

Outbreak Investigation & Management

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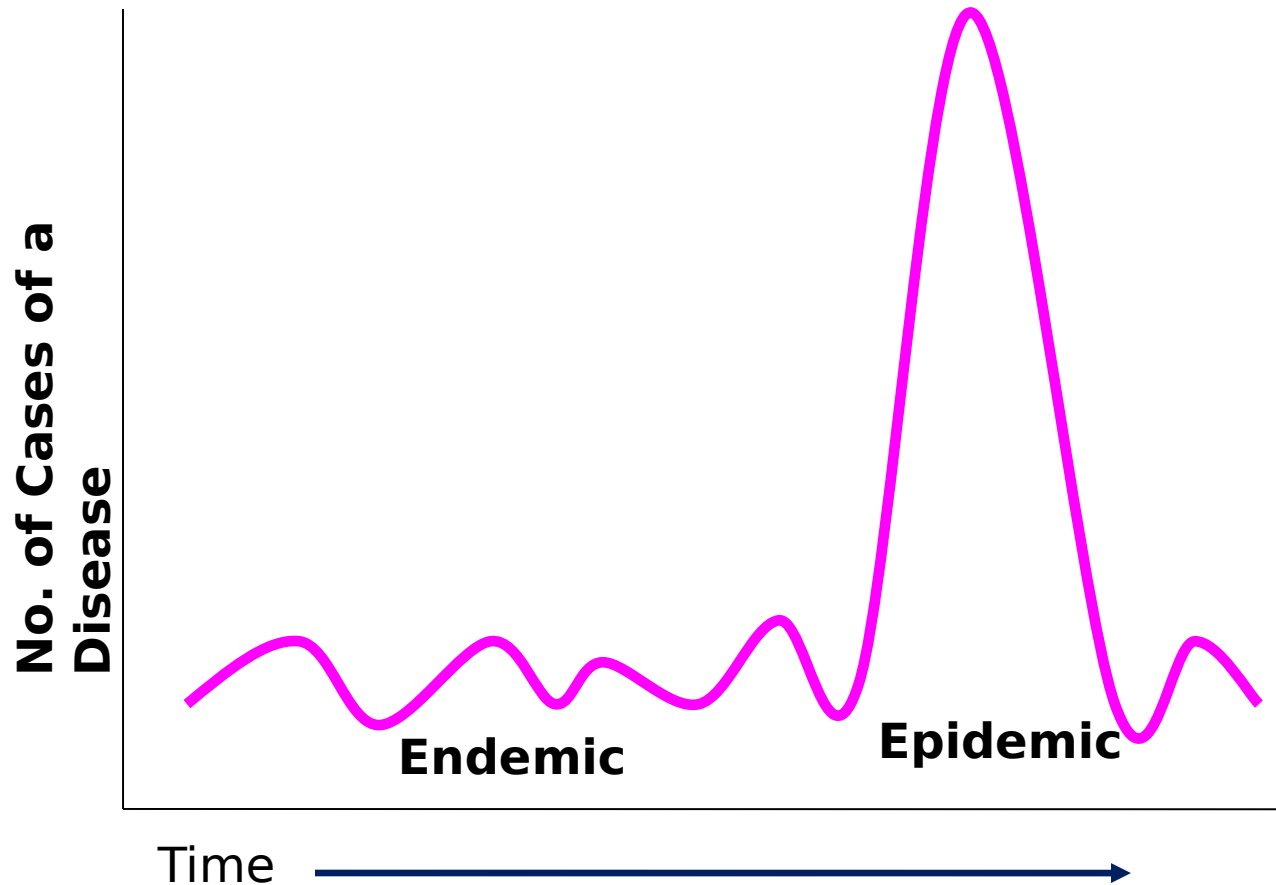
Outline

- Definition of terms,
- Sources of Outbreak,
- Why investigation & How to detect an outbreak,
- Steps in an outbreak investigation & activities,
- Control vs Intervention & impacts,

What is an outbreak?

- An epidemic or an outbreak exists when there are **more cases** of a particular disease **than expected** in a given area, or among a specific group of people, over a particular period of time.

