Chapter 3: Steps in Investigating an Outbreak

Section One: The 10 Steps in Investigating an Outbreak

1) Prepare for an Outbreak Investigation and Field Work
2) Confirm the Existence of an Epidemic or an Outbreak
3) Verify the Diagnosis
4) Define a Case and Identify and Count Cases
5) Describe the Data in Terms of Person, Place, and Time
6) Develop Hypotheses
7) Evaluate Hypotheses (Analyze and Interpret the Data)
8) Refine Hypotheses and Carry Out Additional Studies
9) Implement Control and Prevention Measures
10) Communicate Findings, Write a Report and Enter into the National Outbreak Reporting System (NORS)

Section Two: Management of Multiple Outbreak Investigations

Overview of Steps in Investigating an Outbreak

Introduction

An epidemiologic investigation is an important part of the complete foodborne or waterborne illness investigation which also includes environmental and laboratory investigations. Each part of the investigation compliments the others. **Teamwork and open communication are of utmost importance.**

The purpose of the epidemiologic investigation is to identify the causes of a public health problem by collecting data, and formulating and testing hypotheses. It also involves implementing control measures to prevent additional illness and evaluating the impact of those control measures to make sure that the problem has been adequately addressed.

When an outbreak has been identified, the local health department (LHD) should **immediately** notify the Infectious Disease Branch, Reportable Disease Section at the Kentucky Department for Public Health (KDPH) and/or any other state level office (e.g., Division of Public Health Protection and Safety, Division of Laboratory Services, etc.) that might have expertise that could bear on the investigation. The toll free number is 1-888-973-7678. These offices may assist in coordinating the investigation, assist in the investigation itself if requested by the LHD, and can be consulted on collection of food, clinical, and/or environmental specimens.

Following, are 10 standard steps to an outbreak investigation. Though they are listed in sequential order, their order of implementation is often non-sequential. Knowing these steps prepares one to conduct an investigation properly, using common sense and logic to determine when, how often, and to what extent the different steps should be implemented in a real investigation.

The following steps should be taken in all outbreak investigations:

1. Prepare for an outbreak investigation and field work.
2. Confirm the existence of an epidemic or an outbreak.
3. Verify the diagnosis.
4. Define a case and identify and count cases.
5. Describe the data in terms of person, place, and time.
6. Develop hypotheses.
7. Evaluate hypotheses (analyze and interpret the data).
8. Refine hypotheses and carry out additional studies.
9. Implement control and prevention measures.
10. Communicate findings, write a report, and enter into the National Outbreak Reporting System (NORS).

NOTE 1: It is important to note that while the above list of steps is in a particular order, they do not necessarily have to be carried out in that order. In fact, several steps may be put into action simultaneously. However, confirming the existence of an outbreak and verifying the diagnosis *always* deserve early attention.

NOTE 2: Depending on staffing, resources and time, all the steps may not be covered thoroughly or even covered at all. As stated previously, KDPH is available for guidance and assistance. (Telephone numbers for KDPH are included in this chapter and in Appendix A.)

3.1.1 Step One: Prepare for Outbreak Investigation and Field Work

Although the steps in investigating an outbreak are not always implemented sequentially, preparing for an epidemiologic investigation may be considered as the initial step in any outbreak because at least part of the planning can be done before an outbreak occurs. The LHD can begin by training personnel in how to compile line lists, develop questionnaires, conduct interviews, and use software such as Epi Info for data entry and analysis. Physicians, hospitals, and nursing homes should also be trained on the procedures for reporting infectious diseases. It is important to establish rapport with community stakeholders and to provide them with a copy of the Reportable Disease Desk Reference. The LHD should have 6-8 stool culture kits on hand or readily available should an outbreak occur because in most cases stool specimens must be collected within 72 hours of onset of illness to isolate and identify certain pathogens (e.g., *Clostridium perfringens, Bacillus cereus, Staphylococcus aureus*). Lists of contacts, such as administrative contacts, additional personnel, sanitarians, regional contacts,

physicians, clinical laboratories, or other persons who may become involved in outbreak investigations should be assembled. Resource materials, such as the Red Book or the Control of Communicable Diseases Manual (CCDM), describing signs and symptoms, incubation times, vectors, probable routes of exposure, and specifics regarding specimen collection (e.g. Appendices C, D, E and F of this manual) and appropriate collection kits to be used should be maintained and readily available to those responding to the initial calls. "Go kits" for typical outbreaks can be assembled with all of these materials ready to roll out the door at a moment's notice.

These steps may help in fielding investigators faster and initiating an investigation. It is also very important for the LHD to realize the limits of the LHD's resources; does the LHD have the means to properly conduct the investigation or is there a need to seek outside assistance? If an outbreak investigation requires additional resources, KDPH should immediately be notified. Once the investigation is underway, the proper clinical specimens should be collected as soon as possible before patients recover and become less likely to submit specimens, or are treated, and before general interest in the investigation wanes. Food and water specimens should also be collected as soon as possible. Being prepared in advance increases the likelihood that this will happen. A presumptive diagnosis may be misleading in the absence of a thorough laboratory work up. A determination must be made regarding the feasibility of conducting an investigation even if the time to collect proper clinical specimens has passed. Each step of the investigation can be impacted by prior preparation.

Once an outbreak is identified, final preparation for field work must occur. What will be needed in the field? Who should go? Will food, water, money, or hotel reservations be needed? Who needs to be informed in the office and at the investigation site? How will communications occur and are contact information sheets and clear directions available? What will be the goal of the field work? What is the timeline? Who are the interested parties or stakeholders? Answers to these types of questions will be crucial to a successful investigation.

3.1.2 Step Two: Confirm the Existence of an Epidemic or an Outbreak

Once the health department staff have been alerted to the possibility of some unusual cases, or an unexpected increase in the number of cases of a particular disease or group of symptoms, the first step is to make sure that the information is correct and that there truly is an outbreak to investigate. What determines the existence of an outbreak? The general rule is to compare the current rate of occurrence of the disease to what "normally" occurs to determine if there is a rise in cases *beyond what is normally experienced.* However, for diseases not

often seen in a given area, two or more cases are usually the general rule for declaring an outbreak.

Reporting of cases of illness can occur for any number of reasons that don't relate to a true outbreak. Misdiagnosis is a common occurrence and usually happens in the absence of proper lab testing. Increases in reporting cases of a disease may happen because a specialist starts practice in an area and identifies and reports previously unrecognized cases. Media coverage may cause clinicians to suspect a particular disease more often and report cases. The reportable disease case definition (see Step 4) may change to include more people as cases. Lab testing can bring about many false increases. For instance, a new lab test may be created making testing possible, a more sensitive lab test might be developed, more samples might be gathered and sent for testing because of increased awareness among clinicians, or an increase in inappropriate testing of people will naturally increase the false positive rate bringing about higher lab reports of the disease. In all of these cases, the rate of occurrence of the disease didn't actually increase, but the number of reported cases appears to indicate that it did.

Thus, one should always strive to establish the true existence of an outbreak by comparing the incidence of the disease in a specified population during a comparable previous time period. Often, individuals may exaggerate the number or severity of cases related to a particular event or report "lots of people have it" for a particular disease and once investigated this is not borne out by the facts. It is often unclear when to conduct a full epidemiologic investigation. There is usually no question when the team is notified about a large number of people getting ill at approximately the same time after eating at the same establishment or attending the same event. However, uncertainty arises when sporadic complaints are reported. The response team will need to consider whether the reports indicate that the affected cases are all suffering from the same illness and whether there is any evidence of an association between them. This underscores the need to follow-up (i.e., determine the validity of and initiate further action if necessary) on every complaint received. It often occurs that single complaints are actually related to an outbreak.

To make the task of establishing an outbreak easier, investigators must be familiar with the reportable disease system, know who to contact to find previous and current rates of diseases, and know common disease trends in the community. This can be done through diligent public health surveillance that provides an accurate assessment of the status of the health of the community and helps to determine any increases or decreases in communicable diseases in the local population. Surveillance data should be reviewed by the LHD on a regular basis to become familiar with the status of all communicable diseases in the area of jurisdiction. Be aware of artificial causes of increases such as: (1)

changes in local reporting; (2) changes in case definitions of reportable diseases; (3) increased local or national interest in particular diseases; (4) new physicians in the area or those who might be specialists in certain diseases; (5) new diagnostic procedures which might identify new or existing infectious agents; and (6) increased populations or new arrivals into the area.

When notified of an incident in which illness has resolved and no new cases have been identified, the decision to conduct an epidemiologic investigation should be based on an assessment of what will be gained. As stated above, an investigation always serves as a learning tool. But, if resources (time, personnel, etc.) are limited, a full investigation may not be warranted. Rather, one should ensure that appropriate control measures have been implemented to prevent future outbreaks.

This is especially true of home-based foodborne outbreaks. In many instances, the illness is confined to a finite number of people in a discrete time period. In addition, the health department is often notified well after the fact when there is little or no material left for testing and people have recovered. In this case, the team should review food preparation techniques with the responsible parties and use the opportunity to educate on proper food handling and preparation methods.

Whenever an increase in cases is reported, this is the perfect opportunity to give a “heads up” to each of the investigation partners in the health department. The epidemiologists, communicable disease nurses, and environmentalists should all be aware of the possibility of an investigation from this initial point. Each may have insight into how to determine whether this is truly an outbreak based on prior experience so the intake staff person should not waste an opportunity to collaborate early.

NOTE: Investigation of an outbreak of foodborne or waterborne illness is a team effort where each member has an essential role to perform. In some instances the team may include a number of individuals at the local level (public health nurse, sanitarian, regional epidemiologist) and the state level (state epidemiologist, infectious disease branch, food safety branch, environmental management branch). At times, there may be only one person involved at the local level. **Whatever the circumstances, it is important to remember that KDPH is available for guidance and assistance throughout each step of the investigation.** Phone numbers are listed on the next page.

KDPH Contacts

Division of Public Health Protection and Safety, Food Safety Branch (502) 564-7181	For policy and technical assistance with the environmental investigation such as initiating enforcement actions and collecting food samples. On-site investigation assistance is often available for larger outbreaks.
Division of Public Health Protection and Safety, Environmental Management Branch (502) 564-4856	For technical assistance with water sample collection.
Division of Epidemiology and Health Planning, Reportable Disease Section (502) 564-3261 1-888-9-REPORT or 1-888-973-7678	For technical assistance with the epidemiologic investigation such as obtaining medical histories and developing questionnaires. On-site investigation assistance is often available for larger outbreaks.
Division of Laboratory Services (502) 564-4446	For technical assistance with the collection protocol for food and clinical specimens.

3.1.3 Step Three: Verify the Diagnosis

Verifying the diagnosis is done by obtaining appropriate clinical histories and proper specimens, patient and/or environmental, for laboratory study.

A diagnosis might already be established as is the case when someone notices an increase in positive lab results for a certain disease. It could also happen when area physicians report an increase in the number of patients they are seeing with similar symptoms and at least one doctor tested appropriately and thus already has a diagnosis for the outbreak (which of course must be further confirmed with respect to the actual outbreak but gives the investigator a definite starting point). However, if the diagnosis is not clearly established, then the first step is to obtain clinical histories on the patients.

Obtaining Clinical History

Obtaining accurate clinical histories involves interviewing ill persons, family members and/or physicians, either in person, on the phone, or through a formal survey (discussed in Step 4) to record all relevant symptoms, possible exposures, and other details that might reveal the disease in question. It is also a good time to ask questions that might illuminate the cause of the outbreak or ways to prevent further cases.

The important elements to cover when obtaining initial clinical histories include anything that might lead to the determination of a specific disease entity that is responsible for this outbreak. Primary among these are specific symptoms of the illness, details that could help determine the incubation period, contacts with other sick people who might already be diagnosed or offer a broader symptom profile, and prominent exposures that may have led to infection or poisoning. All of these categories of information could indicate what kind of disease is the etiologic agent in this outbreak. **Remember, the information gathered is confidential and should be shared with only those individuals involved in the investigation.**

Laboratory Specimen Collection

Review the method of laboratory testing, (e.g., sputum swabs, blood tests, stool culture, and select isolates). Be wary of verbal reports of any disease. Insist on obtaining laboratory evidence of positive test results from established laboratories and accepted tests. Other evidence to support the diagnosis (e.g., a lab-confirmed case in a contact) can sometimes be used in lieu of laboratory results. (Information on submitting clinical specimens is discussed in Step 4 of this chapter). In some instances, there will be outbreaks of unknown etiology, and there will be no laboratory results forthcoming to confirm the diagnosis. This often happens because it is well after the outbreak when the investigation begins or clinicians are likely to treat empirically rather than test so inadequate or no testing has occurred. Cases or outbreaks of diseases of unknown etiology are just as valid as those with known etiologies.

NOTE: Laboratory identification of a pathogen can validate the hypothesis and perhaps allow easier implementation of control and preventive measures. **Therefore, time is of the essence when requesting and collecting clinical, food and water specimens.**

- Refer to Appendix D for information on submission of clinical specimens.
- Refer to Appendix E for more information on submission of food specimens.
- Refer to Appendix F for more information on submission of water samples.

It is important to notify the lab prior to the submission of food samples and other specimens. Food pathogen testing is time consuming and involved and the lab needs time to plan and prepare. Each food pathogen has a unique protocol of media and incubation temperature. Media is made on demand because it is expensive and has short expirations.

When submitting any specimens to the Division of Laboratory Services for analysis, it is crucial to have an idea of what the disease or toxin is so that the lab can test appropriately. It is very expensive to run tests on stool or food samples. A request to “test for all gastrointestinal illnesses that could be in stool

sample," or "test for whatever could make people sick in this food," would also be too time consuming for the Division of Laboratory Services. Use symptomatology, probable incubation periods, and other characteristics of the outbreak (e.g., likelihood of waterborne, foodborne or environmental contaminants vs. infectious etiologies), to assist in making educated guesses about the agents to be tested for in order to request specific tests to be performed. Appendix C contains this information and may assist investigation team members in identifying agents to be tested for.

3.1.4 Step Four: Define a Case and Identify and Count Cases

Develop the Case Definition

After establishing that an outbreak is occurring and attempting to verify the correct diagnosis, a *crucial* step is to define what constitutes a case in this investigation. This is called the **Case Definition**. The case definition is then used to identify and count cases.

A case definition is a set of criteria for deciding whether an individual ill person should be classified as a case. The case definition places boundaries on who will be counted as a case, so the investigation does not include those with illnesses unrelated to the outbreak. This step helps to get an idea of the magnitude of the problem and records all cases for follow-up in the investigation.

The common elements of a case definition include information on symptoms, laboratory results, and the essential elements of person, place, and time.

Symptoms: People with the same illness do not always have the same symptoms, but they will experience similar ones. It is important to remember that the symptoms of some foodborne and waterborne illnesses can mimic other foodborne and waterborne diseases. For assistance in determining the incubation period and possible etiologic agent, please refer to the Kentucky Field Guide for Foodborne and Waterborne Diseases in Appendix C as well as the Control of Communicable Diseases Manual.

b) Laboratory results: When a laboratory confirmation is made, the task of defining a case is much easier. Hospitals or local clinicians in the affected jurisdiction may be notified that an outbreak exists and asked to notify the LHD of additional cases of the illness under investigation. **Note: during an outbreak of foodborne illness, efforts should be made to send specimens and/or isolates to the Kentucky Division of Laboratory Services (DLS) for further identification, confirmation and to assure coordination of the investigation. Please contact the Infectious Disease Branch before sending specimens.** (See

Appendices D, E, and F for more information on what testing is done at DLS.)

c) Person: The outbreak may or may not take place within a particular group of people. Therefore, characteristics such as age, sex, occupation, ethnic group, social affiliations or function attendance greatly assist in qualifying the case definition.

d) Place: When there is a common meal involved, the place is already established. But sometimes the only information available may be that cases are occurring in several different locations over the same time period. It is only after more information becomes available that the case definition will become more specific as to the location of the outbreak.

e) Time: If there appears to be a common meal involved, then the time between consumption of that meal and the onset of symptoms provides an indication of the incubation period. The incubation period and symptoms are helpful in determining which illnesses should be considered as possible causes of the outbreak and thus may facilitate decision-making regarding what types of laboratory tests should be run. As with symptoms, incubation periods can vary among individuals; therefore, one should consider a range of time of exposure for the case definition. For example, in the case of a salmonella outbreak, cases may be defined to include those persons who experienced symptoms consistent with the case definition anywhere from 6 – 72 hours after the meal in question.

The initial case definition is usually general so that potential cases are not left out. Once more information is obtained about the outbreak and the team is more certain of the characteristics of true cases, the case definition may be refined to "weed out" extraneous cases. This allows analysis to be more sensitive to true risk factors because ill persons who are probably not related to the current outbreak are excluded.

Case definitions are often broken into sub-categories based on the strength of evidence that this is a true case of the disease or is truly related to the particular outbreak being investigated. These designations are usually, "suspect," "probable," and "confirmed." A suspect case is usually one that has some symptoms similar to known cases, but may be missing a crucial symptom or may not link clearly to known cases and is not lab-confirmed. A probable case usually has all the crucial characteristics but is missing a final component of confirmation, such as a required final lab test, or an epidemiologic link to a known case. A confirmed case meets all the characteristics established in the case definition for a true case. CDC has established guidelines for the suspect, probable and confirmed case definitions for many diseases. Investigators may

want to modify these for a particular outbreak investigation to fit the current investigation needs.

Finding Cases

With the case definition in place, the next half of the equation is to decide how to find additional cases, (i.e., routine methods versus more intensive methods). Is it reasonable to rely on telephone reporting from physicians? Should case reports be actively solicited from area physicians, laboratories, or hospitals? Should the help of the local media be enlisted? These are all "judgment calls" which must be made while taking into account the severity of the disease, how widespread it is, the urgency of intervention, and the manpower available to find and interview case patients.

Develop a Line Listing

During this step (or even in Step 2 or 3), is a great time to start a line listing. A line listing is a simple list of case patients used to keep track of pertinent basic data for cases and potential cases as they are identified. Case names and numbers are listed down the left hand column, and the heading row at the top of the table should contain pertinent information such as the case's age, sex, onset time, and symptoms. This type of organization permits a simple means for comparison of many characteristics at one time, giving a quick way to look for possible patterns, similarities, or associations. Later in the investigation, the team may need to conduct a survey (discussed below) which would be facilitated by having all the case patients listed in one succinct table. As the investigation progresses, one may refine the line list to only include cases that meet a more specific case definition (see *Develop a Case Definition* section above) but initially it may be very inclusive of all potential cases in order to facilitate a broader look at verifying the outbreak and the diagnosis.

Example of a Line Listing Table

#	Name	Age	Sex	Onset Date	Onset Time	Symptoms
1	Mary	32	F	6/4/99	1:00 PM	Diarrhea, abd. cramps
2	Bob	25	M	6/4/99	1:30 PM	Diarrhea
3	Carol	26	F	6/4/99	10:15 AM	Diarrhea, nausea
4	Mark	18	M	6/3/99	11:30 PM	Diarrhea, abd. cramps

Develop the Questionnaire/Survey

A common method of finding cases and simultaneously gathering, organizing and analyzing initial risk factor data is to conduct a questionnaire or survey among the population believed to be at risk. This is particularly effective when the exposure event is already known (e.g., attendees of a wedding). A questionnaire that targets specific questions about foods eaten and symptoms experienced is a valuable epidemiologic tool. A questionnaire is solicited from those ill and well

who are associated with the incident and assists in developing better hypotheses about the etiologic agent's identity, the source of the infection, and the mode and time of transmission.

Key questions to consider when developing a questionnaire:

- What are the demographic characteristics of the individual? (name, age, sex, occupation, home and work addresses, phone numbers)
- Was the individual exposed to potential sources of infection and when?
- What are the symptoms, date of onset, their order of occurrence and duration?
- What medical treatment has been sought and received?
- Did anyone affected get a diagnosis or do they have laboratory results?
- Who else has been exposed to a case during his or her infectious period? (secondary contacts)
- What foods were consumed in the last 72 hours, or other appropriate time frame, before the time of onset? It is also important to interview and obtain food histories from those who ate the same suspect food and did not get sick.

These questions are intended as a guide. They will require modification to fit the particular circumstances surrounding the investigation. Questionnaires can be designed for personal or telephone interviews by the investigator (epidemiologist, nurse, sanitarian, health agent, etc.). Once again, it is important to administer the questionnaire to **all** associated with the exposure event, **both ill and well**.

The KDPH Enteric Disease Investigation Form should be completed for all confirmed or suspect Campylobacter, Cryptosporidium, Salmonella, Shiga toxin-producing E. coli (STEC), and Shigella cases. This form may also be used for suspected foodborne or waterborne outbreaks when the specific source or pathogen is not known. See Appendix I for the KDPH Enteric Disease Investigation Form.

NOTE: The KDPH Enteric Disease Investigation Form can be found in Appendix I.

There is a computer software program called Epi Info™ which can be used to develop questionnaires and analyze data. (The software is free. A copy can be obtained via the internet at www.cdc.gov/epiinfo). For more information about when to use a questionnaire, contact the Division of Epidemiology and Health Planning, Reportable Disease Section at (502) 564-3261.

3.1.5 Step Five: Describe the Data in Terms of PERSON, PLACE and TIME

The purpose of data orientation or epidemiological characterizations is to arrange all incoming data so that patterns or anomalies will be illuminated, both of which might be the key to determining the cause or source of the outbreak. The investigator searches for common associations to strengthen or amend current hypotheses and unusual occurrences to give additional clues. A common method of data orientation is plotting on a graph the cases by time of symptom onset to get an **epidemic curve**.

NOTE: An **epidemic curve** is a graph that depicts the association of the time of illness onset of all cases that are associated with the outbreak. It helps to determine whether the outbreak originated from a common source or is spread person-to-person. Time is plotted on the horizontal axis and the number of cases is plotted on the vertical axis.

A description of how to prepare an epidemic curve in Excel can be found at the following link provided in the *FOCUS on Field Epidemiology* newsletter, a product of the University of North Carolina Center for Public Health Preparedness.

http://cphp.sph.unc.edu/focus/vol1/issue5/1-5EpiCurves_flash.pdf

From the line listing and/or survey described above (Steps 3 and 4), information will have been collected on the characteristics of the ill persons (age, sex, occupation, exposures to specific foods or other items). Very often, simply by knowing these descriptive aspects and the diagnosis, and then plotting an **epidemic curve**, the source, mode of transmission, and who is at risk can be determined. Once the population at risk has been determined, appropriate control measures can be targeted.

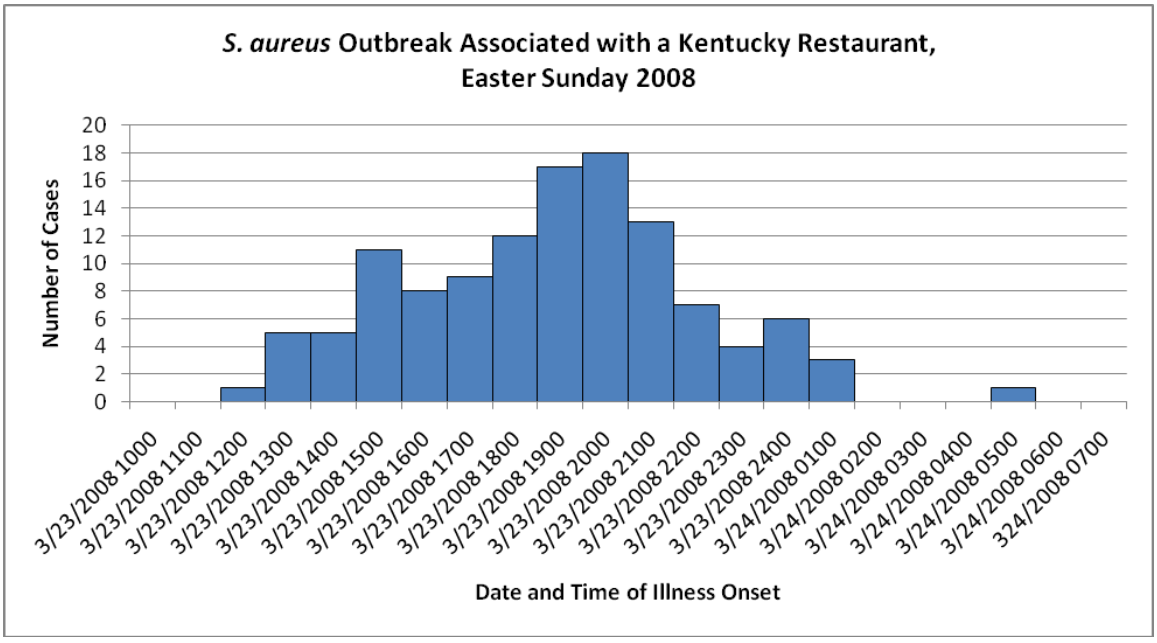
The shape of the epidemic curve may suggest what kind of outbreak is occurring. A *common-source* or *point-source outbreak* looks different than a *propagated-source, a person-to-person outbreak* or *a continual source outbreak*. Definitions of these kinds of outbreaks, and an example of each epidemic curve are found below. Epidemic curves are not only useful in pursuit of the investigation but are also helpful when communicating to lay persons (consumers, restaurant operators, etc.) the nature and magnitude of the outbreak spread.

