

Technical Aspects of Outbreak Investigations

November 7, 2013

Nicole Lee, Foodborne Disease Epidemiologist, MPH

SLIDE 1 –TITLE

SLIDE 2

Hello. My name is Nicole Lee and I'm going to go over some of the technical aspects of outbreak investigations.

SLIDE 3

By the end of this presentation, you should be able to define and explain these three objectives.

The first is regarding case definitions. We will talk about what a case definition is as well as the differences between surveillance and outbreak case definitions.

The second objective is to describe the purpose of line lists and the various components of a line list.

The third objective is to recognize the importance of why the earliest date of symptom onset should be collected for each person in every outbreak.

Of course, there are many more technical aspects of an outbreak and I will mention a few of them at the end. This presentation serves as an introduction to the basic technical aspects.

SLIDE 4

Let's begin by talking about case definitions. They are a fundamental part of outbreak investigations and should be established at the very beginning of an investigation. So what is a case definition? Simply put, it is how you define a case. A case definition is created to help determine if someone should be included in the group of individuals that may be associated with an outbreak of a specific disease. It ensures that you have a standard way of categorizing people. For example, if you were to ask me if someone who is 5 feet 9 inches tall is tall, I would say yes. But if you ask someone else that same question that person may say no. But, if you further define "tall" as someone who is 6 feet tall or greater, I now know what the standard is and can compare anyone you ask me about to that standard. Your case definition creates a uniform standard that can be applied to each person in the group you are evaluating.

Generally, you start with a “loose” definition early in the investigation, which lends itself to identifying anyone who might possibly be a case. It is better to gather too much information than too little. For instance, getting information about patients that later end up not being true cases is better than having to go back and find cases that you mistakenly ruled out early on. As you become surer of the symptoms and the agent, the place of exposure, and the time frame, you can safely narrow the case definition.

SLIDE 5

We also need to establish the difference between surveillance and outbreak activities.

SLIDE 6

Our duties in public health are to report and maintain surveillance of reportable conditions. This is something that occurs each day.

Another duty of public health is to investigate and implement control measures for reportable conditions. This applies during outbreak situations as well. Thankfully, outbreaks do not occur daily.

SLIDE 7

Surveillance must be maintained daily – both during outbreak and also when there are no outbreak. Our surveillance is used locally, statewide, and nationally, to understand the occurrence, trends and changes in reportable conditions.

Outbreaks, on the other hand, do not occur daily – thankfully. Outbreaks are addressed as they are identified. When they do occur it is our job to investigate and implement control measures.

SLIDE 8

So let's get back to the original question regarding the difference between surveillance case definitions and outbreak case definitions. Surveillance case definitions don't change often because they are used for our daily surveillance activities. You may notice that the last time some were changed was in 2003 (some earlier and some later). Any changes that do occur have to go through an internal and external review process. Most surveillance case definitions are created by the Counsel of State and Territorial Epidemiologists (CSTE) in collaboration with the CDC but a few are specific to North Carolina. These surveillance case definitions include a laboratory and clinical component. In addition, there are usually three classifications (confirmed, probable, and suspect in some instances). All cases that meet your surveillance case definition get entered into NC EDSS.

Your outbreak case definition is not fixed. It is used as standard (like we mentioned earlier) to determine who should and should not be considered as part of the outbreak, so it may change as you

gain more information. This is not uncommon. The important point is to have a case definition from the very beginning that has components of person, place, and time (which we will discuss in further detail later). Outbreak case definitions also have confirmed, probable, and suspect classifications. Suspect cases using your outbreak case definition may not get entered into NC EDSS, depending on the circumstances.

SLIDE 9

Here are some examples. We have listed here the surveillance case definition for Salmonella on the left and an example of an outbreak case definition for a Salmonella outbreak on the right.

Let's start with the box on the left that describes the current surveillance case definition for Salmonella.

The laboratory component of our Salmonella surveillance case definition defines a confirmed case as one where Salmonella is isolated from a clinical specimen, which means Salmonella was cultured from a clinical specimen. A suspect case from the laboratory component is when Salmonella is detected from a non-culture based method (i.e. PCR).

The case classification in our Salmonella surveillance case definition can be one of three: confirmed, probable, or suspect, and each is based on laboratory and/or clinical illness.

Now let's look to the box on the right for the example of an outbreak case definition for Salmonella. Remember, it needs to contain the aspects of person, place, and time. So we have An X county resident experiencing diarrhea or vomiting within 7 days of eating at such and such restaurant. As you can see the outbreak case definition is very specific to that particular event in time. It can further be categorized into confirmed and probable cases. Confirmed are those who meet case definition AND have a Salmonella isolate result from the lab. Probable are those who meet case definition but do not have a Salmonella isolate from the lab.

