Reportable Communicable Disease Investigation in New Jersey

Goal

• Ensure consistency in reportable communicable disease investigation across the state
• Define best practices established by NJDOH for communicable disease investigation in New Jersey

Program Outline

• Reporting responsibilities
• Investigations (single case)
• Surveillance
• Disease Frequency
• Outbreak Investigations

Disease Reporting Responsibilities

• New Jersey Administrative Code (NJAC) 8:57
  – Regulations requiring reporting and investigation of certain communicable diseases and outbreaks for the purpose of surveillance and public health intervention

Immediately Reportable vs. Reportable

• Immediately reportable diseases must be reported via the telephone (e.g., meningococcal disease, botulism, any outbreak)
• All other reportable diseases must be reported
  – within 24 hours of diagnosis by healthcare providers
  – within 24 hours of report receipt by health officers
  – within 72 hours of test result for labs

Immediate Reporting

• Call NJDOH to report immediately reportable diseases
  – (609) 826-5964 M-F 8am-5pm
  – (609) 392-2020 After 5pm and Holidays
• Epidemiologists are on call 24/7/365
• When calling to report an immediately reportable disease, NEVER leave a message about the case / disease on voicemail
Who is Responsible for Reporting, Investigating and Implementing Interventions?

• Health care providers and institutions
• Laboratories
• Local health departments

Health Care Providers and Institutions

• Report to the health officer of the jurisdiction where the patient lives (exceptions: TB, Hep C, STDs are reported directly to the NJDOH)
  – If the health officer is not available, report to NJDOH
• Health care providers at state institutions report directly to the NJDOH

Laboratories

• Report to the health officer of the jurisdiction where the patient lives (exceptions: TB, Hep C, STDs are reported directly to the NJDOH)
  – If the health officer is not available, report to NJDOH
• Laboratory results concerning residents of state institutions are reported directly to the NJDOH

Laboratory Submission Requirements

• Laboratories are required to submit cultures of certain organisms to the Public Health and Environmental & Agriculture Laboratory (PHEAL) within three days of isolation for confirmation and further study (e.g., serotyping, PFGE…)

Local Health Departments Responsibilities

• Health officer must report communicable diseases to NJDOH
• Health officer must investigate each case of communicable disease and at a minimum must:
  – Determine whether a single case or an outbreak of disease exists
  – Ascertain the source and spread of the infection
  – Determine and implement appropriate control measures

Salmonellosis Case Investigation
Local Health Department Investigation

- Review laboratory analysis to confirm positive test result. If case has not been submitted via CDRSS, enter case and lab results.
- Interview case patient or guardian if case is a minor using “Salmonellosis Interview Worksheet”.
- Provide education to case on prevention.
- Enter data from interview into CDRSS.
- If a food establishment from another jurisdiction is identified as a possible source of exposure, notify the appropriate local health department.

Review laboratory analysis to confirm positive test result. If case has not been submitted via CDRSS, enter case and lab results.

Interview case patient or guardian if case is a minor using “Salmonellosis Interview Worksheet”.

Provide education to case on prevention.

“Frequently Asked Questions”
“Live Poultry and Salmonella”
“Reptile, Amphibians, and Salmonella”

Enter data from interview into CDRSS.

Local Health Department Investigation

- If case is a foodhandler, daycare worker or attendee or provides direct patient care, exclude from work or school in accordance with recommendations prescribed in communicable disease chapter.
- If additional cases are identified through interview, enter cases into CDRSS and exclude any foodhandlers, daycare workers or attendees, or cases that provide direct patient care in accordance with the recommendations prescribed in the chapter.
- If an outbreak is suspected, report it to the NJDOH, CDS via telephone.
- Upon completion of investigation, determine case status and close case in CDRSS.
If a food establishment from another jurisdiction is identified as a possible source of exposure, notify the appropriate local health department.

If case is a foodhandler, daycare worker or attendee or provides direct patient care, exclude from work or school in accordance with recommendations prescribed in communicable disease chapter.


If additional cases are identified through interview, enter cases into CDRSS as and exclude any foodhandlers, daycare workers or attendees, or cases that provide direct patient care in accordance with the recommendations prescribed in the chapter.

