

Public Health Epidemiology for Law Enforcement

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A Public Health Investigation Primer

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Goals of This Lecture

- Learn common public health terminology
- Learn how public health agencies approach preventing and controlling infectious diseases
- Learn how epidemiologists approach finding, investigating, and controlling outbreaks





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Public Health

- Organized federal, state and community effort to protect, promote and improve the health of its citizens
 - Primary care: focus on individuals
 - Public health: focus on populations
- A social institution, a discipline and a practice





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Goals of Public Health

- Goal: to reduce the amount of premature disease and disability in the population





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Public Health and Law Enforcement Goals Compared

Law enforcement:

- Stop further crimes
- Protect health and safety of public
- Apprehend and convict criminals

Public health:

- Stop further cases of disease and outbreaks
- Protect health and safety of public
- Build science base for future prevention





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Terminology

- Case: the totality of an investigation or a person?
- Suspect: a person under suspicion or a person who may be a case?
- Victim vs. Case
- Evidence: criminal vs. scientific





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Epidemiology

- Originally, the study of epidemics / outbreaks
- Study of the factors that contribute to illness in individuals and communities, and how to improve health by altering those factors





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Epidemiology

- Examples of health problems: infectious diseases, chronic diseases, unintentional injuries, violent injuries, deaths
- Why are some people sick and not others?





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Public Health Emergencies

- Threat and reality of bioterrorism have focused attention on public health preparedness for emergencies
- Planning for public health emergencies requires interagency agreements, training, and exercises





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Public Health Emergencies

- Examples of public health emergencies:
 - Natural disaster: hurricanes, floods, earthquakes;
 - Outbreaks from contaminated food or water, influenza pandemics;
 - Biological, chemical, radiological and nuclear WMD





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Local-State-Federal Relationships

- Public health is constitutionally a state matter
- Local health agencies: disease surveillance, initial outbreak investigations
- State health agencies: technical assistance, policy guidance, lab support, field assistance, resources (vaccines, drugs, ...)





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Local-State-Federal Relationships

- CDC provides resources when outbreaks exceed state capacity, are multi-state or international, or result from bioterrorism
- For events within states, CDC usually investigates only on request of state health department



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Varieties of Local Health Departments

What Do We Have Here?

- City agencies
- County agencies
- City-county agencies
- Multi-county agencies
- County or multicounty branches of state health agency
- Direct service by state health department
- Does this jurisdiction have a local board of health?





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Local Health Department

- Responsibility and authority to investigate all epidemics, outbreaks, and issues of public health concern
- First responder for investigating and controlling biological WMD events
- **County Health Dept Director is Public Health Officer**
- Epidemiologist – Disease Detective



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Public Health 'Police Powers'

- Inspect or close premises
- License and discipline health professionals and facilities
- Limit the movements of people (isolation, quarantine)
- Require vaccination, testing, or treatment
- Seize, embargo, impound food and other hazardous substances, or stop their sale
- Board planes, trains, buses, and ships as part of disease control
- Review medical, hospital etc. records
- Interview whoever and whenever information is needed for investigation of a public health problem





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Public Health Agencies Also Regulate

- Most PH agencies have powers to take disciplinary actions against licensed entities (restaurants, day-care centers, health care workers, etc.)
- These are handled as administrative law issues, not crimes
- Criminal prosecutions are very rare





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Who Works in Public Health?

- Many disciplines:
 - Doctors (MD, DO, DVM, PhD)
 - Nurses (RN, PHN)
 - Laboratory workers (microbiologists, technologists)
 - Social workers, health educators
 - Environmental health workers
 - Attorneys
 - Administrators
- Many have additional degrees/training in public health





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What is an Outbreak?

- An outbreak is the occurrence of more cases of a disease than expected in a population during a certain time
- One case of smallpox, anthrax, plague, botulism, or tuberculosis anywhere in the US is an outbreak requiring immediate response
- An epidemic and an outbreak mean the same thing
 - Epidemic is often applied to an outbreak of special concern





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How Are Outbreaks Detected?