SLIDE 10

Let's think about outbreak case definitions in terms of real life...

SLIDE 11

You get a call about a lot of people saying they started getting sick after a particular event. The graphic just shows a few possible scenarios. The sickness could be gastrointestinal or respiratory. The event could be anything from eating at a restaurant, to being enrolled in a childcare facility or long term care facility.

SLIDE 12

So there are a lot of people in your county and you need to decide who you should count as part of this outbreak so you can further investigate.

SLIDE 13

Your case definition determines who (out of all of those possible people) goes in the box of people you need to investigate further.

SLIDE 14

Remember the three components of a case definition? Person is one of them and here are a few examples. You can decide that your criteria will be someone with XY or Z symptoms who is a resident, visitor, patron, etc.

SLIDE 15

A few examples of place include: county, restaurant, or a particular childcare or long term care facility. If an outbreak is large you may end up listing multiple counties.

SLIDE 16

Here are a few examples of time.

SLIDE 17

Here are all of those pieces put together in a case definition.

Onset of nausea, vomiting, or diarrhea in a patron of restaurant X within 7 days of eating or drinking food/beverage from restaurant X.

SLIDE 18

Now we have a standard that we use to categorize all of the people who want to know if they are part of your outbreak.

SLIDE 19

Using that standard case definition for everyone (in this example) we identified 16 people who met case definition.

So your case definition has helped you to identify people who may truly be part of your outbreak. This allows you to use your time where it counts instead of pursuing people who do not need to be included.

SLIDE 20

Now let's talk about line lists

SLIDE 21

After the case definition, the line list is the next most important technical aspect of outbreak investigations. Knowing your case definition will help you to decide who needs to go on your line list.

The line list is a file or record (or list) of each ill person associated with your outbreak. It is important to keep a list of these people in one spot that is easy to locate, read, and use. Things can get quite hectic during an outbreak and the line list is the place where you are able to have the same information about each person in one spot. This helps in terms of organization and summarizing the information you have at the moment.

SLIDE 22

Here's an example of a line list that was created in Excel. Each row represents an individual ill person. The same information is listed for each person for easy comparison of how many males and females you have, what the age range is, how many saw a provider or were hospitalized, etc. A lot of important information is all in one place, which is why the line list is such an important technical aspect of outbreak investigations.

SLIDE 23

During an outbreak you may get a lot of questions about your cases. The top picture is what often times is used to answer questions – a lot of stacks of interview forms are fumbled through to get the answers. That's not the most efficient use of time.

What we prefer to see instead is an electronic line list where the information for all of your cases is summarized in one place where you can easily review to answer questions.

SLIDE 24

Here we list the various types of information we deem necessary on a line list. It is broken down into categories to help you remember the components.

Identifiers are a necessary component of line lists. It's great to include the NCEDSS ID# in your line list. It not only helps you in looking up a case, but it is also a great way to see which cases you still need to enter into the system.

By listing demographics you're able to see the characteristics of your ill group. Are more adult women ill or more children? Are all the ill from a specific area of your county or all over the place instead? These are important questions that your line list can quickly answer.

The healthcare category on your line list is a good indicator of severity of illness (i.e. visits to providers versus hospitalizations) and treatment.

Symptomology is a necessary component because most infectious diseases have specific clinical picture in terms of symptoms, duration of illness and average incubation period.

Laboratory testing helps us to verify a diagnosis. Having this on your line list will help you classify your cases (i.e. confirmed vs. probable) and recognize which individuals may have a sample collected but no result yet.

SLIDE 25

Here is where knowing the circumstances of your outbreak is important. If you've already identified or are trying to identify some common exposures it would be helpful to have that on your line list. When you're asked a question about a common exposure like, "How many of your cases are in childcare?" you will be able to answer that question pretty quickly if it is already on your line list. Being able to anticipate what questions may be asked by knowing your disease and exposure characteristics from your initial interviews helps in determining what would be most beneficial to include in your line list.

SLIDE 26

We've established that the line list is fundamental and here's what makes a line list good. As mentioned before, it must contain answers to the basic questions you will be asked for the specific event (i.e. case classification, demographics, laboratory and general exposure information).

If it isn't updated regularly it won't be helpful to you or the people asking you about it.

Incomplete data is unavoidable at times, but the more complete your line list the better – especially when it comes to onset dates and symptoms.

So there you go – now you know why the line list is important and the necessary components of a good line list.

SLIDE 27

Now let's move on to our final objective which is to understand the purpose of obtaining the earliest date of symptom onset. This is that important piece of information that we just mentioned should go in the line list. Now we'll talk about why.