Endemic vs. Epidemic



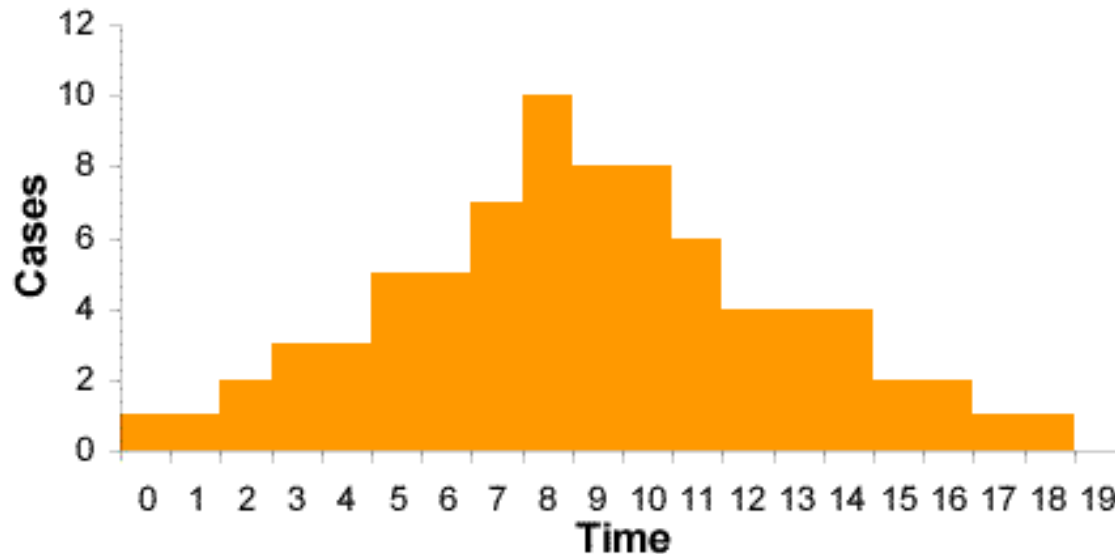
Definitions ...

- Epidemic
 - more cases of disease than expected
 - in a given area or specific group of people
 - over a particular period of time
- Outbreak
 - An epidemic limited to localized increase in the incidence of disease, e.g., village, town

Sources of Outbreak

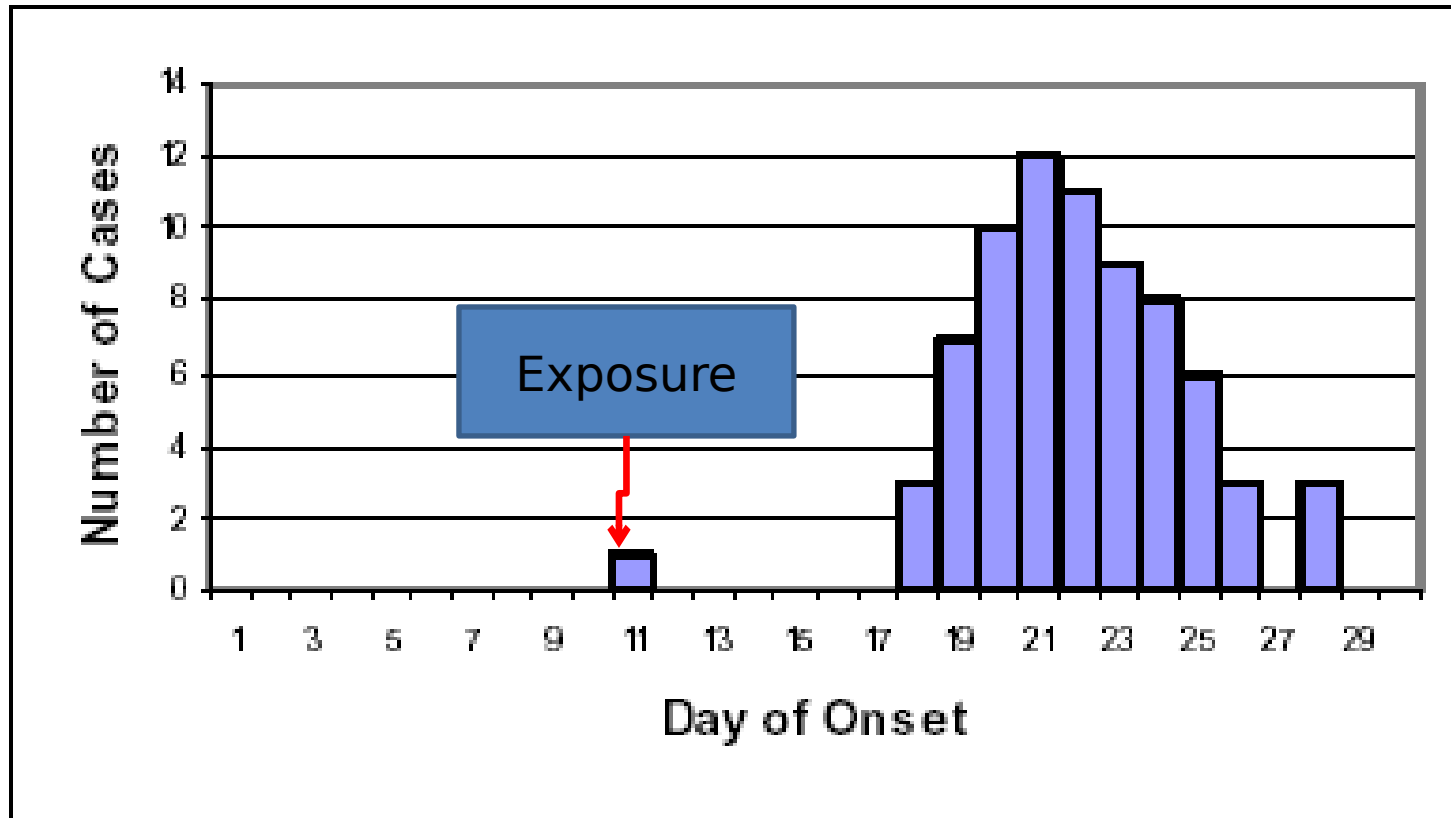
- Multiple source: e.g. Vector born diseases,
- Common source:
 - Point source of single exposure, e.g. Food born disease,
 - Common source of intermittent exposure,
 - Common source of continuous exposure,
 - Point source of propagating disease,