NOTE: The following pages contain definitions and examples of the different kinds of outbreaks:

- Common-Source or Point-Source Outbreak
- Propagated-Source Outbreak or Person-to-Person Outbreak
- Continual-Source Outbreak
- Intermittent-Source Outbreak

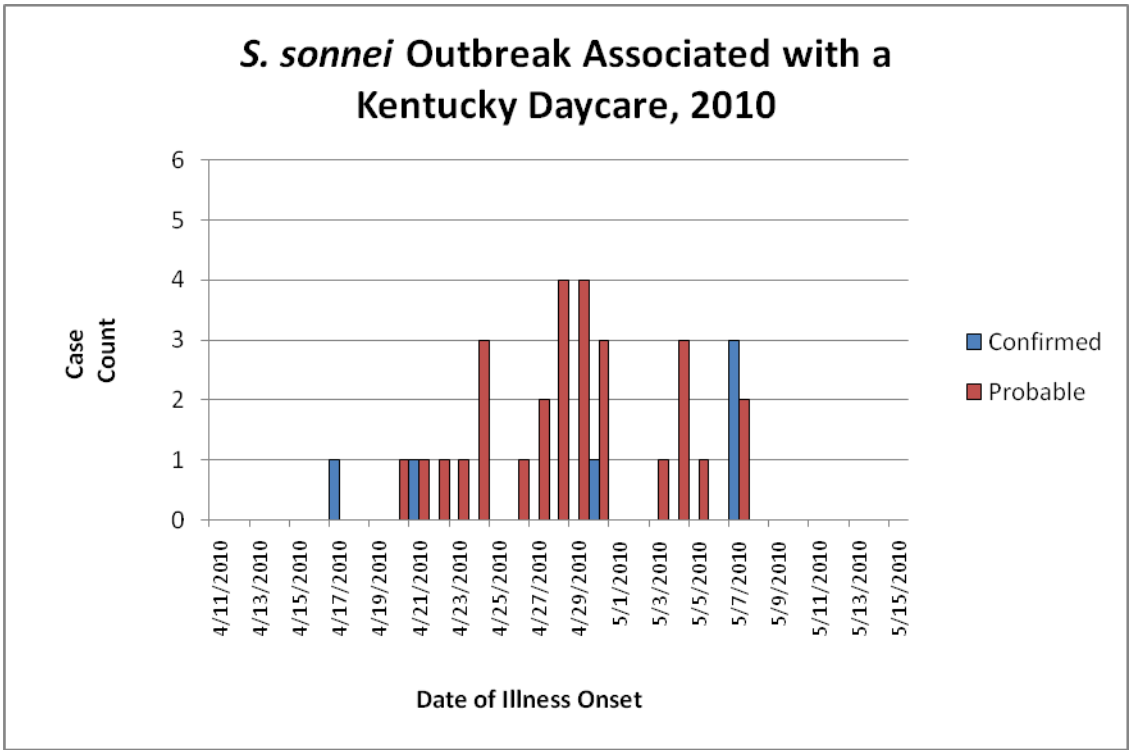
Common-Source or Point-Source Outbreak: An outbreak of illness in which susceptible individuals are exposed simultaneously to one source of infection. For example: guests at a company retirement party potluck. The epidemic curve for this type of outbreak is characterized by a sharp rise to a peak followed by a decline usually less abrupt than the rise. See Example 3.1 below. The slower decline is related to the manifestation of varying incubation periods in different individuals. Most people will get sick in a short time frame but others may have delayed onset based on several characteristics, such as the dose of infectious or toxic material they received, their body's defenses, when they ate the meal, and other factors specific to the person.

Example 3.1
Point Source Outbreak Epidemic Curve



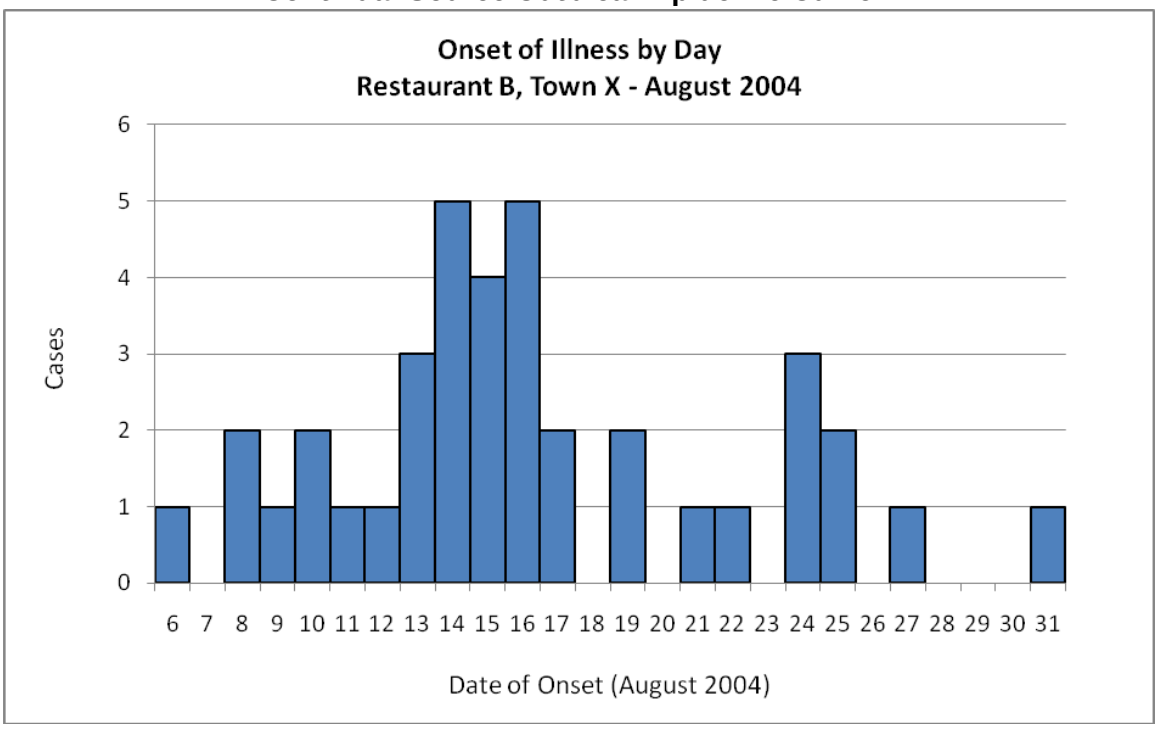
Propagated-Source Outbreak or Person-to-Person Outbreak: An outbreak of disease or illness that is spread from one person to another rather than from a single source. For example: a community-wide outbreak of shigellosis or pertussis. The epidemic curve for this type of outbreak is characterized by a relatively slow, progressive rise. The curve will continue for the duration of several incubation periods of the disease. Propagated outbreaks may exhibit periodic peaks that correspond to incubation cycles of the disease, particularly if the disease is highly infectious. This typically occurs earlier in the outbreak rather than later when infection is more widespread. See Example 3.2 below.

Example 3.2
Propagated-Source Outbreak Epidemic Curve



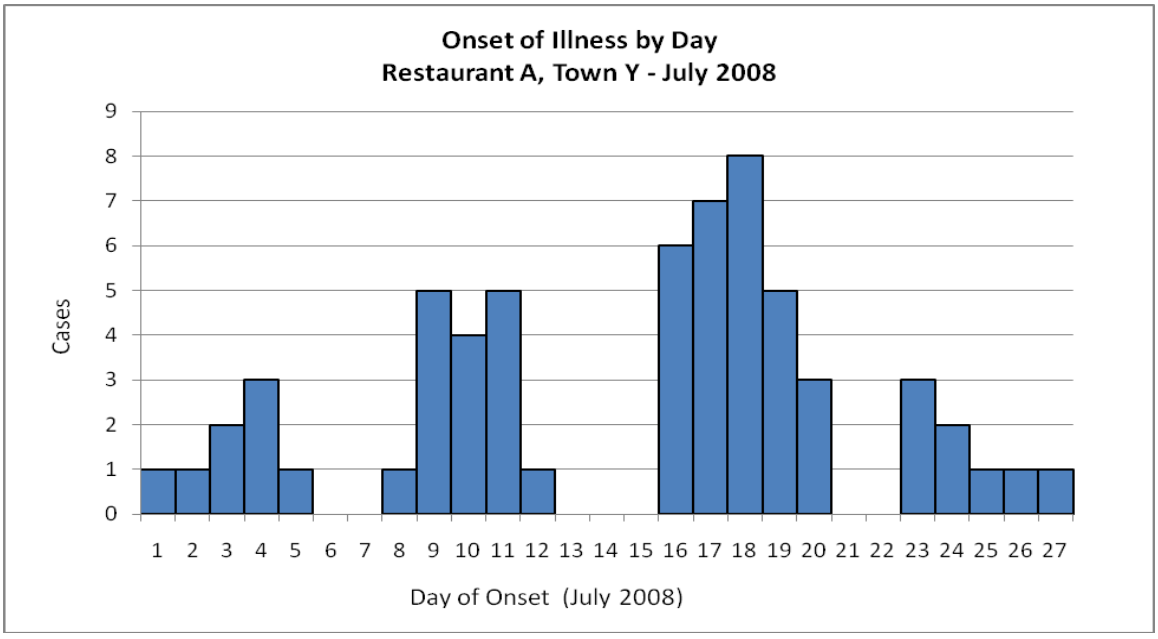
Continual-Source Outbreak: An extended outbreak of disease or illness caused by a source that continues to be contaminated. For example: an outbreak where food is continuously contaminated by an infected food handler. The epidemic curve for this type of outbreak is characterized by ongoing peaks over time (e.g., weeks, months). The peaks may not be as dramatic as a common-source epidemic curve, and the outbreak may not be as obvious (i.e., lower incidence). See Example 3.3 below.

Example 3.3
Continual-Source Outbreak Epidemic Curve



Intermittent-Source Outbreak: An extended outbreak of disease or illness caused by a source in which exposure is not consistent but intermittent in nature. This type of outbreak is characterized by an epidemic curve with irregular peaks and valleys and the incubation period is often unclear. Examples include chemical exposures at a worksite related to specific work processes that occur at different times, irregular emissions from a factory, or a sick food worker who serves on different days at restaurant while infectious over a period of time.

Example 3.4
Intermittent Source Outbreak Epidemic Curve



3.1.6 Step Six: Develop Hypotheses

Using the information gathered so far, the next step is to consider which specific exposure(s) may have caused the disease and develop a hypothesis (or several hypotheses). A useful hypothesis is testable, sensible, and fits the full picture of what has been learned as much as is possible. One example of a simple hypothesis is: The cases became ill after eating at a local restaurant. A more specific example, arrived at after further investigation, might be: The illness was caused by eating the potato salad at the Restaurant X's salad bar on Tuesday, June 5th.

As stated in Step 5 above, very often simply by knowing the descriptive aspects, the diagnosis, and then plotting an epidemic curve, the source, mode of transmission and who is at risk can be determined. To test or prove the hypothesis, analytical techniques such as statistical testing need to be applied using the data collected. The epidemiologist is usually the team member who specializes in statistical analysis and should be in charge of this part or consulted about analytic techniques. This may also be carried out by an epidemiologist at the state level or done in collaboration with the state staff.

One very important point in hypothesis development is that it is the job of the team to find the actual cause of the outbreak and not to prove or disprove any particular theory. Many times, a cause may seem obvious at first review but as the investigation progresses facts seem to conflict with this theory. It can be a strong temptation, especially when a scenario fits into the category of "what usually happens" in a certain type of outbreak, to bend the facts to fit the theory rather than bending the theory to fit the facts. The latter course is what should happen and needs to be protected against over-exuberant team members who have a pet hypothesis to prove.

NOTE: Although implementing control and prevention measures is not noted as a step on the outbreak investigation until Step 9, it should be noted that if at any time throughout the entire investigation, an ongoing, potentially hazardous source of illness is discovered, recommendations for control measures should be implemented immediately. Regulatory actions may also need to be taken.

3.1.7 Step Seven: Evaluate Hypotheses (Analyze & Interpret the Data)

In order to evaluate a hypothesis, one must compare the hypothesis with established facts. There are many ways to do this, including lab testing and environmental investigation, which may confirm or deny the plausibility of a given hypothesis. The primary tools that epidemiologists use in foodborne and waterborne outbreaks are specific study designs. These study designs are particular ways of collecting and analyzing data that allow easy comparisons of hypotheses to facts (the data collected). The basic epidemiologic study designs are the **"Case/Control"** and **"Cohort"** studies.

Cohort Study

Cohort studies are used when a whole group of people who might have been exposed can be surveyed to test hypotheses about what caused the illness. This is the typical study done in foodborne outbreaks when one can identify all who

ate at a restaurant, for example. All people had an equal chance of being exposed but only some got sick. This type of study can be done retrospectively, and commonly is in foodborne outbreak investigations. *All* people who ate at the restaurant during a given period of time are asked what specific food items they ate and if they became ill. We then compare food exposures to illness status to determine what food items might have caused the outbreak.

To do this in a foodborne illness outbreak, food-specific **Attack Rates** (AR) are calculated. Attack rates are used to determine if one or more food items were responsible for causing the illness. The food that caused the problem shows a higher attack rate in persons who ate the food than in those who did not. The AR is usually expressed as a percent. It represents the proportion of ill persons observed due to a specific exposure or event.

Attack Rate (AR)
The Attack Rate is simply the percentage of people who become ill out of all who were exposed. Example: If 228 people attended the catered wedding banquet and 46 got sick, the Attack Rate would be 46 / 228 x 100 or 20.2%.

When doing analysis in a cohort study design, the common measure of exposure is the **Relative Risk (RR)**. When several sources of exposure are implicated (a fairly common situation), the epidemiologist can run a model on the computer that compares all the food items at once and arrives at relative risks for each item compared to all the others so that the one with the greatest likelihood of being the culprit can be identified.

Risk
Risk is the percentage of people who become ill divided by all who were at risk and in an acute outbreak setting is represented by the Attack Rate.

And

Relative Risk (RR)
A Relative Risk is a proportion. It is the risk among those exposed to some risk factor divided by the risk among those who are not exposed. For example, in a restaurant outbreak, if 28 of 90 people who ate asparagus got ill (31.11%) while only 3 of 98 who didn't eat it got sick (3.06%), the RR is 31.11 / 3.06 = 10.2. In other words, people who ate asparagus were 10.2 times more likely to become ill than those who did not eat asparagus.

