Steps of an Outbreak Investigation: Back to Basics

Communicable Disease Branch
North Carolina Division of Public Health
Example Agenda

9:30 am    Welcome and Introduction
9:35 am    Pre Test and Learning Objectives
9:40 am    Steps 1 – 3; Activity 1
10:15 am   Break
10:25 am   Steps 4 – 5; Activity 2 & 3
11:15 am   Lunch
12:15 pm   Steps 6-8
1:00 pm    Steps 9-10
1:15 pm    Post Test
1:20 pm    Break
1:30 pm    Activity 4: Outbreak Exercise
2:50 pm    Evaluation and Conclusion of Training
Pre Test

• Close all training materials!
• Using the colored cards
  – At the top, write the name of the person sitting directly across from you
  – In order, list the 10 steps of an outbreak investigation
• Turn in cards
Training Credit

Continuing education credit (4 hours) has been applied for through

• Public Health Nursing & Professional Development, &

• NC Board of Environmental Health Specialist Examiners
Course Materials (on-line)

- Steps of an Outbreak Investigation
- List of Terms
- Outbreak Report Form
- Evaluation Form
- Activity 1: Resource Table
- Activity 3: Surveillance
- Activity 4: Case Study & Compendium
Target Audience

• Local health department
  – Communicable Disease nurses
  – Environmental Health staff

• Force multipliers
  – anyone who may be called to assist
Learning Objectives

• Describe public health importance of outbreak investigations
• List components of a case definition
• Define elements included on a line list
• Describe potential control measures
• List and describe the steps of an outbreak investigation
What are the reasons for investigating an outbreak?
Reasons to Investigate an Outbreak

• Identify, describe the source
• Describe new diseases, learn more about known diseases
• Identify populations at risk
• Evaluate existing prevention strategies
  — E.g., immunization requirement
• Opportunity to educate public about disease prevention
• Address public concern
• Develop strategies to prevent future outbreaks
• Fulfillment of legal obligations and duty of care for the public
• Terminate the outbreak!
What factors should you consider when deciding to investigate?
When to Investigate

• Consider the following factors:
  – Severity of illness
  – Transmissibility
  – Unanswered questions
  – Ongoing illness / exposure
  – Public concern
  – Prevention potential
Principles of Outbreak Investigations

• Be systematic
  – Follow the same steps for every type of outbreak
  – 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
Steps of an Outbreak Investigation

• These steps may occur simultaneously or be repeated as new information is received
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10 Steps of an Outbreak Investigation

1. Identify investigation team and resources
   a. Local and state resources
   b. Outbreak investigation team, team lead
   c. Research disease, review scientific literature
   d. Determine if immediate control measures needed
   e. Prepare for field work
Local and State Resources

• Local
  – CD nurse(s)
  – Environmental health
  – Preparedness coordinators
  – EpiTeam
  – LHD director

• State
  – CD Branch epidemiologists (epi on call)
  – CD Branch subject matter experts
  – TATP Nurse Consultants
  – PHPR Team
Other Resources

• Local / State
  – Disease Intervention Specialists (DIS)
  – Local PIO
  – State Laboratory of Public Health
  – Hospital-based Public Health Epidemiologist (PHE)

• Other resources
  – CDC
  – NC EDSS
  – NC DETECT
  – Media
Activity 1 – Resource Team

• Who is on your resource team?
• Why those individuals?
• Could you reach them after hours?

**Routinely update this information**
Investigation Team

• Members from your resource table
• Consider establishment of ICS
• Identify ‘Lead’
Research Disease, Review Literature

• NC DPH Communicable Disease Manual (on-line)
• MMWR & other CDC published information
• Control of Communicable Disease Manual (19th edition)
• Manual for the Surveillance of Vaccine-Preventable Diseases (5th edition, 2011)
• Epidemiology and Prevention of Vaccine-Preventable Diseases (12th edition, May 2012) (e.g., ‘the Pink Book’)
Control Measures

• When should control measures be implemented immediately?
  – Source is identified
  – Continued risk of either exposing others or being exposed
  – E.g., food handler

• Control measures are applied as soon as possible, may change at any point during investigation
Prepare for Field Work

• Identification of team
• Gather resources, supplies, equipment
  – Computer, questionnaires, specimen collection kits
• Make necessary administrative, personal arrangements for travel
  – Determine role in the investigation
  – Identify points of contact (field and office)
• What do you need to do to prepare?
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2. Establish Existence of an Outbreak