Upon completion of investigation, determine case status and close case in CDRSS.

Single Case Investigation: Legionellosis

Local Health Department Investigation

- Review laboratory analysis to confirm positive test result. If case has not been submitted via CDRSS, enter case and lab results.
- Review Legionellosis case definition and chapter
- Interview case patient or healthcare provider (if patient is hospitalized) to assess illness onset, symptoms, LTC resident, travel history, possible water exposures (can use CDC Hypothesis Generating Questionnaire) which include using nebulizer or respiratory therapy, general construction, decorative fountains, etc)
- Enter data from interview and pertinent medical information into CDRSS.
- If the case is in a long-term care resident, assisted living resident, or stays at residential facility, contact facility to determine whether the patient was at the facility in their incubation period, determining if they left their facility for any length of time.
Local Health Department Investigation (cont)

- If the case is a long-term care resident AND spent the majority of the incubation period within the facility, report it to the NJDOH, CDS via telephone.
- If the case is a resident in the community, make sure specific exposures including information about travel is entered into CDRSS. Look for other cases in your jurisdiction who may have the same exposure/building mentioned.
- Upon completion of investigation, determine case status and close case in CDRSS.
- Complete the CDC Legionellosis Case Report Form for every confirmed case and fax or mail it to CDS. These forms all go to CDC, who entered them into a database and looks for common exposures throughout the country.

Possible Legionella Labs

- *Legionella pneumophila* urine antigen
  - One of the confirmatory tests (with symptoms)
  - Only tests of serogroup 1
  - Most common
- *Legionella* culture from respiratory sample
  - Not common, hard to grow, gold standard
- *Legionella* antibody (serology)
  - Somewhat common
  - Not confirmatory, unless paired with second test
  - Tests for various species and different serogroups
  - If one serology lab entered, ESORTED/ECLOSED

Review laboratory analysis to confirm positive test result. If case has not been submitted via CDRSS, enter case and lab results

Laboratory Evaluation:
- Can be confusing
- Look at lab
  - Urine = Antigen
  - Serum = Antibody
- Urine antigen confirmatory with clinical symptoms
- Serology needs to be paired to show 4-fold rise in titer

Review legionellosis case definition and disease chapter

- What symptoms are associated with disease?
  - Fever, chills, cough, myalgia, headache
  - Pneumonia (Legionnaires Disease)
- What conditions and tests meet confirmed case definition?
  - Fever, myalgia, cough AND clinical/radiographic pneumonia AND confirmed by culture, urine antigen, paired serology
Enter data from interview and pertinent medical information in CDRSS.

Interview case and/or healthcare provider (if patient is hospitalized):
- What (Symptoms? Fever, cough, myalgia, pneumonia)
- When (Symptoms began? Incubation period)
- Where (Travel? LTC resident? Hot tub? Nebulizer? CPAP?)

Patient Info Tab:
- Illness onset
- Facility name if resident

Address Tab:
- Investigation
- Travel location
- Work place

Clinical Status Tab:
- Illness onset
- Hospital and dates
- Pre-existing conditions
- Treatments
- Died
Signs and Symptoms Tab:
- Part of case definition
- Add all symptoms
- Pneumonia?
- Add comments to describe

Risk Factor Tab:
- Exposures and risk factors are similar to CDC hypothesis questionnaire
- Add travel information
- Add comments that provide more detail about risk factor
- Use CDC hypothesis generating questionnaire

Laboratory Evaluation:
- Lab tests and results
- Add diagnostic test
- X-ray or Cat scan
- Pneumonia
- Comments

If the case is in a long-term care resident, assisted living resident, or stays at residential facility, contact facility to determine whether the patient was at the facility in their incubation period, determining if they left their facility for any length of time.

If the case is in a long-term care resident AND spent the majority of the incubation period within the facility, report it to the NJDOH, CDS via telephone.

Case Comments: Pertinent information gathered from case investigation
If the case is a resident in the community, make sure specific exposures including information about travel is entered into CDRSS. Look for other cases in your jurisdiction who may have the same exposure/building mentioned.

