

# Introduction to Communicable Disease Surveillance and Investigation in North Carolina



# Fundamentals of Outbreak Investigations

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# Learning Objectives

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



# Reasons to Investigate an Outbreak

- Control disease spread
- Identify the source
- Describe new diseases, learn more about known diseases
- Identify populations at risk
- Evaluate existing prevention strategies
- Develop strategies to prevent future outbreaks
- Educate public about disease prevention
- Address public concern
- Fulfillment of legal obligations and duty of care for the public

# When do you investigate?

Always!

Consider the following factors:

- Severity of illness
- Transmissibility
- Unanswered questions
- Ongoing illness / exposure
- Prevention potential
- Public concern



# Principles of Outbreak Investigations

## Be systematic

- Follow the same basic steps for every type of outbreak
- Develop and write down case definitions
- Ask the same questions of everybody

## Stop often to re-assess what you know

- Line list and epidemic curve provide valuable information; many investigations never go past this point
- Consider control measures to be applied

## Coordinate with partners (e.g., environmental)

# 10 Steps of an Outbreak Investigation

1. Identify investigation team and resources
2. Establish existence of an outbreak
3. Verify the diagnosis
4. Construct case definition
5. Case finding: Find cases systematically / develop line list
6. Perform descriptive epidemiology / develop hypotheses
7. Evaluate hypotheses / perform additional studies (as necessary)
8. Implement control measures
9. Communicate findings
10. Maintain surveillance



# The 10 Steps and The Scientific Method



## Scientific Method

## Outbreak Investigation Steps

Obtain background information (Steps 1-3)

1. Prepare for field work
2. Establish the existence of an outbreak, consider severity, potential for spread, public concern and availability of resources
3. Verify the diagnosis

Define the problem (Step 4-5)

4. Define and Identify the Cases – case definition and line listing
5. Describe and orient the Data in Terms of Time, Place, and Person – Descriptive Epidemiology

Formulate hypothesis (Step 6)

6. Develop hypothesis (Agent / Host / Environment Triad) = Chain of transmission

Develop a Study to Test the Hypothesis (Step 7)  
Collect Data and Observations (Step 7)  
Evaluate Results (Step 7)

7. Evaluate hypothesis – Analytical Studies \*Must have a control group\*

Determine if Hypothesis is true / modify (Step 8)  
Formulate Conclusions (Step 9)  
Report Results (Step 10)

8. Refine hypothesis and Carry out Additional Studies
9. Implement Control and Prevention Measures
10. Communicate Findings



# What is an outbreak?

Increase in cases above what is normally expected (e.g., baseline):

- in that population
- in that area

Occurrence of 2 or more 'epi-linked' cases



# How do you know if it is an outbreak?

For notifiable diseases

- Reported to local, state health departments

**NC EDSS!**

- Compare number of current cases / rate with previous weeks
- Compare number of current cases / rate with same time period or season in previous years






# Example: NC Notifiable Disease Summary

NORTH CAROLINA COMMUNICABLE DISEASE MONTHLY REPORT

July, 2012

Number of probable and confirmed communicable disease cases in North Carolina by disease for: 1) the current month, 2) the year to date, 3) the average cases for the year to date, 4) the total cases during 2011, 5) and the average (with 95% confidence intervals) of the previous five years.

DISEASE	Cases in July, 2012	Cases During January and July, 2012	Average Cases During January and July, 2007 - 2011	Cases in 2011	Average cases (95% confidence interval) per year 2006 to 2010
Botulism <sup>1</sup>	0	0	1	2	1 (0 - 4)
Campylobacter Infection*	122	557 	309	909	693 (361 - 1,026)
Chlamydia <sup>2</sup>	4,035	27,689	16,345	54,891 	39,161 (29,695 - 48,641)
Cryptosporidiosis	15	58	34	115	114 (22 - 206)
E. coli O157:H7/ STEC Infection*	7	52	51	155	126 (57 - 194)
Ehrlichiosis <sup>3</sup>	26	40	23	107	67 (40 - 174)
Gonorrhea	1,108	8,102	7,083	17,487	15,336 (8,779 - 21,892)
Group A Strep Infection, Invasive	13	87	99	181	143 (81 - 205)
Haemophilus Influenzae	8	56	50	84	86 (7 - 179)
Hepatitis A	0	12	27	31	60 (11 - 109)
Hepatitis B (acute)	4	36	56	124	128 (66 - 190)
Hepatitis B (perinatal)	0	0	0	1	2 (0 - 5)
Hepatitis B (chronic) <sup>4</sup>	52	498	522	1,309 	873 (662 - 1,085)
Hepatitis C (acute)	13	39	19	61	29 (6 - 64)
Influenza Death, Adult <sup>5</sup>	0	7	8	26	50 (0 - 117)
Influenza Death, Pediatric	0	2	2	10	3 (0 - 14)
LaCrosse Encephalitis	3	6	3	24	15 (1 - 31)
Legionellosis	4	25	24	86	52 (15 - 86)
Listeriosis	1	5	9	21	25 (8 - 42)
Lyme Disease	6	25	30	91	66 (23 - 155)

# How do you know if it is an outbreak?

For non-notifiable conditions such as norovirus or influenza:

- Common symptoms/syndromes
- Seasonal patterns



# Is it a true increase?

Reasons why the observed cases may exceed the expected numbers:

- Increased awareness or public interest
- Changes:
  - Reporting procedures
  - Case definition
  - Diagnostic procedures
  - Clinician or clinician practices
- Actual outbreak



# Examples: Are these outbreaks?

- Single case of acute Hepatitis A in food handler?
- Seven cases of pertussis in a community in December?
- One case of acute GI illness in individual after eating at Diner A?
- Thirty cases of acute GI illness after eating at church picnic?
- One case of smallpox?



# Legal Responsibilities of Local Health Department

- Investigate potential outbreak
- Implement interventions and control measures
- Ensure compliance with control measures





# Conclusions



Epidemiologic investigations essential component of public health, present opportunities to:

- Characterize diseases
- Identify populations at risk
- Evaluate programs, policies, or existing prevention strategies
- Train public health staff
- Educate the public
- Fulfill legal obligations and duty of care for the public

10 steps provide systematic framework necessary to investigate any outbreak