- Recognized and reported by individual doctors or groups (e.g., an emergency dept) **Add your reporting number here!**
- Recognized and reported by those affected (e.g., coworkers, school, banquet)
- Detected by PH agency through review of individual cases reported by doctors, or review of lab reports or other health care data
- Enhanced surveillance in cooperation with state and federal public health officials



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Surveillance

- The ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely feedback of these data to those who need to know.

In public health, 'surveillance' means tracking the occurrence of diseases of importance – not watching individuals or premises



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Communicable Disease Reporting

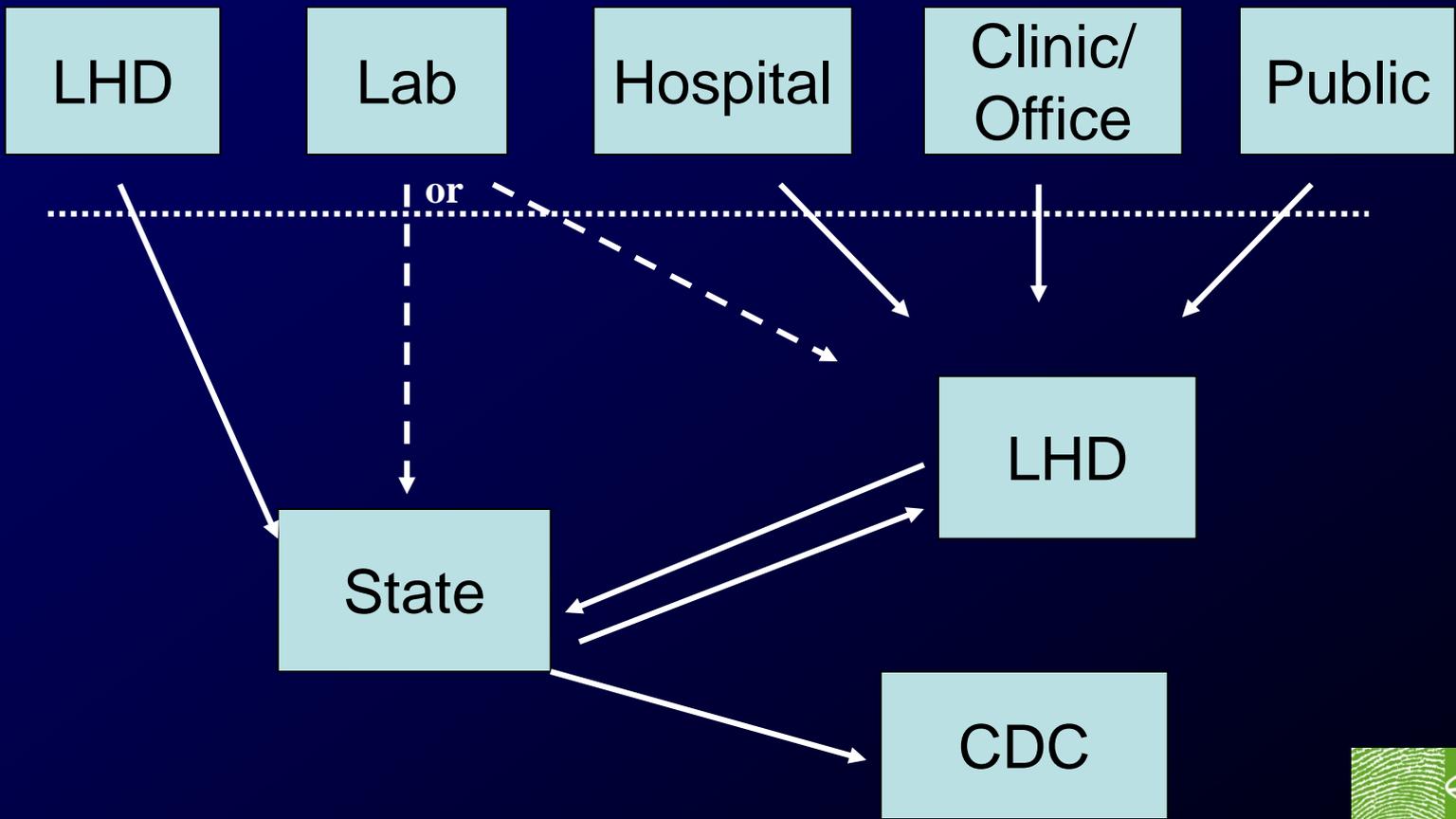
- About 60 diseases reportable in most jurisdictions
- Includes diseases linked with bioterrorism
- What mechanism does this jurisdiction use to collect case reports from physicians, hospitals, and laboratories?
- Does this jurisdiction have a way to detect outbreaks based on early symptoms or syndromes, before diagnoses are made?