• What is an outbreak?
  – Increase in cases above what is expected in that population in that area
  – Occurrence of 2 or more ‘epi-linked’ cases
2. Establish Existence of an Outbreak

• How do you know?
  – 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
2. Establish Existence of an Outbreak

<table>
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<tr>
<th>DISEASE</th>
<th>Cases in July, 2012</th>
<th>Cases During January and July, 2012</th>
<th>Average Cases During January and July, 2007 - 2011</th>
<th>Cases in 2011</th>
<th>Average cases (95% confidence interval) per year 2006 to 2010</th>
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<td>51</td>
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<td>31</td>
<td>60 (11 – 109)</td>
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<td>36</td>
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<td>124</td>
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<td>498</td>
<td>522</td>
<td>1,309</td>
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<td>39</td>
<td>19</td>
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<td>26</td>
<td>50 (0 – 117)</td>
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<td>24</td>
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<td>Legionellosis</td>
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<td>25</td>
<td>24</td>
<td>86</td>
<td>52 (15 – 86)</td>
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<td>6</td>
<td>25</td>
<td>30</td>
<td>91</td>
<td>66 (23 – 155)</td>
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</table>
2. Establish Existence of an Outbreak

• For non-notifiable conditions:
  – National estimates
  – Hospital discharge records
  – Mortality data
  – Other available records
  – Use data from neighboring areas
  – Call local health care providers
  – Call community members
Potential Pitfalls: 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
    • Population
  – Actual outbreak
Example: Outbreak or Not

• Single case of acute Hepatitis A in foodhandler?
• Four cases of ‘respiratory illness’ among residents of a nursing home in January?
• 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?
• Three cases of active pulmonary TB at Hospital B?
Example: Establish Existence of an Outbreak

An Outbreak...To Be or Not To Be

Number of Cases

Time
Example: Establish Existence of an Outbreak

An Outbreak...To Be or Not To Be

Number of Cases

Time
10 Steps of an Outbreak Investigation

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3. Verify the Diagnosis

• What does that mean?
• Confirm:
  – Clinical signs
  – Clinical symptoms
  – Test results
• Reduce diagnostic error
  – Confirm appropriate lab tests were performed
  – Confirm symptoms were reported accurately
  – For rare conditions, educate clinicians
3. Verify the Diagnosis

- Obtain medical records, laboratory reports
- Talk with patients
- If needed,
  - Conduct clinical testing
  - Collect specimens
  - Hold specimens
- Consult with DPH CDB, SLPH
- In conjunction with CDB, request SLPH to perform bacteriologic, virologic, other testing
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4. Construct Case Definition

• A case definition
  – Allows a simple, uniform way to identify cases
  – “Standardizes” the investigation
  – Is unique to outbreak but is based on objective criteria
4. Construct Case Definition

• 3 components:

  – Person....... Type of illness, characteristics (e.g., “a person with...”)
  – Place......... Location of suspected exposure
  – Time.......... Based on incubation period* (if known)
4. Construct Case Definition

• Can emphasize sensitivity (broad) or specificity (narrow) in case definition
  – Sensitive early in investigation
  – Specific as more information is obtained
Example: Case Definition – Broad

• An individual reporting 2 or more of the following symptoms: diarrhea (3 or more loose stools within a 24 hour period), abdominal pain, nausea, or fever with illness onset on or after February 28th and resided in or traveled to County B during the 10 days prior to illness onset.
Example: Case Definition – Specific

• Laboratory confirmation of Salmonella paratyphi B with PFGE pattern missing or pending in a person who experienced illness onset on or after February 28th and resided in or traveled to County B during the 7 days prior to illness onset.
Example: Case Definition – Very Specific

• Laboratory confirmation of Salmonella paratyphi B with PFGE pattern .1228
Activity 2 – Case Definition
Activity 2 – Case Definition

• 12 ill persons
  – One infant with post-tussive vomiting
• Cough lasting ≥2 weeks
• Onset of illness 12/5/11 – Present
• Resident of Community A
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5. Case Finding

• ‘Enhanced surveillance’
  – Look for additional cases
  – Use the case definition