Upon completion of investigation, determine case status and close case in CDRSS.

Complete the CDC Legionellosis Case Report Form for every confirmed case and fax or mail it to CDS. These forms all go to CDC, who entered them into a database and looks for common exposures throughout the country.
Overview
Single Case Investigation

Case Reporting
• Provider or Institutional reporting
  – Usually by phone

• Laboratory reports
  – Majority via electronic laboratory reporting (ELR) in CDRSS

Obtaining Information
• Determine what information is needed
  – Signs/Symptoms
  – Laboratories
  – Risk Factors

• The source to obtain that information
  – Clinical information – health care provider
  – Risk Factors – patient

Reporting Information
• Forms
  – Ensure any required forms are completed
  – Use of forms by LHD

• CDRSS
  – Document the collected information
    • In the fields vs. in comments
  – Document you actions as an investigator
    • Phone calls placed
    • Actions recommended

LHD complete CRF on EACH confirmed legionellosis case and send to CDS
Actions
What public health actions need to be taken?

– Education
– Specimen collections
– Infection Control Measures
– Exclusions

It’s not what you know ....but who you know

• There is no way to know everything about all disease
• Know where to get assistance with investigations
  – Regional Epidemiology Program
  – Subject Matter Experts at NJDOH
  – Other disease investigators

Surveillance

Types of Surveillance

• Passive surveillance
• Active surveillance
• Enhanced passive surveillance

Passive Surveillance

• Provider-initiated
• Useful for large numbers of common events
• Reporting entity must know how to report, what to report and who to report to
• Under-reporting is an issue

Active Surveillance

• Health department initiated
• Involves monitoring sites/persons
• Immediacy inherent in request
• Often requires additional resources
• Viable only for short period of time
Enhanced Passive Surveillance

- Rapid reporting between surveillance agency and stakeholder
- Useful in outbreak situation

Which of the following provides and example of surveillance?

A. A physician reporting a case of salmonella to their local health department.
B. A report from EpiCenter indicating and increase in rash like illness in Hospital X.
C. An infection preventionist reporting a suspect case of novel influenza.
D. A and C only
E. All of the above

Why do we do surveillance?

- Monitor disease trends
- Identify disease clusters
- Detect unusual diseases
- Assist in health planning

Components of Surveillance

- Information
  - Where do we get the information from?
  - What kind of information do we collect?
- Rules
  - How do we compare the information we collect?
- Observe
  - What do we do with the information once it’s collected?

Information

Where do we get the information from?

- Individual Reporting
  - NJAC 8:57
- Electronic Systems
  - CDRSS, EpiCenter, Hippocrates, PulseNet, NHSN
- Public/Media Reports

What kind of information do we collect?

- Investigation
  - Person, Place, Time
    - Who, What, When, Where, Why
  - Does the case meet the case definition
  - Clinically diagnosed case ≠ Surveillance case
Rules
How do we compare the information we collect?

- Case definition
  - Allows for standardization
  - Contains clinical and laboratory components
  - May differ for outbreaks
  - Clinically diagnosed case ≠ Surveillance case
    - Used to count cases not decide whether an investigation is needed or if the person was actually ill

Case Definition Example
Salmonella

- **Confirmed**
  - Isolation of *Salmonella* from a clinical specimen.

- **Probable**
  - A clinically compatible case that is epidemiologically linked to a confirmed case.

- **Possible**
  - Detection of *Salmonella* from a clinical specimen using a non-culture based method.

Case Definition Example
Amebiasis (Intestinal)

- **CONFIRMED**
  - A clinically compatible* case, AND
  - Demonstration of *E. histolytica* cysts or trophozoites in the stool, OR
  - Demonstration of trophozoites of *E. histolytica* in tissue biopsy or ulcer scrapings by histopathology or culture.

*Clinical illness with intestinal disease varies from acute dysentery with fever, chills, and bloody diarrhea to mild abdominal discomfort with diarrhea containing blood or mucus alternating with periods of constipation or remission.

