Fundamentals of Outbreak Investigations
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Slide 1: Title

Slide 2:
Hello, my name is Jennifer MacFarquhar, and I am a Centers for Disease Control epidemiologist assigned to the North Carolina Division of Public Health, Epidemiology Section. This presentation is about the Fundamentals of Outbreak Investigations.

Slide 3:
At the end of this presentation, you should be able to:

- Understand why outbreak investigations are important
- Know how to perform the steps of an outbreak investigation
- Identify and define an outbreak, and
- Describe the legal responsibilities of LHD during an outbreak.

Slide 4:
There are several reasons why it is important to investigate an outbreak. First, it's important to prevent the disease from spreading further. In addition, it's important to be able to identify the source of the outbreak and, hopefully, eliminate it. Outbreaks can also allow us to describe new diseases and to learn more about known diseases. It's also important to develop strategies to prevent future outbreaks from occurring. Outbreaks present an opportunity to identify populations at risk for a particular disease, to evaluate existing prevention strategies and identify gaps, and to develop strategies to prevent future outbreaks from occurring. Outbreak investigations are an important way in which public health departments can educate the public about disease prevention, and address public concerns. And, finally, if you are a communicable disease nurse in a local health department, outbreak investigations are a fulfillment of your legal obligations and duty of care for the public residing in your community.

Slide 5:
When deciding when to investigate an outbreak, it's important to recall that outbreaks of diseases should always be investigated. Other factors are also important. First of all, the severity of illness should be considered. An outbreak that involves mild respiratory or gastrointestinal illness might be much less likely to prompt an immediate investigation as compared to an outbreak involving hospitalizations. Transmissibility and the apparent spread of disease are also important in making this decision. It is important to determine if there are unanswered questions. If the cause of an outbreak

is known and the outbreak is proceeding along the expected path for that disease, it might be appropriate to implement control measures immediately rather than focusing on the investigation. But, if there are unanswered questions, the investigation may be more, or equally, important. Another factor when deciding whether to investigate is to determine if there are ongoing illnesses or exposures, or if the outbreak appears to be over. The ability to learn from the outbreak and more rapidly identify, prevent, and implement control measures in future situations is important. And again, assessing and responding to the level of public concern can help you determine your investigation response.

Slide 6:
On this slide you will see some basic principles of an outbreak investigation. First, be systematic. Follow the same steps for every type of outbreak, every time. This will help you be sure you are not forgetting important components. Write down your case definitions as you develop them, and be aware that they will likely change as the investigation progresses. Always ask the same questions of everyone in the same manner as much as possible. This will allow you to avoid a situation where the same information has not been obtained from every person who was contacted. Stop often to re-assess what you know. Using a line list and an epidemic curve, otherwise known as an epi-curve, can provide valuable information. Many investigations do not need to go past this point. With every step in the investigation, consider what control measures need to be applied, or if control measures need to be changed. And lastly, coordinate with your partners. For example, coordinate with environmental health if a site visit needs to be performed or food specimens need to be obtained.

Slide 7:
Now I will list 10 steps of an outbreak investigation. I will not review each step in detail today, as a separate educational curriculum has been developed and in which you will likely have the opportunity to participate at a later date. However, I will highlight selected steps. The important point today is that you have a set of steps that you can follow and that you approach outbreaks systematically.

1. First, identify the investigation team and resources.

2. Second, establish the existence of an outbreak.

3. Third, verify the diagnosis.

4. Fourth, construct a case definition.

5. Fifth, find cases systematically and develop a line listing.

6. Sixth, perform descriptive epidemiology and develop hypotheses.

7. Seventh, evaluate your hypotheses and perform additional studies, if necessary.

8. Eighth, implement control measures.

9. Ninth, communicate the findings of your investigation and,

10. Finally, maintain surveillance.

Slide 8:
The 10 steps reviewed on the previous slide are based on the scientific method, which serves as the basis for epidemiologic practice. Slide 7 demonstrates the correlation of the scientific method with the steps of an outbreak investigation.