• Two methods: Active and Passive
  – Active
    • Visits, phone calls
    • Ask cases if they know of other ill people
  – Passive
    • HAN, blast fax, press release
    • People self-report illness
Activity 3 – Surveillance
5. Develop Line List

• Method to systematically record information
• Simple to review, update, summarize
• Paper or electronic
• NC DPH encourages use of Outbreak Workbook Tool
  – Automatically populates descriptive epidemiology
  – Easily imports cases into NC EDSS
  – Easily attaches to a case associated with an outbreak in NC EDSS
5. Develop Line List

• Identifying information
  – Name, address, phone number, unique identifier

• Demographic information
  – DOB, gender, race, occupation

• Clinical information
  – Date(s) of report and onset of illness, symptoms
  – Laboratory specimen submitted, results

• Exposure / risk factor information
  – Food, water, activities
## 5. Develop Line List

**Identifying Information**

<table>
<thead>
<tr>
<th>First-Name</th>
<th>Last-Name</th>
<th>Street1</th>
<th>City</th>
<th>State</th>
<th>Zip-Code</th>
<th>County</th>
<th>Home-Phone</th>
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<tbody>
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<td>Ally</td>
<td>Alligator</td>
<td>100 Swamp Lane</td>
<td>Cedar Park</td>
<td>NC</td>
<td>27514</td>
<td>Escambia</td>
<td>111-111-1111</td>
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<td>27514</td>
<td>Escambia</td>
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<td>Carie</td>
<td>Cat</td>
<td>52 House Circle</td>
<td>Cedar Park</td>
<td>NC</td>
<td>27514</td>
<td>Escambia</td>
<td>333-333-3333</td>
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<tr>
<td>Donald</td>
<td>Duck</td>
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<td>Escambia</td>
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<td>Cedar Park</td>
<td>NC</td>
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<td>Escambia</td>
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<td>NC</td>
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<td>Escambia</td>
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5. Develop Line List

Demographic Information

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<tr>
<th></th>
<th>Gender</th>
<th>DOB</th>
<th>Age at Onset</th>
<th>Foodhandler</th>
<th>HCW</th>
<th>Childcare Worker</th>
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### 5. Develop Line List

#### Clinical Information

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<th>Date of Report</th>
<th>Date of Onset</th>
<th>Died</th>
<th>Hospitalized</th>
<th>ER Visit</th>
<th>Provider Visit</th>
<th>Vomiting</th>
<th>Diarrhea</th>
<th>Bloody Stools</th>
<th>Fever</th>
<th>Abdominal Cramps</th>
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## 5. Develop Line List

### Laboratory & Case Classification Information

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<th>Serotype Enteriditis</th>
<th>PFGE .0246</th>
<th>Confirmed</th>
<th>Probable / Epi-Linked</th>
<th>Suspect</th>
<th>Why Status?</th>
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NCPH
North Carolina Public Health

Fall 2012
5. Develop Line List

Exposure Information

<table>
<thead>
<tr>
<th>No.</th>
<th>Travel to Escambia County</th>
<th>Ate at Restaurant A</th>
<th>Swam in River B</th>
<th>Attends Day Camp C</th>
<th>Other Exposures</th>
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<tr>
<td>3</td>
<td>1</td>
<td>0</td>
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<td>lifeguard at River B</td>
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<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>works at Day Camp C</td>
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<td>5</td>
<td>1</td>
<td>1</td>
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<td>8</td>
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<td>0 unknown</td>
<td>0</td>
<td>1</td>
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</table>
# Example – Outbreak Workbook Tool

<table>
<thead>
<tr>
<th>Line Number</th>
<th>First Name</th>
<th>Middle Name</th>
<th>Last Name</th>
<th>Date of Birth</th>
<th>Gender</th>
<th>SSN</th>
<th>Street1</th>
<th>Street2</th>
<th>City</th>
<th>State</th>
<th>Zip Code</th>
<th>County</th>
<th>Country</th>
<th>Home Phone</th>
</tr>
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<tr>
<td>1</td>
<td>Ally</td>
<td>Alligator</td>
<td>1/2/1986</td>
<td>Female</td>
<td>100 Swamp Lane</td>
<td>Cedar Parr</td>
<td>NC</td>
<td>27514</td>
<td>Escambia</td>
<td>302-58</td>
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<td>2</td>
<td>Benjamin</td>
<td>Bear</td>
<td>12/1/1988</td>
<td>Male</td>
<td>506 Forest Road</td>
<td>Cedar Parr</td>
<td>NC</td>
<td>27514</td>
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<td>3</td>
<td>Carla</td>
<td>Cat</td>
<td>5/7/1992</td>
<td>Female</td>
<td>52 House Circle</td>
<td>Cedar Parr</td>
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<td>27514</td>
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<td>5</td>
<td>Emily</td>
<td>Elephant</td>
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<td>8/24/1982</td>
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<tr>
<td>7</td>
<td>Gary</td>
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<td>11/25/1981</td>
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<td>NC</td>
<td>27514</td>
<td>Escambia</td>
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<tr>
<td>8</td>
<td>Henry</td>
<td>Horse</td>
<td>9/11/2001</td>
<td>Male</td>
<td>300 Farm Court</td>
<td>Cedar Parr</td>
<td>NC</td>
<td>27514</td>
<td>Escambia</td>
<td>225-92</td>
<td></td>
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</tbody>
</table>
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
6. Perform Descriptive Epidemiology

• What and why
  – Provides systematic method
  – Characterize, or describe what has occurred
  – Person, place, time

• Components
  – Line list useful for developing hypotheses
  – Epi curve
  – Others, but we will focus on line list and epi-curve
6. Perform Descriptive Epidemiology

- Person
- Place
- Time

{ Line List

{ Epidemic curve (‘Epi curve’)}
6. Perform Descriptive Epidemiology

• Epi curve: visual representation of
  – Ill persons (cases) over time
  – Magnitude of outbreak
  – Type of outbreak
    • Point source
    • Propagated (person-to-person)
  – Exposure period / Time of exposure (if agent known)
  – Incubation period
  – Possible agents (if time of exposure known)
6. Perform Descriptive Epidemiology

• How do I make an epi curve?
  – Number of cases on the vertical (y) axis
  – Time period (or date of illness onset) on the horizontal (x) axis
Example – X and Y axis

Y-axis

X-axis

Number of Cases

Time
6. Perform Descriptive Epidemiology

- How do I choose the correct unit of time?
  - Depends upon the incubation period
  - If incubation period is not known, graph several epi-curves with different time units
Example Epi Curve – Time Unit (Day)

Number of Cases

Time

0 20 40 60 80 100

1-Apr 3-Apr 5-Apr 7-Apr 9-Apr 11-Apr 13-Apr 15-Apr 17-Apr
Example Epi Curve – Time Unit (Hours)
6. Perform Descriptive Epidemiology

• Epi curve: visual representation of
  – Ill persons (cases) over time
  – Magnitude of outbreak
  – Type of outbreak
    • Point source
    • Propagated (person-to-person)
  – Exposure period / Time of exposure (if agent known)
  – Incubation period
  – Possible agents (if time of exposure known)
6. Perform Descriptive Epidemiology

• Epi curve: visual representation of
  – Ill persons (cases) over time
  – Magnitude of outbreak
  – Type of outbreak
    • Point source
    • Propagated (person-to-person)
  – Exposure period / Time of exposure (if agent known)
  – Incubation period
  – Possible agents (if time of exposure known)
6. Perform Descriptive Epidemiology

• Point source
  – Usually demonstrated by sharp upward slope and a gradual downward slope
  – Common source outbreak
  – Period of exposure is brief
  – Cases occur within one incubation period
Example Epi Curve – Point Source

An Outbreak...Point Source

Number of Cases

Time
6. Perform Descriptive Epidemiology

- Propagated (person-to-person)
  - Progressively taller peaks, an incubation period apart
  - Person to person transmission
  - May last a long time
  - May have multiple waves
Example Epi Curve – Person to person (Propagated)
Example Epi Curve – Person to person (Propagated)

Epi Curve…Person to Person

Number of Cases

Time
Example Epi Curve – Person to person (Propagated)

Epi Curve...Person to Person

Number of Cases

Time
6. Perform Descriptive Epidemiology

• Epi curve: visual representation of
  – Ill persons (cases) over time
  – Magnitude of outbreak
  – Type of outbreak
    • Point source
    • Propagated (person-to-person)
  – Exposure period / Time of exposure (if agent known)
  – Incubation period
  – Possible agents (if time of exposure known)
Example – Exposure Period

Number of Cases

Average incubation

Known time of Exposure

Exposure

Time

Fall 2012
Example – Exposure Period

Number of Cases

Estimated Exposure Period

Time

Average incubation

Known Agent
6. Develop Hypotheses

• What are hypotheses?
  – Statements which help us describe why and how the outbreak occurred

• How do you generate hypotheses?
  – Examine descriptive epidemiology: line list, epi-curve
  – Administer open-ended questionnaire to cases
  – Review the existing body of knowledge
6. Develop Hypotheses

• Questions to ask yourself:
  – What is the agent’s usual reservoir
  – How is the agent usually transmitted
  – What vehicles are commonly implicated
  – What are the known risk factors
  – In discussions with ill persons, what possible exposures were in common
Example – Develop Hypothesis

• Case and clinical information:
  – Acute gastroenteritis
  – Most aged 14 – 18 years
  – 307 ill persons (cases)
  – Onset of illness: 12am Feb 12 – 10am Feb 14

• Common exposures:
  – Attending youth conference
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Date and Time of Illness Onset

Banquet dinner
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Date and Time of Illness Onset

Banquet dinner
Catered lunch
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Date and Time of Illness Onset

Banquet dinner
Catered lunch
Catered breakfast
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Date and Time of Illness Onset

- 11-Feb
- 12-Feb
- 13-Feb
- 14-Feb

Events:
- Banquet dinner
- Catered lunch
- Catered breakfast
- Pizza
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Date and Time of Illness Onset

Banquet dinner  
Catered lunch  
Catered breakfast  
Pizza  
Laboratory Testing
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Laboratory Testing 4/9 norovirus +

Date and Time of Illness Onset
Norovirus Infection

- RNA virus
- Resistant to environmental stress
- Incubation period:
  - usually 24 hours
  - range 12-72 hours
- Causes GI illness with watery diarrhea and >50% vomiting
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Norovirus: 24 hour incubation

Date and Time of Illness Onset
Example – Initial Hypothesis

- We hypothesize that:
  - norovirus was the causative agent of the outbreak, and
  - eating breakfast served on February 12 was the most likely exposure to norovirus
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Norovirus: 24 hour incubation

Epidemiology

Banquet dinner
Catered lunch
Pizza
Catered breakfast

Date and Time of Illness Onset
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Norovirus: 24 hour incubation

Epidemiology:
Breakfast: RR=1.1
Dinner: RR=2.6
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

Norovirus:
24 hour incubation

Lab = Norovirus
Epi = Incubation period too short for norovirus
Example: Cases of Gastroenteritis by Time of Symptom Onset (n=307)

What has an incubation period this short?

Date and Time of Illness Onset

Pizza
Catered breakfast
Catered lunch
Banquet dinner
**Clostridium perfringens** Toxicoinfection

- Spore-forming Gram positive rod
  - Arises after consumption of bacteria-containing food
  - Toxin produced within the small intestine following ingestion
- Diarrhea predominant illness with little vomiting
- Incubation period usually 6–12 hours
- Associated with poorly cooked meat
Example – Additional Lab Information

• Norovirus testing
  – Reverse transcription PCR (RT-PCR)
  – Sent to CDC for confirmation

• Clostridium perfringens enterotoxin testing
  – Oxoid toxin detection kit
  – PCR
Example – Additional Lab Information

• Testing did not confirm the presence of norovirus

• After 4 weeks at 4 °C, stool tested for *Clostridium perfringens* enterotoxin
  – Toxin present in 8 of 9 specimens tested
  – Enterotoxin gene detected in 5 of 6 specimens tested
Example – Final Hypothesis

- We hypothesize that:
  - *Clostridium perfringens* toxicoinfection was the causative agent of this point source outbreak
  - Associated with consumption of inappropriately-cooked chicken at the dinner served on February 12
6. Develop Hypotheses

• Questions to ask yourself regarding hypothesis:
  – Is hypothesis stated in a way that can be ‘tested’
  – Does it address:
    • agent
    • vehicle / source
    • mode of transmission
    • exposure that caused illness
6. Test the Hypothesis

- We hypothesize that:
  - *Clostridium perfringens* toxicoinfection was the causative agent of this point source outbreak
  - Associated with consumption of inappropriately-cooked chicken at the dinner served on February 12

- Testable ✓
- Agent ✓
- Vehicle or source of agent ✓
- Mode of transmission ✓
- Exposure ✓
10 Steps of an Outbreak Investigation