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Communicable Disease Reporting -- Passive Surveillance





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How Do Infectious Diseases Spread?

- Airborne
- Common source (food or water)
- Person-to-person
- Vector-borne



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Airborne

Aerosolized infectious agents enter lungs

- Anthrax
- Plague (pneumonic form)
- Smallpox
- Tuberculosis
- Influenza
- Measles
- Whooping cough
- Legionnaires' Disease



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Common Source

- Food
 - Place: restaurant, home, store
 - Item: ground beef, eggs, salad
- Water
 - Drinking water
 - Swimming pool, lake, hot tub, fountain





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Person-to-Person

- Direct contact
 - HIV, Sexually transmitted diseases, smallpox
- Indirect contact
 - Fecal-oral
 - Shared towels, combs or toys
- Face-to-face via droplets
 - Coughing, sneezing





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Vector-Borne

- West Nile Virus (mosquitoes)
- Malaria (mosquitoes)
- Lyme disease (ticks)
- Plague, typhus (fleas)
- Saint Louis Encephalitis (mosquitoes)



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Incubation Period

- Time interval between initial infection and onset of clinical features of disease
 - Very short: influenza, colds (12-36 h)
 - Short: salmonella (24-72 h)
 - Long: measles (10-14 d), hepatitis A (2-6 wks)
 - Very long: hepatitis B (6 w – 6 mo), TB (mos – yrs)
- Key concept in disease transmission and control
- For some diseases, people are infectious during part of the incubation period



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Steps in an Outbreak Investigation

- Detect problem by public health surveillance
- Verify diagnosis
- Confirm epidemic
- Identify / count cases
- Characterize data → time / place / person
- Take immediate control measures
- Formulate / test hypotheses
- Implement / evaluate additional control measures
- Report findings





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Detect Problem

- Infection control nurse at one hospital in a city reports to the local health department that 4 people were admitted overnight with bloody diarrhea and fever





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Verify Diagnosis

- Health department epidemiologist contacts hospital and clinical labs and confirms diagnosis: *Shigella sonnei*





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Confirm Epidemic

- Epidemiologist checks with other hospitals and labs to see if there are any additional lab-confirmed cases finds 5 more, with additional specimens cooking





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Identify and Count Cases

- County epidemiologist investigates:
 - Talks to cases
 - Learns of other ill people
 - Arranges for lab testing
 - Develops case definition (diarrhea plus fever >101 or positive culture)
 - Alerts primary care physicians/ emergency departments to look for and report additional shigellosis cases and recommends lab testing





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Characterize Data by Time / Place / Person