Observe

- Each individual investigation contributes to a larger picture
- Need to look at cases as a whole as well
  - Person – Place - Time
LHD Responsibility in Surveillance

- Investigation of individual cases of disease
  - Complete and submit required forms
  - Following case definitions assign case status
- Evaluate if anything unusual with single case that might require further action
  - Infection control, exclusions etc..
- Look at the bigger picture

Others Responsible for Surveillance

- NJDOH
  - Coordinate multi-jurisdictional efforts within NJ
  - NJ Lead in multi-state investigations
  - May be lead agency in multi-state outbreak
- CDC (FDA or USDA)
  - May be the lead in multi-state investigation

Surveillance Challenges

- Confusing lab results
- Unfamiliar with disease
- Uncooperative physician
- Contacting the patient
- Disease volume

Disease Frequency & Data Comparison

Determine Whether to Investigate Further

- Increase in the number of reports over expected (or possible public report)
- Possible epi association (person, place, and time)
- Possible laboratory linkage

How to Investigate Further

- Review surveillance information
- Review outbreak definitions
- Review published literature about pathogen (known or suspected) involved
Make Epidemiologic Associations

- Person, Place, Time
- Systematically organize key information
- Develop initial hypothesis and case definitions

Epidemiologic Associations

- Use the data in CDRSS
  - Do these children attend the same daycare, school, summer camp?
  - Do they live in the same neighborhood?
  - Did they attend a common event (e.g., street fair, recreational activity)?
- Call in an epidemiologist

Disease Frequency and Data Comparison

- Aggregate data
  - Allows CDRSS users to view compiled data
  - Can compare week to week, month to month or year to year

Disease Frequency & Data Comparison - CDRSS

Scenario

- Your working at local health department and noticed you have done more salmonella investigations than normal
- How do you check if to determine your instincts are correct?
Is this normal to see 12 cases in February? How do we check?

- Compare to similar time period in previous year.
  - Why similar time period?
  - Can you think of other reasons we might see increases?

What do you see? Is there a problem?

What do you do next?

Do you see anything of interest?
Next Steps

- Check individual CDRSS cases for commonalities
  - Same daycare/school
  - Same recreational program
- Re-interview old cases/interview new cases
Run another report looking specifically at risk factors.

Produces an excel file.

Can request information based on what your hypothesis is.

What do you notice??

Other Data to Watch For

• Common Place
  – Hotels, Restaurants, Daycares
• Common Risk Factors
  – Procedures at same facility
• Increases in the number of cases
  – Geographically linked
  – Same time frame
  – Same age group

Timing is Everything

• Enter data in a timely manner to determine and identify disease trends, outbreaks and clusters
• For more info, contact your regional epidemiologist

What do you notice??

Not just for outbreaks – can help identify risk factors that need to be reported.
Other Uses for Data

- Determining disease burden in your community
- Better understand the needs and target groups for public health education messages
- Tracking work load

Outbreak Investigations

Local Health Departments

- LHDs are required to respond to public health emergencies
- LHD must provide health care providers, NJDOH and the public with a contact in the event of an emergency
  - 24 hours per day, seven days per week, including weekends and holidays
- Develop a preparedness plan
- Hold staff trainings at least once a year

Health Officer Authority

[N.J.A.C. 8:57-1.10]

- Investigate the facts contained in disease report(s)
- Determine whether an outbreak exists
  - Order testing of suspected cases
- Ascertain the source and spread of the infection
- Determine and implement appropriate control measures
  - Prophylaxis if necessary
  - Order isolation/quarantine

Categories of Reportable Diseases in NJ

- Confirmed or Suspect Cases IMMEDIATELY Reportable to LHD
  - Includes suspected outbreaks
- Reportable within 24 hours of diagnosis to LHD
- Reportable directly to NJDOH within 24 hours
- Report to NJDOH within 30 days of diagnosis/treatment

Healthcare providers and administrators
- Clinical lab directors
- Veterinarians, animal control officers etc.
- Outbreaks must be reported, not just entered into CDRSS

Who Reports What?
What is an Outbreak of Disease?