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9. Communicate findings
10. Maintain surveillance
7. Evaluate Hypotheses

• Two methods:
  – Compare hypothesis with established facts
  – Perform additional studies (e.g., analytic)
    • Cohort or case-control
    • Assess exposures equally among ill and non-ill persons
7. Evaluate Hypotheses

• Compare hypothesis with established facts
  – Evidence is so strong that hypothesis does not need to be tested
  – E.g., Salmonella Paratyphi B with PFGE pattern .1228 (the outbreak strain) isolated from unpasteurized tempeh
  – E.g., norovirus identified in a nursing home; norovirus is known to be circulating in the community
7. Perform Additional Studies

- Used when the relationship between exposure and disease is less clear
Value of Analytic Studies

• Support for specific public health action (e.g., recall)
• Describe new diseases, learn more about known diseases
• Address public and political concern
• Develop strategies to prevent future outbreaks
• Fulfillment of legal obligations and duty of care for the public
7. Perform Additional Studies

• Cohort
  – Able to identify every person in group (‘cohort’)
  – Possible when group is well defined
  – Include EVERYONE who could have been exposed
    • E.g., Meeting attendees, students, wedding reception, LTCF residents
7. Perform Additional Studies

• Case-control
  – Compare exposures among ill persons (case) and non-ill persons (controls)
  – Used when a complete list is not available or too large
  – Controls are sample of same population from which cases arose (e.g., source population)
    • E.g., same city, attend same restaurant
  – If a control had developed illness, would have been included as a case
7. Perform Additional Studies

**Step 7 will almost always be performed in consultation with DPH and we will assist you. This will not be addressed in further detail at this initial training, but may be addressed in a later training.**
7. Example – Evaluate the Hypothesis

• What type of analytic study could be used to evaluate the *C. perfringens* hypothesis?

  – *Clostridium perfringens* toxicoinfection was the causative agent of this point source outbreak
  – Associated with consumption of inappropriately-cooked chicken at the dinner served on February 12
10 Steps of an Outbreak Investigation

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9. Communicate findings
10. Maintain surveillance
8. Implement Control Measures

• Immediate implementation of control measures from Step 1
  – Source is identified
  – Continued risk of either exposing others or being exposed
  – E.g., food handler
8. Implement Control Measures

• Required response from public health
• Can occur at any point during the outbreak
• Prevent further exposure, future outbreaks
• Should be guided by epidemiologic results in conjunction with environmental investigation
• Performed in conjunction with DPH, regulators, industry, other agencies
• Balance between preventing further disease, protecting credibility and reputation of institution
• Identify one person to communicate control measures
8. Example – Control Measures

• Summary:
  – Attendees at a youth conference
    • > 1,000 attendees
    • 307 ill persons (cases)
  – *Clostridium perfringens* toxicoinfection
  – Associated with inappropriately cooked chicken

• Recommended control measures?
8. Example – Control Measures
10 Steps of an Outbreak Investigation

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8. Implement control measures
9. Communicate findings
10. Maintain surveillance
9. Communicate Findings

• Two forms:
  – Oral:
    • Internally with team
    • Externally to public, media, health care providers
  – Written:
    • Daily updates (Situation Reports)
    • Final outbreak report, which is a public record
9. Communicate Findings

• Public and media:
  – Single member of team should interact with media, communicate progress and findings
  – Media attention desirable if public action is needed
  – Response to media attention important to address public concerns about outbreak
  – Opportunity to educate community
  – Single overriding communication objective (SOCO)
9. Communicate Findings

• Daily updates (Situation Reports)
  – Narrative
    • Number of persons ill
    • Number of persons potentially exposed (if known)
    • Range of onset dates
    • Type of symptoms
    • Available laboratory results
    • Number hospitalized / died
    • Actions already taken
  – Action Items
    • Summary of recommendations and plans for surveillance, control
Example – Situation Report

SIT REP: Unknown respiratory illness in a LTCF, Guilford County
Fleischauer, Aaron

This message was sent with High importance.
Sent: Fri 6/1/2012 4:26 PM
To: sit.rep
Cc: brogers@co.guilford.nc.us; phillard@co.guilford.nc.us; wrobinson@co.guilford.nc.us

SIT REP – June 1, 2012

Reported by: Aaron Fleischauer, 919-715-6431

Event: Unknown respiratory illness outbreak in a long-term care facility (LTCF), Guilford County, NC