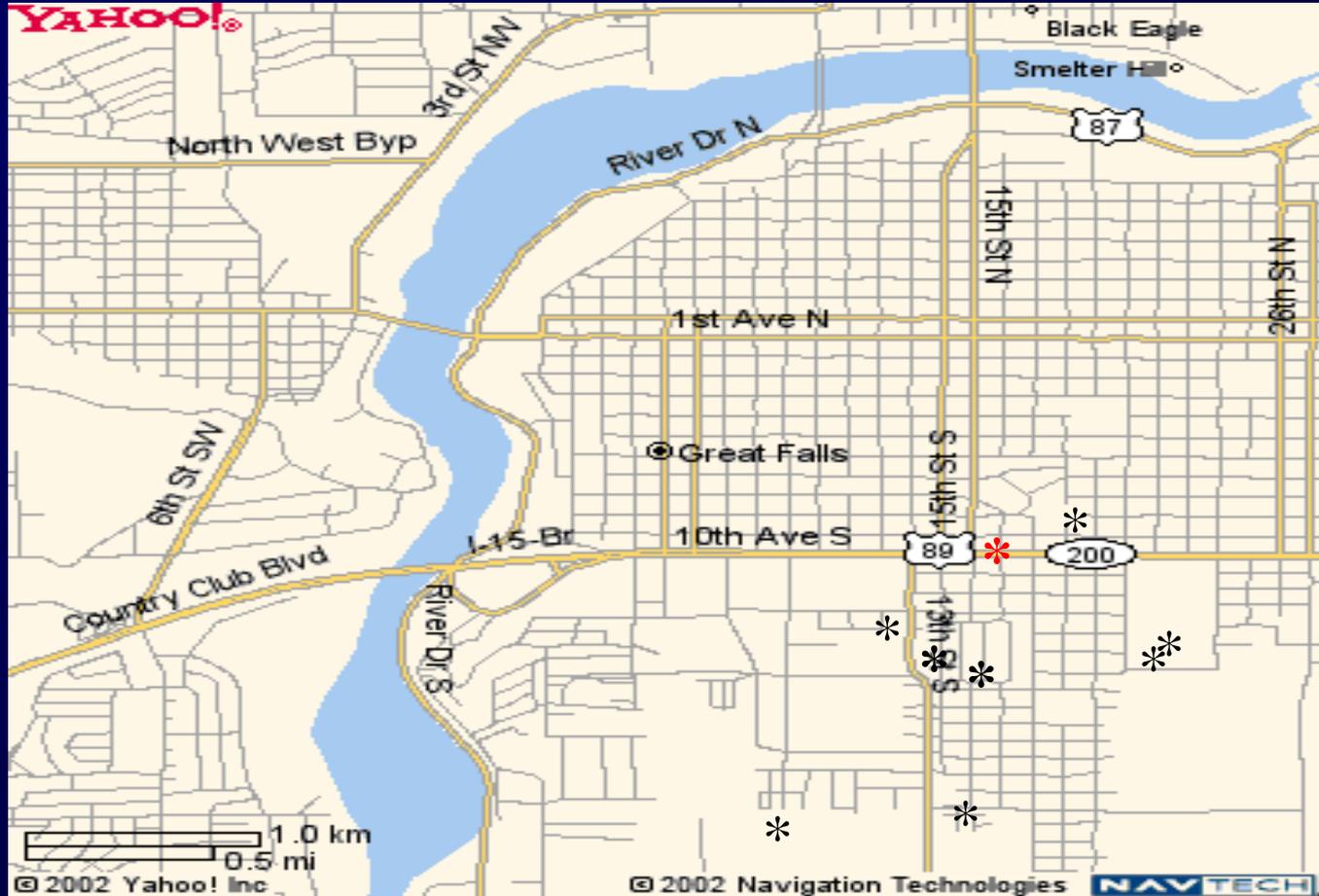
- Epidemiologist interviews cases looking for common exposures (e.g., day-care, restaurant, unusual food item)
- Most cases report eating at one Mexican-theme fast-food outlet in the southeast part of city about 2 days before onset of illness
- Makes list of cases, plots cases on city map, draws time line
- Epidemiologic tools can be used to show that an outbreak is NOT of natural origin