• Increase of disease in time or place
• Typically involves 2 or more cases but can vary by disease
• Can vary in magnitude and complexity
  • Small, local cluster
  • Larger, multistate

Routes of Transmission

• Direct
  – Person-to-person (fecal-oral)
  – Animal-to-person (petting zoos, farms)
• Indirect
  – Foodborne/waterborne
  – Fomites (environmental)

⇒ Specific routes of transmission will help guide the investigation activities

Steps to an Outbreak Investigation

• Make required notifications
• Brief the team/prepare for field work
• Confirm the suspected outbreak
• Verify the diagnosis
• Declare an outbreak
• Develop preliminary hypothesis
• Implement initial control & prevention measures
• Communicate with stakeholders
• Define cases
• Identify and track cases
• Create linelists
• Describe the data
• Evaluate your hypothesis
• Adjust control & prevention measures
• Declare outbreak over
• Report/communicate findings
• Review lesson learned

What Constitutes an Outbreak?

(foodborne)

• Two or more persons experiencing a similar illness after ingestion of a common food or different food from a common source or
• Report of cases of a disease in excess of what is normally expected.
• Note: exception- household clusters

“The Call…”

• April 29th
  – University notified local health department
    • 2 university students positive for Salmonella group B
    • 50 additional students with possible GI illness
• April 30th
  – Local health department notifies State health
    • State health department assistance offered
    • Public health authority is Local Health Department
  – Salmonella is reportable through N.J.A.C
  – Investigation at university was started

SALMONELLA OUTBREAK AT A UNIVERSITY
-REAL LIFE EXAMPLE
Confirm the Outbreak

- Compare the current number of reported cases with:
  - numbers from the previous weeks or months, or
  - from a comparable period during previous years
- Other possible reasons for increase in cases:
  - Changes in reporting procedures
  - Revised case definition
  - New diagnostic procedures
  - Heightened awareness at the local or national level

Verify the Diagnosis and Confirm Outbreak

- Preliminary confirmatory laboratory results for Salmonella type B for several students via stool samples
- Many more students reported to school health clinic with consistent Salmonella symptoms:
  - Onset 6-72 hours after ingestion of organism
  - Nausea
  - Vomiting
  - Fever
  - Abdominal cramps
  - Diarrhea
  - Resolution typically within 7 days
- University proactive in obtaining stool specimens

Prepare for Fieldwork

- University + LHD + NJDOH
- Outbreak team assembled for site visit (consider roles that need to be filled)
  - Registered environmental health specialist
  - Epidemiologists
  - Public health nurse
  - Health Officer
- BRING CAMERA!
- Address, contact lists, supplies (stool kits, labels)
- Met with University staff to discuss investigation
- Obtained campus map (floor plans, site map, layout)

University Description

- People:
  - 850 full-time faculty members
  - 4,850 undergraduate students
  - 2,295 graduate students
- Places:
  - 6 residential colleges with dining halls
  - 10 "eating clubs"
  - 120 to 180 members, private dining halls
  - Retail dining, Campus Center X
  - Ill students reported eating at Campus Center X

The Investigation Begins

- Investigation team formed on campus to gather initial data
- Interviews initiated
  - Cold-food prep employees of main campus dining facility
  - Ill students and staff
  - Dining services administrators
- Case ascertainment
  - Student and employee health services
  - Several ill students reported eating Mexican food from Station A of main campus retail dining facility (Campus Center X)

Develop Preliminary Hypothesis

- As information comes in, focus on a preliminary hypothesis to guide the investigation
- Information that can help includes:
  - The nature of the disease
  - Source of the agent
  - Mode of transmission
  - Potential exposures that caused the outbreak
- NOTE: You will revise your hypothesis based on the information you gather during the investigation.
Develop Preliminary Hypothesis: Commonalities in place, time, exposure

- **PLACE**: Several ill students reported eating at the Campus Center prior to becoming ill
  - Common exposure in cases reporting to student health services
- **TIME**: Students reported eating at Campus Center X with overlapping dates of meals and dates of illness onset
- **EXPOSURE**: Reports of eating from one specific station at Campus Center