Case/Control Study

Case/control studies are used primarily when the illness is rare or when it is easier to select participants for the study based on illness status. This is different from a cohort study because participants are selected not on where they ate, or swam, or lived, but on whether they got sick or not. This can be

used in the typical restaurant outbreak when there are so many patrons that surveying them all would not be possible. In this case, all or a random selection of sick patrons can be enrolled in the study and then controls, or well people who also ate at the restaurant, can be selected randomly from restaurant patrons or groups of patrons. The primary measure of association that is used with case/control studies is the **Odds Ratio (OR)**. This compares the "odds of exposure" to particular sources of infection between cases and controls, indicating the most likely sources.

Odds

An "Odds" of something happening is the probability of it happening divided by the probability of it not happening. In the case of outbreak investigation, it is applied to the probability of having a risk factor among those who are ill or not ill. For example, if we have 31 sick people in a particular outbreak and 28 of them ate the asparagus, then the odds of exposure to asparagus among the sick is (28/31) / {1 – (28/31)} = 9.33.

and

Odds Ratio (OR)

The Odds Ratio is a ratio of the odds of having exposure to a particular risk factor among the sick divided by the odds of having the risk factor among those who are not ill. To continue the example above, if we find additionally that 26 ate asparagus among 62 people who did not get sick then the odds of exposure to asparagus among these controls is (26/62) / {1 – (26/62)} or 0.72. Thus, the Odds Ratio for the odds of exposure to asparagus between the ill (cases) and not ill (controls) is 9.33 / 0.72 or 12.96. Interpreting this, ill people were nearly 13 times as likely as not ill people to have eaten asparagus.

3.1.8 Step Eight: Refine Hypotheses and Carry Out Additional Studies

Analytic studies often reveal results that require modifications of, or fail to confirm, the hypotheses that were originally generated. Additional sources of infection may be identified through the investigation. The existing hypotheses may need to be modified or new hypotheses generated. In either case, the hypotheses will need to be tested requiring further studies be conducted.

For example, based on evidence gathered, the team generates a hypothesis that the salad was the vehicle of transmission in a salmonella outbreak. The next logical questions are, "How did the salad become contaminated with salmonella and could this be verified with the results of the environmental investigation?" In other words, are the epidemiologic results plausible and consistent with other investigational findings? For instance, salad is not usually a food that harbors salmonella. However, it can become contaminated when ill or infected food handlers prepare the salad without adequate hand washing or use of gloves. Compare hypotheses to the results of the environmental investigation. Did the inspector note how the salad was made and served? Was it possible for this scenario to have happened? Was any of the salad available for lab testing? Can laboratory results confirm that salmonella found on the salad matches that found in a patient's stool specimen? Some of the questions that need to be addressed to make sure that the hypothesis is not only statistically sound, but makes sense in the real world are:

- Could the hypothesized events actually have happened?
- Is the hypothesis consistent with environmental aspects of the investigation?
- Is it likely the vehicle of transmission identified became contaminated with the organism that has been isolated?

NOTE: Not all outbreaks have a resolution. In fact, it is rare when everything comes together and a cause can be definitively determined. Investigators should not become discouraged. Careful development of epidemiologic inferences coupled with persuasive clinical and environmental evidence will almost always provide convincing evidence of the source and mode of the spread of a disease. In most cases, there will be enough evidence to present a plausible hypothesis.

3.1.9 Step Nine: Implement Control and Prevention Measures

Control Measures

Once an outbreak is identified, control measures are important for interrupting disease transmission and/or limiting exposure to the source of infection. If a pathogen or other suspected source of the outbreak is identified, control measures should target specific agents, sources, or reservoirs of infection.
The objectives of foodborne and waterborne outbreak control measures are:

- Control of Source
- Control of Secondary Transmission
- Prevention Future Outbreaks

NOTE: **Be advised that control measures can sometimes be implemented very early in an outbreak investigation.**

Control measures should be implemented at the first available point in the investigation and should occur concurrently with other investigation steps. Often, non-specific control measures can be put into place regardless of the type of disease or source. Decisions should be made based on available evidence and control measures should be prioritized in consultation with Epidemiologists, Environmentalists, and Laboratory personnel, if available.

Control of Source

Known Pathogen, Unknown Source

If a source of infection has not been implicated but the pathogen is known, control measures will include non-specific recommendations in order to prevent secondary spread among known cases.
Non-specific control measures may include:

- Communication with healthcare providers
    - Advice about specific treatment and follow up
    - Ways to avoid spread
    - Infection control precautions for hospitalized or institutionalized patients
    - Reporting newly identified cases to the local health department
- Communication with the public
    - Practical measures to decrease risk
    - Basic food/water safety recommendations
    - Instructions on what to do if illness is suspected
    - Contact information for public health officials

- Outbreak communications with the public must balance the potential for legal or economic consequences for implicated sources and the health consequences of no communication (harm to industry vs. harm to consumers)

Known Pathogen, Suspected Source

Once an association between an exposure and illness has been identified, control measures should be implemented based upon the known exposure and the suspected pathogen. Information such as suspected source of infection (i.e. food item/water exposure), incubation period, symptom profile, and duration of illness can assist the investigator in narrowing down the list of suspected pathogens (Appendix C contains information to support this process). If a facility has been implicated as a common exposure but no specific food or water item has been identified some steps to implement regardless of the disease include:

- Review the history of the implicated establishment to identify previous outbreaks or issues.
- Environmental Assessment by Environmental Health Personnel from the Local Health Department
  - Including an inspection of the implicated facility
    - Educate employees about the implicated disease and about general infection control precautions
    - Observe food preparation processes
    - Assess food holding temperatures
    - Observe food service processes
    - Review appropriate logs for quality control
    - Interview facility manager and food service workers
    - Determine if any employees are ill
    - Determine if there have been any issues with systems and processes at the facility (e.g. pool filters, water treatment systems, coolers, etc.)
    - Obtain menus of food served for 1 week prior to earliest case illness onset
  - Quarantine or collect any suspect food item(s) for testing (if applicable)
  - Collect water samples for testing (if applicable)
  - Recommendations for control measures should be made, based upon inspection findings, including, but not limited to:
    - Properly holding the leftovers for further laboratory analysis if warranted
    - Stopping bare-hand contact

- Emphasizing hand washing
- Monitoring time and temperature control of food
- Excluding employees ill with gastrointestinal symptoms (vomiting and diarrhea)
- Prohibiting serving of uncooked foods if any possibility of norovirus exists
- Cleaning/sanitizing of equipment and other high-touch areas
- Corrective actions for treatment or chemical balance of recreational water (if applicable)
- Closing of specific parts of a facility (e.g. kiddie pool, a specific food service area, etc.)

o Closing the facility:
- If site inspections reveal a situation that poses a continuing health risk to consumers, it may be advisable to close the premises until the problem has been solved. Ideally, this will be done with:
  - the agreement of the business or
  - enforced by law through a closing order
- Once closed, they should be monitored by the appropriate authorities and remain closed until reopening is approved.
- Potential consequences (economic or legal) for closing a facility should be weighed against the likelihood of additional cases occurring if the facility is not closed.

o Removing implicated foods from the market:
- The objective of food recall and food seizure is to remove implicated foods as efficiently, rapidly and completely as possible from the market.
- A **food recall** is undertaken by any business responsible for the manufacture, wholesale, distribution, or retailing of the suspect food and may be initiated by the business itself or undertaken at the request of an appropriate health authority.
- **Food seizure** is the process by which an appropriate authority removes a food product from the market if the business does not comply with the request to recall.
- The longer the time that passes between a food appearing on the market and it being identified as a potential source, the less likely is the recovery of that food. This should be coordinated with appropriate food safety agencies.

* Remember: **Those participating in facility improvement recommendations (corrective actions), facility closures, food seizures, or food recalls must balance potential consequences (economic/legal) against the likelihood that any action taken will prevent further cases of disease**.