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Spot Map

* = one case * = restaurant



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Line List

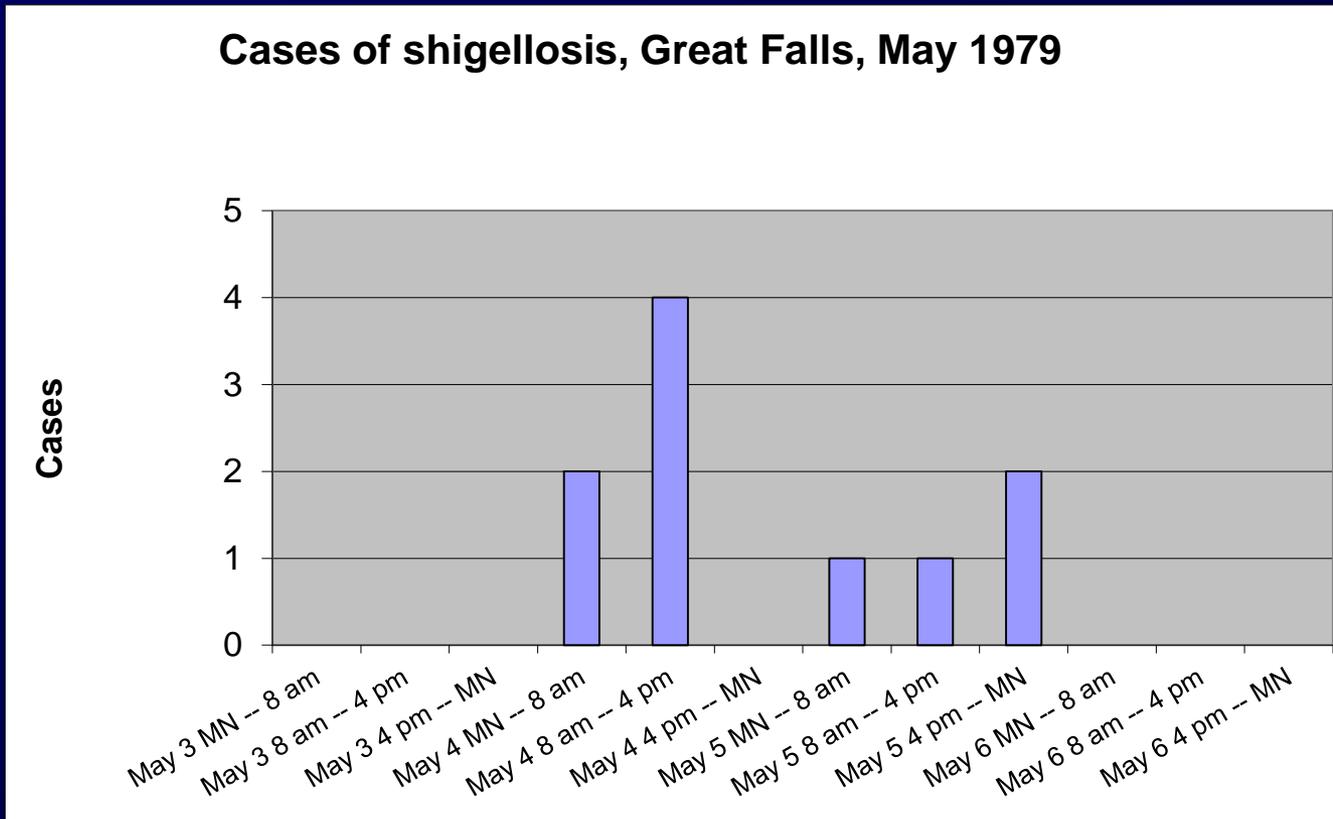
Line list of cases of probable and confirmed shigellosis						
Great Falls, MT, May, 1979						
Initials	Date of onset	Time of onset	Diarrhea	Fever	Culture	Category
RS	4	4:00 AM	Y	Y	Pos	Conf
GM	4	6:00 AM	Y	Y	Pending	Prob
AH	4	8:00 AM	Y	Y	Pos	Conf
JM	4	2:00 PM	Y	Y	Pos	Conf
TD	4	3:00 PM	Y	Y	not done	Prob
JD	4	4:00 PM	Y	Y	Pos	Conf
LR	5	6:00 AM	Y	Y	Pos	Conf
AR	5	11:00 AM	Y	Y	Pending	Prob
RG	5	7:00 PM	Y	N	Pending	Poss
TM	5	9:00 PM	Y	Y	Pos	Conf





