Conducting an Outbreak Investigation in 7 Steps (or less)

Center for Infectious Disease Preparedness
UC Berkeley School of Public Health
URL: http://www.idready.org

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http://www.openoffice.org

Learning objectives: Participants will be able to ...

- Describe at least three ways that outbreaks are recognized;
- Describe at least three reasons for investigating an outbreak;
- Describe at least three constraints to conducting an outbreak investigation;
- Describe the seven step of conducting an outbreak investigation.

Overview

- Introduction
- Seven steps
- Case studies (optional)

For detail steps see the Essential Field Epidemiology Quick Reference Guide, available at http://www.medepi.net/epitools/QuickRefGuide.pdf

Notes:

How are outbreaks recognized?

- Practitioners (astute clinician, infection control professional, laboratory worker)
- Patient or patient's family
- Public health surveillance data (uncommon)
- Local media (newspaper and television)

Reasons for investigating outbreaks

- Prevent additional cases in the current outbreak
- Prevent future outbreaks
- Learn about a new disease
- Learn something new about an old disease
- Reassure the public
- Minimize economic and social disruption
- Teach epidemiology

Constraints of field outbreak investigation

- Urgency to find source and prevent cases
- Pressure for rapid conclusion
- Statistical power often limited
- Media reports may bias interviewees
- Pressures because of legal liability
- Pressures because of financial liability
- Delays lead to limited human or environmental samples for testing

Notes:

Conducting an outbreak investigation in 7 steps (or less)

1. Case investigation
2. Cause investigation
3. Control measures (do early)
4. Conduct analytic study (if necessary)
5. Conclusions (epi/causal inference)
6. Continue surveillance
7. Communicate findings

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Outbreak investigation: 1. Case investigation

- Confirm outbreak
  - Confirm diagnoses
  - Case definition
  - Case line listing started
  - Case finding
  - Case interviews
  - Complete line listing
  - Case descriptive epidemiology
  - Establish baseline occurrence of cases
  - Rule out alternative explanations (chance, bias, ...)
- Generate preliminary causal hypotheses

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Outbreak investigation: 2. Cause investigation

- Systematically review known causal factors (Transmission mechanisms and dynamics)
- Prioritize likely causes to guide control measures (Step 3)
- Generate testable hypotheses to conduct analytic study (Step 4) if cause remains unknown or control measure not working

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Notes:

How is cause investigation usually organized?

- Epidemiologic/clinical investigation
- Environmental investigation
- Laboratory investigation
- Veterinary or vectorborne investigation
- Forensics/Law enforcement investigation

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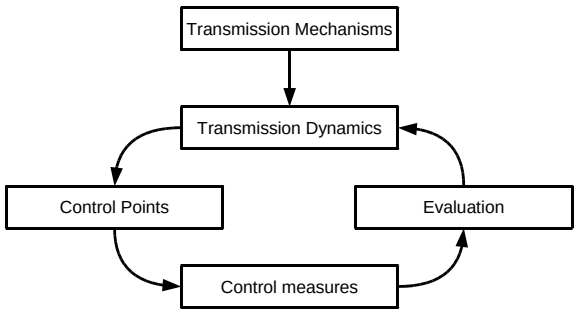
Outbreak investigation: 3. Control measures (do early)



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Transmission dynamics and control points

Effective reproductive number

$$R(t) = c\ p\ d\ x(t)$$

Conditional infection rate

$$I(t) = c\ p\ P(t)$$

Control points	Prevention and control strategies
Contact rate (c)	1. Reduce contact rate
Prob. source infectious (P)	2. Reduce proportion infectious sources
Transmission prob. (p)	3. Reduce infectiousness 4. Reduce susceptibility 5. Interrupt transmission
Duration infectiousness (d)	(see #3)
Fraction susceptible (x)	6. Increase herd immunity

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Notes:

Outbreak investigation: 4. Conduct analytic study

- Prepare study protocol
  1. Primary question(s)
  2. Significance
  3. Design
  4. Subjects
  5. Variables
  6. Statistical issues
- Conduct study
- Analyze data
- Interpret findings

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Outbreak investigation: 5. Conclusions (inference)

- Epidemiologic inference
  - Validity (internal and external)
  - Threats to validity
- Causal inference
  - Causal criteria
  - Causal models

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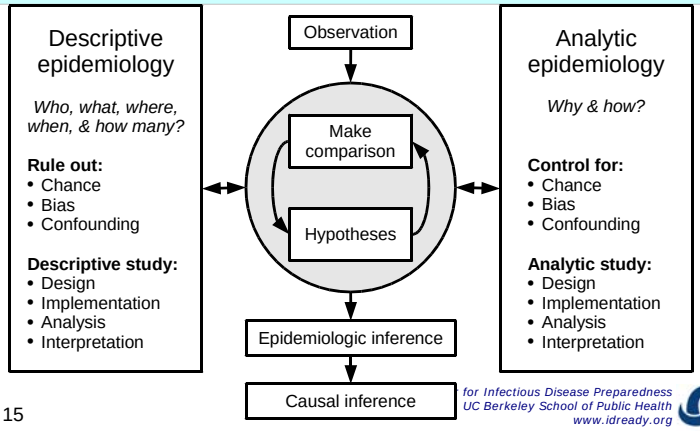
Inferences in epidemiology



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Notes:

Outbreak investigation: 6. Continue surveillance

- Detect outbreaks
- Detect public health threats
- Detect infectious cases (case finding)
- Monitor trends in a target population
- Monitor exposed individuals for symptoms
- Monitor treated individuals for complications
- Direct public health interventions
- Evaluate public health interventions
- Generate hypotheses for further evaluation

Outbreak investigation: 7. Communicate findings

- Communicate preliminary assessments and recommendations (letter, memo)
- Prepare interim/final reports
- Prepare manuscript (optional)
- Risk communication strategy (what to say)
- Media communication strategy (how to say it)

Case studies

Please review assigned case studies.

Notes: