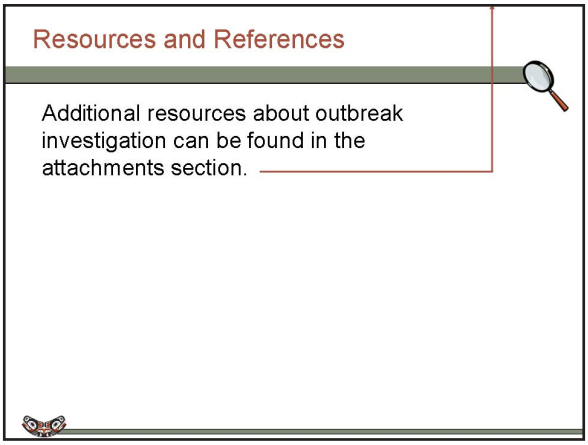
The steps provided here are intended to serve as a basic guide. Remember that many steps occur simultaneously and not all the steps are necessary for any given outbreak investigation. Make good communication a priority within and between the various outbreak responders. You'll need to be flexible and adapt to the actual event as it unfolds.

It's always best to prepare ahead of time, so you may want to learn about your role and responsibilities in an investigation within your agency.



Resources and References

I encourage you to read more about outbreak investigations.



Final Assessment