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Epidemic Curve





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Prevention and Control Measures

- Visit to food outlet finds food handler who had a compatible illness on the right days. Her job was shredding lettuce.
- Health department
 - Orders this person taken off the job
 - Reinforces hand washing for all food-handlers
 - Cultures all employees



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Formulate / Test Hypotheses

- All cases report eating items with lettuce from one restaurant
- Only half of restaurant orders include items with lettuce
- Only the lettuce-shredder has positive culture for *Shigella sonnei*

 **Conclusion:** outbreak caused by contamination of lettuce by ill foodhandler



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Implement / Evaluate Additional Control Measures

- Restaurant manager admonished and educated
- Restaurant not closed
- No further cases





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Write Report

- Report written for health department director and food service licensing office
- Recommends further efforts to educate restaurant owners to not let ill persons work, and to require hand-washing by employees.



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Hypotheses -- Theories

- Epidemiologists develop and test theories about how the outbreak occurred
 - Gather information about circumstances of outbreak
 - Do lab tests of people, food, water, environment
 - Interview cases and non-cases to see how they are different
- *This is similar to how law enforcement investigators pursue a theory of the case with interviews and lab tests*



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Where Did the Outbreak Start?

- Most outbreaks do not have an identifiable scene you can put a tape around:
 - Spread is from person to person; or
 - Common source is gone; or
 - Group has dispersed from site of exposure; or
 - Source material discarded or replaced



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What Should Make You Suspect an Intentional Outbreak?

- Cases of an extremely rare disease (anthrax, plague, smallpox) that could be BT agent
- Ordinary disease but out of season or area or with wrong mode of spread or other unusual characteristics (I.e. antibiotic resistance, atypical symptoms or victim demographics)
- Cannot solve outbreak with usual techniques
- Threats received
- Group taking credit
- Plausible accusations



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What Should Make You Suspect an Intentional Outbreak?

- All victims attended a common event
- All victims share a common workplace or other locale
- All victims work for the same agency
- A dissemination device is found
- Whom should PH workers call first in this community when they receive allegations that someone has caused an outbreak deliberately?





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Categories of Intervention

- Efforts directed at source of infectious agent
 - Vehicle
 - Vector
- Efforts directed at people at risk





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Interventions Directed at Source

- Eliminate / treat source
 - Dispose of contaminated food, shock-chlorinate contaminated water
- Isolate / treat infected persons
 - Prevent further exposures by minimizing susceptibles' risk of exposure to infectious persons
- Close contaminated sites / sources
 - Protect susceptibles by minimizing risk of exposure from infected sites / sources





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Interventions Directed at People at Risk

- Reduce risk of exposure in susceptible people – e.g., by educating on how to avoid exposure
- Directly protect at-risk people
 - Vaccinate
 - Post-exposure treatment with medicines or vaccines to prevent or lessen illness



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Goal of Epidemiologic Investigation: Prevention

This is the source of urgency for PH staff

- Find and fix ongoing point source (like contaminated water supply)
- Close location until fixed
- Take food product off the market
- Find, isolate, and treat infectious people
- Find exposed people, give them prophylactic treatment or vaccine, and/or quarantine them



Questions?

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