- Modifying a facility's process:
  - Once the investigation identifies the specific issues in a facility's process that may have contributed to the outbreak, corrective action should be taken immediately to avoid recurrences. Examples of corrective action are: modification of water treatment procedures, modification of recipe or process, reorganization of working practices, change in storage temperatures, or modification of instructions to consumers.
- Menu modification to remove a suspected food from the menu until control measures are in place
- Excluding ill food workers

- Public Health Agency communication with the public regarding suspected source

  Although the business may have already issued a press release, the Public Health agency may decide to notify the public. Ideally, this should be coordinated with the business and done on the same day as the decision to close a facility or recall a food product. Information given to the public should include:
  - Actions the consumers should take to prevent further exposure and illness
  - Name and brand of the food product (including labeling) being recalled
  - Name and location of the implicated facility (e.g. swimming pool name, city, state)
  - The nature of the problem, the reason for the facility closure or recall of the product, and information about how the problem was discovered
  - Names and locations of the food producing establishment and point of contact
  - Locations where the product is likely to be found

  - Product numbers, amounts, and distribution
  - A description of common symptoms of the illness associated with the contamination
  - Appropriate food-handling information for consumers
  - Appropriate water safety information for consumers
  - Actions that consumers should take if illness occurs

Control of Secondary Transmission

Communication with Healthcare Providers

- Encourage reporting newly identified cases to the local health department or the Kentucky Department for Public Health
- Provide specific treatment guidelines
- Provide infection control guidance
- Encourage appropriate specimen collection

Public Advice

If contamination of the water or food product cannot be controlled at the source, or a facility cannot be temporarily closed, steps need to be taken to eliminate or minimize the opportunities for further transmission of the pathogen. Depending on the situation, appropriate public advice may be issued during a period of hazard. For example:

- Cleaning/disinfecting high-touch or high-risk areas, such as, areas in the bathroom
- Boiling microbiologically contaminated water or avoidance of chemically contaminated water
- Advice on proper preparation of foods
  - Avoid cross-contamination
  - Thoroughly wash fruits and vegetables prior to cutting
- Advice on proper disposal of implicated foods
- Emphasizing personal hygiene measures (e.g. washing hands after defecation and urination and before preparing or consuming food)
- Avoid eating food that has not been handled properly (e.g. hot food that has not been kept hot, cold food that has not been kept cold)
- If an individual has diarrhea, do not prepare food for others, until symptoms have stopped
- If an individual has diarrhea, do not swim in pools or hot tubs, until symptoms have stopped
- Public notices to avoid swimming/bathing in suspected bodies of water

Exclusion of Infected Person from Work and School

The risk of infection being spread person to person depends on their clinical state and their personal hygiene. People with diarrhea are more likely to spread infection than asymptomatic individuals with subclinical illnesses. For certain illnesses, individuals in high-risk settings may be required to have two negative stool cultures collected 24 hours apart and 48 hours after completion of antibiotic treatment, before being cleared to return to work/school. Disease specific criteria may be found in the American Academy of Pediatrics *Red Book* or the *Control of Communicable Diseases Manual (CCDM).* In general, the following groups with diarrhea or vomiting should be excluded from work or school until they are no longer infectious:

- Food-handlers
- People who have direct contact with highly susceptible patients or persons in whom gastrointestinal infection would have particularly serious consequences (i.e. health care workers, daycare workers)
- Children under age 5
- Older children and adults with doubtful personal hygiene or with unsatisfactory toilet, hand-washing or hand drying facilities at home, work, or school.

If these individuals cannot be excluded from work, consider restricting them to specific areas and tasks that provide minimal risk for transmitting the disease.

*When making decisions to exclude individuals, the legal and economic impact of exclusion of individuals from work or school should be considered.

Food or Water Potentially Contaminated by an Infected Individual

Identify potentially contaminated food items or water sources that may be contaminated by an infected individual.

- Embargo or dispose of potentially contaminated food items
- Treat or take other measures necessary to control the spread of disease through water sources potentially contaminated by an infected individual (e.g. shock treatment of pools, draining and cleaning of hot tubs, etc.)

Facility Control Measures

The facility should create a risk-control plan or have an infection control plan in place, including:

- Employee training
- Adequate oversight to ensure procedures are being followed
- Staff education
    - Implicated disease
        - Symptoms

- Mode of transmission
- Prevention of spread

o Infection control precautions

- Procedures for proper food handling
- Proper personal hygiene practices
- Personal Protective Equipment (PPE)
- Cleaning/Sanitizing surfaces and equipment
- Isolation of ill individuals in hospitals, healthcare facilities, or institutions
- Disposal or decontamination of contaminated clothing, surfaces, or bedding

* Recommendations for infection control practices are frequently changed and updated; therefore check key sources such as CDC to ensure the organization or facility's recommended practices are up to date.

3.1.10 Step Ten: Communicate the Findings, Write a Report and Enter into the National Outbreak Reporting System (NORS)

After analysis of epidemiologic and environmental data, conclusions should be summarized in a report and sent to KDPH. This is one of the most important steps in the outbreak investigation. Not only does the report detail the agency's efforts, but identifies a potential source(s) of the outbreak and suggests control measures to prevent future illness.

The report should follow one of two suggested formats: **1) scientific format** or **2) After Action Report format**. The usual scientific format follows the following outline: introduction, background, methods, results, discussion, recommendations, and references. The After Action Report format should be used if an LHD or KDPH Department Operations Center (DOC) is activated and should follow this outline: Handling Instructions; Contents; Executive Summary; Section 1: Event Overview, including Event Details, Event Leadership, and Participating Organizations; Section 2: Event Summary, including Event Purpose, Objectives, Capabilities and Activities, Scenario Summary, Supporting Events or Event; Section 3: Analysis of Capabilities; Section 4: Conclusion; and the following appendices, as appropriate: Appendix A: Improvement Plan Appendix B: Lessons Learned (optional); Appendix C: Participant Feedback Summary (optional); Appendix D: Event Summary Table (optional); Appendix E: Performance Ratings (optional); Appendix F: Acronyms.

Do not use the names of case-patients, but LHD personnel or authorized personnel involved in the investigation may be included. The names of facilities or locations where the outbreak occurred may be included at the discretion of the LHD.

NOTE: For detailed information on writing a report and sample reports see Chapter 4**.**

NORS

During the process of preparing the outbreak report or immediately after submitting the final report to KDPH, the regional epidemiologist should enter the outbreak into NORS. NORS is a Centers for Disease Control and Prevention (CDC) developed web based outbreak data entry system for waterborne, foodborne, enteric person-to-person, animal contact, and environmental contact disease outbreaks. This is an important step to ensure that the CDC is aware of Kentucky's foodborne and waterborne outbreak responses. A sample of the NORS reporting forms are included in Appendix J. Questions regarding NORS should be directed to the KDPH Division of Epidemiology and Health Planning, Reportable Disease Section at (502) 564-3261.

3.2.1 Steps in Investigating and Managing Multiple Outbreaks Occurring Simultaneously

Large-scale outbreaks (any outbreak for which the response needs exceed the ability of the jurisdiction to manage with existing resources), outbreaks involving multiple jurisdictions, or multiple outbreaks occurring simultaneously may overwhelm local health departments or the Kentucky Department for Public Health. This section provides information related to the process of managing multiple outbreaks occurring simultaneously.

The KDPH Disease Outbreak Investigation Support Plan (under development) contains the detailed protocol for the management of investigations of multiple outbreaks occurring simultaneously, regardless of etiology. This section in this manual provides a basic overview of the process for foodborne and/or waterborne illness outbreaks.

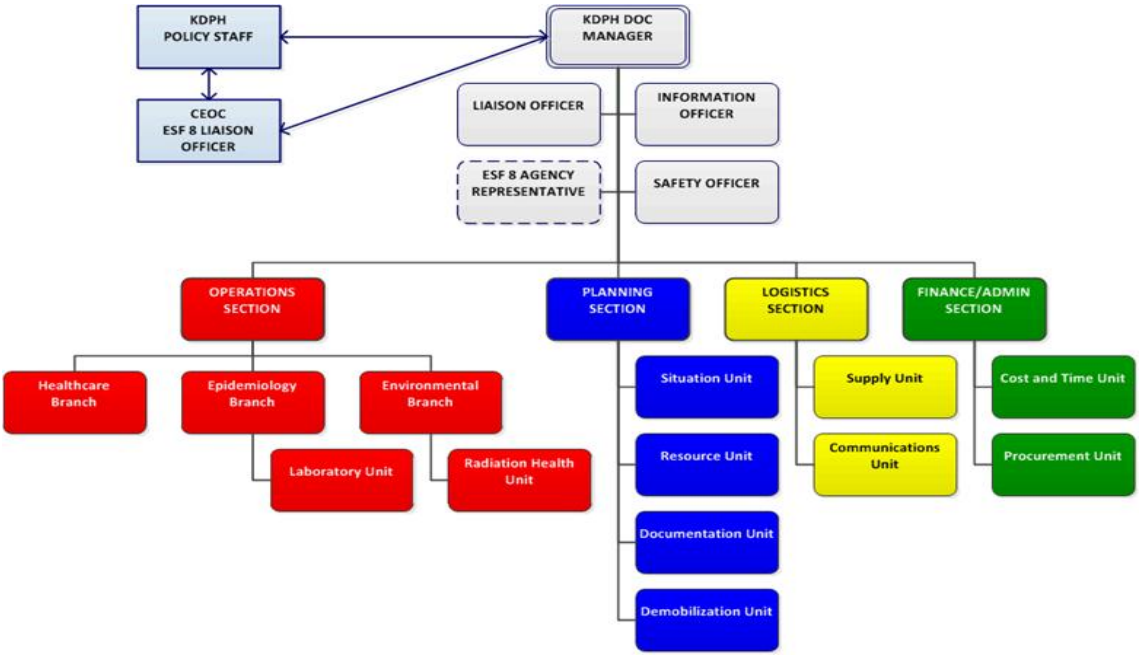
Command

All large-scale outbreaks, outbreaks involving multiple jurisdictions, or multiple outbreaks occurring simultaneously should be managed using the Incident Command System (ICS). The Incident Command System is a standardized,

incident management approach that enables a coordinated response among various jurisdictions and agencies, establishes common processes for planning and managing resources, and allows for the integration of facilities, equipment, personnel, procedures and communications operating within a common organizational structure.

In the event of a large-scale outbreak, outbreaks involving multiple jurisdictions, or multiple outbreaks occurring simultaneously, the KDPH Department Operations Center (DOC) shall be activated in order to manage the overall response to these events.

The following is a basic command structure that may be used when the KDPH DOC is activated in response to disease outbreaks.



The KDPH DOC Plan provides the framework for management of any type of incident of public health significance, including disease outbreaks. The KDPH DOC Plan provides detailed information related to activation levels and operations during any event of public health significance, including multiple outbreaks occurring simultaneously.

Roles and Responsibilities

No matter the size of the outbreak, all outbreak investigations follow the same process as outlined previously in this chapter. During large-scale outbreaks, outbreaks involving multiple jurisdictions, or multiple outbreaks occurring

simultaneously, it is imperative that resources be managed so that the most effective and efficient response can be executed.

Subject-matter experts will be assigned to specific operational roles based upon their area of expertise. Subject matter experts will be responsible for providing disease-specific consultation and recommendations to the Operations Section.

The Operations Section Chief should be an individual who has an epidemiology background but does not need to be a disease subject-matter expert. The role of the Operations Section Chief is to facilitate the epidemiological operations for the Department.

The Operations Section may be divided into multiple sub-sections, depending upon the number of outbreaks occurring. Each sub-section will have a "lead" that will be responsible for the coordination of the KDPH response to a specific outbreak. This sub-section lead will be responsible for maintaining situational awareness related to their assigned sub-section, to include providing situational report drafts to the Planning Section Chief; the individual sub-section Lead's skills may be used across multiple outbreaks due to the multiple operations proceeding simultaneously. The division of the Operations Section into multiple sub-sections is the key to a successful response to multiple, simultaneous outbreaks, as this provides outbreak-specific management and a single point of contact each investigation/response for situational awareness.

Collaboration with other Agencies

Multi-disciplinary coordination is crucial to an effective and efficient response to foodborne and/or waterborne outbreaks. Support for outbreak investigations may come from various divisions or departments within the Kentucky Department for Public Health or from other Agencies within the State and Federal Government. The nature of the outbreak will dictate the involvement of other agencies.

Support Agencies:

- Local Health Departments
- Regional Child Care Consultants
- KDPH Division of Epidemiology and Health Planning
    - Public Health Preparedness Branch
- KDPH Division of Public Health Protection and Safety
    - Food Safety Branch
    - Environmental Management Branch
- KDPH Division of Laboratory Services
- KDPH Division of Maternal and Child Health – Early Childhood Development Branch – Early Childhood Promotion Section

- Cabinet for Health and Family Services (CHFS) Office of the Inspector General
- CHFS Office of Communications
- Kentucky Department of Corrections
- Kentucky Department of Agriculture
- Kentucky Department of Fish and Wildlife
- Kentucky Energy and Environment Cabinet
- Kentucky Emergency Management
- Centers for Disease Control and Prevention (CDC)
- U.S. Food and Drug Administration (FDA)
- U.S. Department of Agriculture (USDA)

Surge Capacity

When LHDs and KDPH have exceeded their ability to respond, there are resources available to assist in the response.

- **Epidemiology Rapid Response Team (ERRT)** – the ERRT is a state-wide cadre of individuals, environmentalists, nurses, and epidemiologists, who are trained in epidemiological methods and have the expertise to conduct outbreak investigations. Each ERRT member has a sign-off sheet on file with KDPH signifying agreement by their health department that they may be used as surge capacity during epidemiological investigations anywhere in the Commonwealth of Kentucky.
    - This resource may be accessed by making a request the respective LHD housing the ERRT members. This process is further outlined in the Disease Outbreak Investigation Support Plan (under development).
- **KDPH Program Staff –** In addition to the ERRT, there are KDPH staff members who can assist with data entry, data analysis, interviews, and other epidemiological activities. These individuals are employed in various Divisions across the Department and may be accessed by a request to their supervisor.
- **Other Departments and Agencies** – staff from other departments or agencies in the State may be available to assist with various aspects of outbreak investigations, these may include regulatory and inspection functions related to food or water.
- **Medical Reserve Corps** – Kentucky maintains a volunteer program, sponsored by the Office of the Surgeon General of the United States, for both medical and non-medical volunteers. Each county in Kentucky is covered by a Medical Reserve Corps unit, with most units being sponsored by local health departments in conjunction with local emergency management agencies. All MRC volunteers are pre-credentialed and trained to respond during large-scale public health emergencies to provide surge capacity. These volunteers may be called upon during large-scale outbreaks; outbreaks involving multiple jurisdictions; or multiple outbreaks

occurring simultaneously, to assist with various aspects of data collection, entry, or analysis.

- **Kentucky Public Health Assistance and Support Teams –** "K-PHASTs" are comprised of public health students and faculty from Kentucky Universities. Members of these support teams may be called on at both the State Health Department and Local Health Department levels to assist during public health emergencies or special projects. The Kentucky Department for Public Health is responsible for training these teams at each university on an annual basis. The training consists of an overview of the public health system in Kentucky, use of the incident command system during public health response, the steps in investigating an outbreak, and interview techniques. Just-in-time training may be provided for each K-PHAST team when deployed.

After Action Report and Corrective Action Plan

After an activation of the DOC in response to large-scale outbreaks, outbreaks involving multiple jurisdictions, or multiple outbreaks occurring simultaneously, an evaluation of the response must be completed. All outbreak responders should assemble and participate in an event de-brief and response hotwash. During this debrief and hotwash, an overall summary of the response will be given, along with a discussion of response successes and lessons learned. Successes and lessons learned should be recorded for inclusion in an After Action Report. An After Action Report must be completed, including an Improvement Plan, within 120 days of an event. Following completion of the After Action Report and Improvement Plan, an After Action Conference shall occur, where these documents are discussed with all stakeholders. During this conference, corrective actions noted in the Improvement Plan shall be discussed, including the identification of the primary responsible agency for each corrective action and the assignment of a completion date for each task.

After Action Reports and Corrective Action Plans from all foodborne and/or waterborne outbreak investigations shall be reviewed on an annual basis in conjunction with the annual review of this manual, thereby allowing any corrections or additions to be addressed during the manual update.

Reporting Requirements

Report all outbreaks in NORS and as appropriate, the AAR/IP should be recorded in the Homeland Security Exercise and Evaluation Program (HSEEP) Corrective Action Program System (CAP).