Public Health Control Measures

- Cohort/isolate/embargo
- Eliminate source
- Time, temp, and procedures
- Hand washing and hygiene issues
- Barrier precautions
- Health education
- Restrict movement
- Prophylaxis
- Exclusion from work/school
- Close facility

Implement Initial Control and Prevention Measures (Don’t Wait)

- Investigation team met with university administration
  - Proactive closing of Station A and salad bar
  - Items not passed through “kill” or cooking step
  - Cease serving of uncooked cheddar cheese campus-wide
  - Various foods sampled for testing
- Work exclusions
  - All campus food handlers with nausea, vomiting, or diarrhea regardless of testing status or results were excluded from work
  - Food prep kitchen visited to verify appropriate preparation steps were taken

Communicate with Stakeholders

- Not really a separate step
- Keep in constant contact
- Essential in controlling outbreak and getting up-to-date case number
- If necessary, set up after hours contact number

Identify and track cases and Communication

- Passive sources
  - Reports from student and employee health services
  - Interviews of student presenting during weekend sick call
- Active sources
  - Blast, campus-wide emails
  - Active recruiting at Campus Center X for cases/controls
  - Swipe card data
    - Identification of times, location, prices of food purchases

YOU CAN HELP!
Did you eat at the XXX Center or other campus venues between April 20 and May 21???
PLEASE STOP BY FOR A 5-MINUTE SURVEY!!!

VOLUNTEERS NEEDED FOR SALMONELLA INQUIRY
PRINCETON STUDENT AND STAFF ASSISTANCE NEEDED

WHAT: A public health investigation is being conducted by NJ Dept Health
WHO: Investigators would like to talk to persons who are at the XXX Center between Sunday April 20-Thursday May 1
Please speak to us if you:
- Got sick
- Did not get sick
WHERE: The XXX Center, room in the G Level
WHEN: Tuesday, May 6th from 10 AM to 3 PM
Data Collection: Foodborne-Illness Questionnaires

- Symptoms (diarrhea, vomiting, fever, abdominal cramps, etc)
- Date of onset illness and date of onset of diarrhea and/or vomiting
- Hospital visit and laboratory testing
- Detailed food history starting with last meal before symptoms began
  - Breakfast, lunch, dinner
  - Open-ended questions
  - “What do you normally eat?”
- Locations, events attended, grocery stores
- Different Questionnaires for cases/controls helpful
  - Case/control study appropriate for foodborne illnesses where the number of exposed people is unknown

Data Collection: Laboratory Testing

- All students and employees reporting diarrheal illness to campus health clinics
- Campus Center X food handlers mandatory stool testing
  - Cold-food preparers only (May 2)
  - All food handlers (May 5)
  - Workers given 3 days to comply with testing

Laboratory Results

- Single PFGE pattern of outbreak strain identified
  Salmonella Paratyphi B, variant Java (N=28)

- Results from mandatory stool cultures of food handlers (N=67)
  - Negative = 60 (90%)
  - Positive = 4 (6%)
  - Refused = 3 (4%)

Salmonella

- There are approximately 2500 serotypes of Salmonella
- Salmonella enterica serovar Paratyphi occur primarily in developing areas and cause illness that leads to an estimated 20 million cases worldwide (not common in US)
  - Salmonella Paratyphi B, variant Java rare
- Usually classified as a foodborne disease because contaminated food is usually the mode of transmission
- Incubation period: 6-72 hours, usually 12-36 hrs
Define Cases

- Case Definition: a standard set of criteria for deciding whether a person should be classified as having the disease and be included in your outbreak investigation.
- May Include:
  - Clinical information about the disease
  - Characteristics about the people who are affected
  - Information about the location or place
  - Specification of time during which exposure or onset occurred
- Outbreak case definition ≠ surveillance case definition
- Can be refined as time goes on
  - Early working case definition might be very broad
  - Can capture suspected/possible cases as well as confirmed and probable cases

Case Definition Classifications

- Confirmed: Verified case, usually through laboratory results
- Probable: A case that fits most of the typical clinical features of the disease but typically has no laboratory confirmation
- Suspect: A case that has some of the typical clinical features of the disease and has no laboratory verification
- Not a case: One that does not meet the outbreak case definition or working case definition