SLIDE 28

As mentioned earlier, infectious agents have specific characteristics in terms of incubation period, duration of illness, and the symptoms they cause. When these three components are known it can help confirm the type of agent causing illness or rule out particular agents when the agent causing the illness is unknown.

SLIDE 29

We use the date of earliest onset of illness to create an epi curve as you can see in the example here. Each box represents a person's illness onset date.

This is the epi curve for a salmonella outbreak that occurred after a church barbeque. The epi curve allows us to see that most cases started feeling ill 2 days after exposure to the BBQ. This is consistent with the usual incubation period for Salmonella which is known to be 12 – 36 hours, but it can range from 6 – 72 hours. Cases that became ill later could be due to low infectious doses or eating leftovers. We know that longer incubation periods have been documented (up to 16 days).

SLIDE 30

This is the epi curve for a 2010 outbreak of GI illness among youth conference attendees.

To put things in perspective, 7 ambulances were dispatched to hotel, ~150 ill persons were identified on scene, 25 received IV fluids at the hotel, and 5 were transported to a local hospital.

Preliminary lab tests were positive for Norovirus. When we looked at the peak of the epi curve (6am on 2/13) and went back 24 hours (which is the average incubation period for Norovirus), we ended up right at the catered breakfast as the likely culprit.

BUT, our analysis of our cohort study data showed that those who ate the catered breakfast were 1.1 times more likely to become ill compared to people who didn't eat the catered breakfast [CLICK]. Whereas those who ate the banquet dinner were 2.6 times more likely to become ill than those who did not eat the banquet dinner [CLICK]. Something was obviously happening at the banquet dinner instead of the catered breakfast.

Long story short, the cause of the outbreak was undercooked chicken served at the banquet dinner that was perpetuating the growth of *Clostridium perfringens*. The typical incubation period for *Clostridium perfringens* is 6 – 12 hours which coincides with the 10 hour time frame time between the dinner and the peak of our epi curve. Our epidemiology data helped us to identify the true cause of the outbreak.

Take home message: the onset dates you put on your line list are very important pieces of information for outbreak investigations.

SLIDE 31

Let's review...

SLIDE 32

We had three specific objectives we hoped to achieve by the end of this presentation: that viewers should be able to:

Define a case definition and explain the differences between surveillance and outbreak case definitions.

Describe the purpose of line lists and the various components of a line list.

And to recognize the importance of why the earliest date of symptom onset should be collected for each person in every outbreak.

SLIDE 33

This presentation has been a broad introduction, but I want to share two more slides listing some other technical aspects of outbreak investigation that have not been covered already.

SLIDE 34

Communication activities are one of the most important and time consuming technical aspects of outbreak investigation.

This includes conference calls at various intervals that occur to provide the latest updates, ensure that everyone is on the same page and to answer questions. They will often include state, local, and partner organizations. When state staff are involved in outbreak conference calls, we send situation reports regarding the status of the outbreak and send you a copy via email.

Guidance documents are another aspect of communications that require a lot of time and need to be done promptly to address questions and control measures for various audiences. Templates are VERY helpful and if you can collect some beforehand it will serve you well during an outbreak. Press releases and information sheets about the agent and/or control measures are included here too.

It's important that you communicate when you need assistance from the state. Our assistance can be provided from our offices in Raleigh where we can assist with technical support, review of materials before they're released, data entry, or interviews. OR, if requested, our assistance can be on-site which happens most often when analytic studies begin.

And finally, the final communication of an outbreak is the final report, which should be completed within 30 days of an outbreak being declared over. If the state leads an outbreak investigation, the state will likely complete an outbreak report, but if a local health department leads an outbreak investigation, the local health department CD nurse will need to submit the 1 page outbreak report to the TATP nurse within 30 days of the end of the outbreak.

SLIDE 35

Laboratory results help us to confirm a diagnosis. Sometimes we have a lot of specimens that are submitted to the state lab for testing and at other times we don't have many people who are willing to submit a specimen. Having a stool specimen that can be tested is very important, especially in the later scenario where we don't have many people who are willing to submit a specimen.

Please ensure that stool specimens submitted to the state lab do not go above the red line marked on the side of the stool cup.

SLIDE 36

We have this stool collection instruction sheet that you can use as a reminder. It may be a helpful aid for you and for those who may be collecting stool specimens.

SLIDE 37

This concludes the presentation on technical aspects of an outbreak investigation. And remember, your TATP nurse and the communicable disease branch are available to answer questions and provide technical assistance as needed.

You can reach the epidemiologist on call at 919-733-3419.

Thank you for your time and good luck with your outbreak investigations!

Thank you for your time and good luck with your outbreak investigations!