LHD Contact: Betty Rogers, Guilford County Health Department, 336-641-6500

Dr. Ward Robinson, Guilford County Health Department, 336-549-9724

DPH Contact: Dr. Jean-Marie Maillard, 919-7157395

Narrative:
- Guilford County reports an unknown respiratory illness outbreak at a LTCF (Adams Farm Living and Rehab, Jamestown, NC)
- An estimated 20-30 residents and at least 2 staff have reported febrile respiratory illness during past 2-3 weeks
  - Several residents have been admitted to Moses Cone and High Point Regional Hospitals
  - Possibly 4 deaths secondary to pneumonia have also been reported
- The facility has been closed to new admissions

Action Items:
- Guilford County will visit the facility this afternoon to:
  - Begin line list of ill persons

• Outbreak report
  – Final summary of investigation
  – Actions taken
  – Recommendations provided
### Example – Outbreak Report

![Outbreak Report Form](image)

**General Information**
- Today’s Date
- County
- Person completing this form

**Lead Investigator**
- Title
- Telephone

**Outbreak Information**
- Date LHD notified
- Date investigation initiated
- Suspected transmission mode

**Facility Name / Setting**
- Facility Address

**Setting Type:**
- Nursing Home
- Assisted Living
- School
- Day Care
- Prison
- City
- Zip
- Restaurant
- Community
- Other

- NCEDSS Event #

**Date of Illness Onset for 1st Case**
**Date of Illness Onset for Last Case**

<table>
<thead>
<tr>
<th>Residents / Students / Patrons</th>
<th>Number</th>
<th>Faculty / Staff / Employees</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number in facility / setting*</td>
<td></td>
<td>Number exposed*</td>
<td></td>
</tr>
<tr>
<td>Number exposed*</td>
<td></td>
<td>Number ill</td>
<td></td>
</tr>
<tr>
<td>Number ill</td>
<td></td>
<td>Number investigated / interviewed</td>
<td></td>
</tr>
<tr>
<td>Number sought medical care</td>
<td></td>
<td>Number hospitalization</td>
<td></td>
</tr>
<tr>
<td>Number hospitalized</td>
<td></td>
<td>Number of deaths</td>
<td></td>
</tr>
<tr>
<td>Number of deaths</td>
<td></td>
<td>Number with laboratory confirmation</td>
<td></td>
</tr>
<tr>
<td>Number vaccinated before outbreak*</td>
<td></td>
<td>Number vaccinated after outbreak started*</td>
<td></td>
</tr>
<tr>
<td>Number vaccinated after outbreak started*</td>
<td></td>
<td>Number received Post-exposure prophylaxis*</td>
<td></td>
</tr>
</tbody>
</table>

**Predominant Symptoms:**
- Nausea
- Vomiting
- Abdominal Cramps
- Diarrhea
- Bloody Diarrhea
- Fever
- Cough
- Difficulty Breathing
- Renal Failure
- Other

**Investigation Methods**
- Site Visit
- Develop outbreak case definition
- Perform case finding
- Conduct interviews
- Conduct chart reviews
- Collect specimens
- Confirm diagnosis
- Conduct environmental inspection
- Perform environmental sampling

**Laboratory Methods**
- Other

---

**North Carolina Division of Public Health Outbreak Report Form**

Within 30 days of the end of an outbreak, complete this form and e-mail it to your TATP nurse consultant. The TATP nurse consultant will assure creation of a NCEDSS outbreak event and attachment of this form and a line list. Do not e-mail a line list.
10 Steps of an Outbreak Investigation

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8. Implement control measures
9. Communicate findings
10. Maintain surveillance
10. Maintain Surveillance

• Evaluate / document effectiveness of control measures
• To ensure outbreak is over
• To ensure secondary outbreak is not occurring

• It is recommended to maintain surveillance for 2 average incubation periods following the last date of illness onset
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
Acknowledgements

• CDB Epidemiologists
• TATP Regional Nurse Consultants
• CDB Field Services Unit
• Patricia Kempton, DON, Moore County Health Department
• Tammra Morrison, Wilson County Health Department
Post Test
Activity 4

Oswego – An Outbreak of Gastrointestinal Illness following a Church Supper

Case Study No. 401-303

Centers for Disease Control and Prevention
Epidemiology Program Office