Outbreak Case Definitions

- Confirmed
  - GI illness with onset on or before April 20, 2008
  - History of eating at Campus Center X
  - WITH laboratory-confirmed Salmonella Paratyphi B, variant Java infection
- Probable
  - GI illness with onset on or before April 20, 2008
  - History of eating at Campus Center X
  - WITHOUT laboratory-confirmed Salmonella Paratyphi B, variant Java infection

Identify and Track Cases

There are many ways to track down potential cases:
- Ask stakeholders (physicians, administrators, infection preventionists) to identify cases
- Review communicable disease registries
- Check with medical facilities and labs
- Conduct interviews within the population in question

Communicable Disease Reporting and Surveillance System (CDRSS)

- Secure, web-enabled, electronic disease reporting system
- Real time, 24/7
- Patient-centric
- Available to all LHDs and acute care hospitals in NJ
- Tools Include:
  - Detailed case management
    - patient demographics
    - disease signs, symptoms and risk factors
    - laboratory data
    - medical follow-up
  - Outbreak management
  - Contact tracing
  - Surveillance
  - Mapping/Graphs

Create Line Lists

- Line lists are created to keep track of cases and information from an outbreak
- Good way to organize important information pertaining to your case definition (Step 9)
- Constantly changing/revising
- Can include:
  - Risk Factors, Clinical Information, Symptoms, Location, Onset Date etc.
 Describe Data

- Use data from your line list
- Describe the data in terms of
  - Person
  - Place
  - Time
- Outbreak trend over time, geographic context, and affected populations
- Allows us to review and revise hypothesis, data collection plans, as relevant

 Describe the Data: Descriptive Epidemiology

- 28 confirmed cases
- 42 probable cases
- 52% male
- Age range: 17-56 years, Median: 21 years

 Symptoms of Probable and Confirmed Case-Patients

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>66 (97)</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>56 (82)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>53 (79)</td>
</tr>
<tr>
<td>Headache</td>
<td>49 (72)</td>
</tr>
<tr>
<td>Chills</td>
<td>49 (72)</td>
</tr>
<tr>
<td>Fever</td>
<td>37 (56)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>21 (31)</td>
</tr>
</tbody>
</table>

 Epidemic Curves (Epi Curves)

- Created using the outbreak line list
- Number of cases and the date of illness onset
  - Time on the graph can be different
  - Hours, days, weeks, months, years
- Helps describe the outbreak
- Can show type of source under investigation

 Point-Source Exposure

 Ongoing Source Exposure
Evaluate Hypothesis

Analytic Epidemiology

- Used when the cause of the outbreak is less clear
- Quantifies the relationship between the exposures and the disease to find a causal link
- Different Types
  - Case series
  - Case-control study
  - Cohort study

Case-Control Study

- Compares individuals with disease to those without disease, but that share a similar feature (location, particular exposure)
- Cases are picked by disease status first, with the outcome as the exposure(s)
- Retrospective in nature
- Relatively easy to conduct

Cohort Study

- Used to study a defined group of people
- Compares a group of people with a similar exposure to another group who do not share that exposure
- Here the cases are picked by exposure status, and the outcome is disease
- Can be retrospective or prospective in nature
- Generally more time consuming, more costly, but a more reliable study design

Analytic Study: Cases vs. Controls

- Age range:
  - Cases: 17-56 years, Median 21 years
    - 54% were 19-25 years old
    - 21% were 56 years or older
  - Controls: 5-68 years, Median 31 years
    - 28% were 19-25 years old
    - 37% were 56 years or older
- Gender:
  - Cases: 52% male (27/52)
  - Controls: 59% male (53/90)
Test Hypothesis: Case/Control Study

<table>
<thead>
<tr>
<th></th>
<th>Confirmed</th>
<th>Probable</th>
<th>Controls</th>
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</thead>
<tbody>
<tr>
<td>N=28</td>
<td>N=42</td>
<td>N=93</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>19 (68%)</td>
<td>29 (69%)</td>
<td>35 (38%)</td>
</tr>
<tr>
<td>Staff</td>
<td>5 (18%)</td>
<td>10 (24%)</td>
<td>51 (55%)</td>
</tr>
<tr>
<td>Food Handlers</td>
<td>4 (14%)</td>
<td>3 (7%)</td>
<td>6 (7%)</td>
</tr>
</tbody>
</table>

46% of confirmed/probable cases ate at Station A compared to 18% of controls (p-value < 0.001)

Results of Bivariate and Multivariable Analyses (N=145)

<table>
<thead>
<tr>
<th>Food item</th>
<th>Bivariate OR</th>
<th>Multivariable OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheddar cheese</td>
<td>6.7*</td>
<td>6.2*</td>
</tr>
<tr>
<td>Sour cream</td>
<td>3.3*</td>
<td>1.7</td>
</tr>
<tr>
<td>Salsa</td>
<td>3.0*</td>
<td>0.5</td>
</tr>
<tr>
<td>Chicken from Station A</td>
<td>4.0*</td>
<td>3.4</td>
</tr>
<tr>
<td>Nacho cheese</td>
<td>7.1*</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*P-value < 0.05

Interpretation of Multivariable Analyses

The odds of confirmed or probable illness were 6.2 times greater among persons who ate cheddar cheese than those who did not

– Controlling for:
  • Foods associated with illness in bivariate analysis

Environmental Investigation

• Proactive preventive measures (May 2)
  – Closing of Mexican station, salad bar
  – Cease serving of uncooked cheddar cheese campus-wide

• Multiple inspections
  – Regional Health Department EHS
  • Campus and non-campus locations
  – University EHS

• 32 foods sampled and tested

• Food testing is not usually done for outbreaks due to the cost and labor-intensive nature of the testing

Adjust Prevention and Control Measures

• The investigation progresses and narrows the source of disease

• Fine tune your prevention and control measures to fit with the updated information

• Do not wait to adjust for this “step”, this can be done throughout as new information comes in

• Evaluate effectiveness through surveillance
Develop, Evaluate and Refine Hypotheses

- Food contamination most likely caused by worker(s) at Campus Center X
  - Several food items implicated in a single facility
  - Implicated foods not associated with illness at other facilities
  - Food handlers reported working while having diarrheal illness
- Cheddar cheese strongly associated with illness
  - Biologically plausible: bare hand contact of uncooked food
- Unlikely any product was contaminated before handling
  - Cheddar cheese tested from unused bag: negative
  - No other clusters/outbreaks of Salmonella Paratyphi B, variant Java reported during same period

Declare the Outbreak Over

- Outbreak is over when no case is reported within two incubation periods of the disease in question
- Can vary greatly by disease
- Allow for delays in reporting
- Consult with NJDOH if questions arise

Limitations

- Recall bias associated with food histories
  - Multiple food stations
  - Mixing of various food items within a station
- Recall bias associated with worker exposures
  - Campus Center X workers with various daily responsibilities
  - Stool testing of employees may have been late
- Data “contamination”
  - Heightened awareness, over-reporting by ‘non-cases’
    - 57 students/staff investigated who had illness that was not related to the outbreak
- Food testing did not occur after food handling

Communication and Report Findings

- Reinforce safe food-handling practices
  - Worker should avoid all food-handling responsibilities during GI illness
  - Emphasize frequent and adequate hand-washing and glove usage
- Provide appropriate instruction that takes into account potential language barriers
- Utilize existing networks for case ascertainment and risk communication

Report and Communicate Findings

- Provide an oral briefing to your outbreak team; might have to include the media also
- Provide a written final report
  - Summary of findings
  - Actions taken to stop disease transmission
  - Recommendations
  - Must be submitted to NJDOH within 30 days of outbreak completion

Review Lessons Learned

- Take this time to look back on the investigation to see what went well and what needs to be improved upon
- Every new outbreak is a learning experience as every outbreak is different
Investigation Highlights

- University cooperation
  - Resources
  - Staff meetings
  - Student/employee Health Services
- Outbreak team
- Communication
  - Detailed daily updates of investigation
  - Press office(s) coordination
  - E-mails to entire campus
- Swipe card data

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