Slide 9:
I'd like to take a few minutes to define an outbreak, as this can be a source of confusion. Does one case of illness constitute an outbreak? Two cases? Basically, an outbreak is any increase in cases above what you would expect in that population in that area. Or, the occurrence of 2 or more epidemiologically – linked, or epi-linked, cases. An epi-linked case is a patient who has direct contact with a confirmed case within the confirmed case's infectious period. For example, if a 5 year old child has laboratory confirmation of *Salmonella*, and a 2 year old friend becomes ill with *Salmonella* during the 5 year old child's incubation period, we would consider the 2 children to be epi-linked.

Slide 10:
On the previous slide, we reviewed the definition of an outbreak. Over the next few slides, I will review how you determine if you have an outbreak for both reportable and non-reportable diseases. Review of existing surveillance baseline data may be used to confirm the existence of an outbreak. For those diseases that are reportable, or notifiable, each local health department has records on the number of cases of those diseases that have been diagnosed, as well as the timeframe for diagnoses, over the years. The state's electronic disease surveillance system, NC EDSS, is the ideal tool to use to determine trends of diseases over time. To determine if the number of cases you have is higher than expected, compare current reports of disease with previous weeks, or with reports during the same month or season in previous years. If the current numbers seem unusually high, you may have an outbreak on your hands.

Slide 11:
This is a North Carolina notifiable disease surveillance summary. These data demonstrate baseline data with which you can compare current data to look at trends. This summary is published quarterly and can be found on the Communicable Disease Branch website.

Slide 12:
For non-notifiable diseases or conditions including norovirus or influenza, the primary methods to determine if you have an outbreak are to review trends in symptoms and seasonal patterns. For example, the Communicable Disease Branch tracks and distributes weekly influenza surveillance trends for North Carolina during the fall and winter months. You can review these date to compare trends.

Slide 13:
Verifying the existence of a true outbreak is critical to proceeding with an investigation. There may be some reasons why you see an increase in the number of cases of illness above what you would expect. First, has there been an illness or a product recall in the news that precipitated increased public interest? Has there been a change in reporting procedures, case definition, diagnostic procedures, clinician or clinician practices, or has the population changed somehow? All of these could result in an increased number of cases. Finally, you may have an actual outbreak on your hands.

Slide 14:
Now I'd like to review some examples of scenarios that might be considered an outbreak. First, a single case of acute Hepatitis A in a food handler. While this would not constitute an outbreak, it does require a public health response to assure that transmission of disease has not occurred to restaurant patrons, co-workers, or close contacts. Second, seven cases of pertussis in a community in December may or may not be an outbreak. Again, this does garner a public health response to institute control measures. An individual who experiences vomiting after eating at Diner A may or may not represent an increase above what is expected. However, thirty individuals with vomiting after eating at a church picnic would definitely represent something that is beyond what is expected and therefore constitute an outbreak. Similarly, one case of smallpox would represent an outbreak since this disease was eliminated during the late 1970's. It is good to remember that recognition of outbreaks comes with experience.

Slide 15:
The North Carolina Administrative Code (10A NCAC 41A .0103) states that it is the legal responsibility of the local health director (and thus the local health department) to

investigate a potential outbreak, implement interventions and control measures, and ensure compliance with control measures. Thus, not only is it important to investigation outbreaks as reviewed in this slide set, it is your legal responsibility.

Slide 16:
In conclusion, epidemiologic investigations are essential components of public health. They are opportunities to describe new diseases and learn more about known diseases, identify and describe the source of illness, identify populations at risk, evaluate programs or existing prevention strategies, develop strategies to prevent future outbreaks, train staff, educate the public about disease and disease prevention, and fulfill our legal obligation to the public. Finally, the 10 steps of an outbreak investigation provide the systematic framework necessary to investigate any outbreak.