Vector-borne_Disease

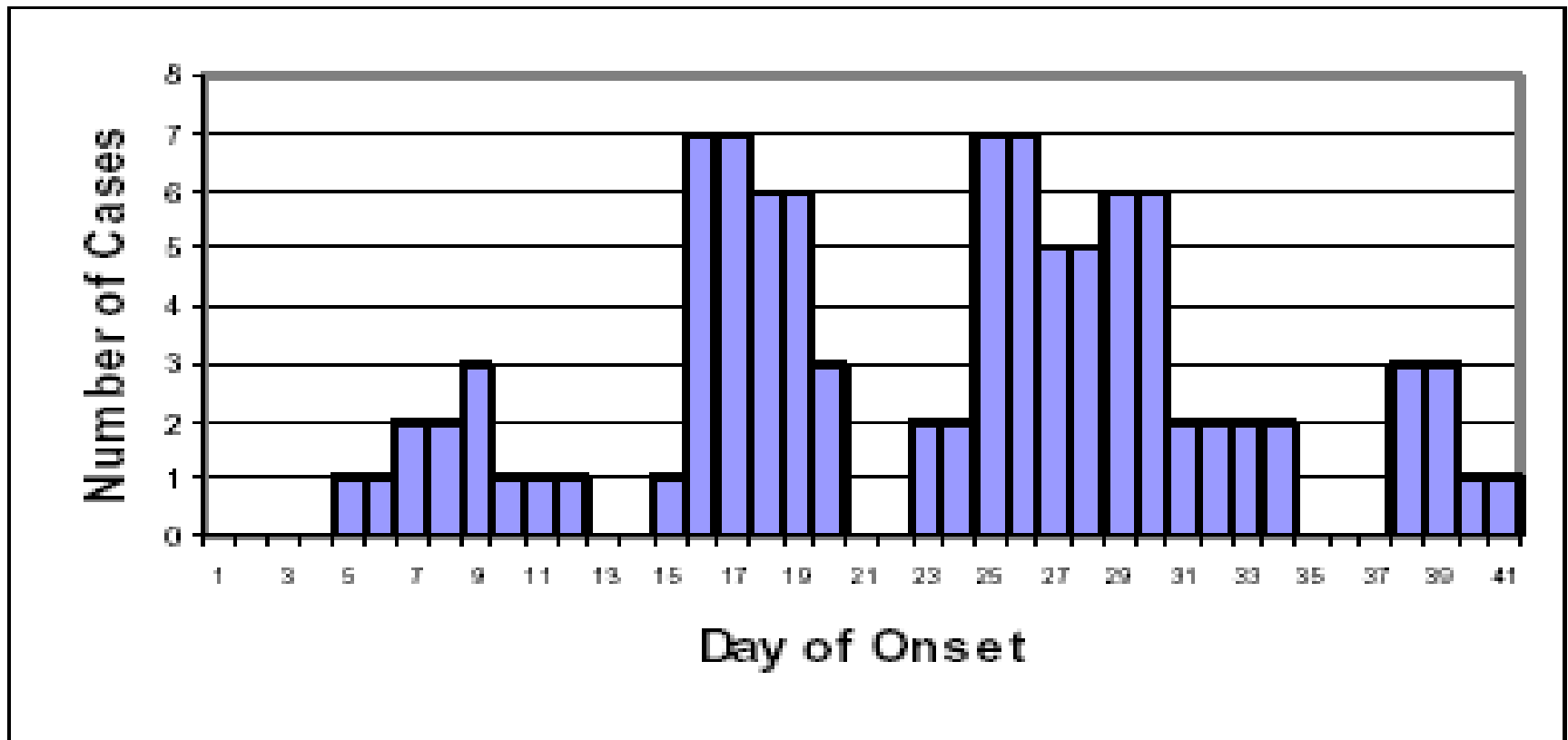


- Starts slowly
- Time between the first case and the peak is comparable to the incubation period.
- Slow tail

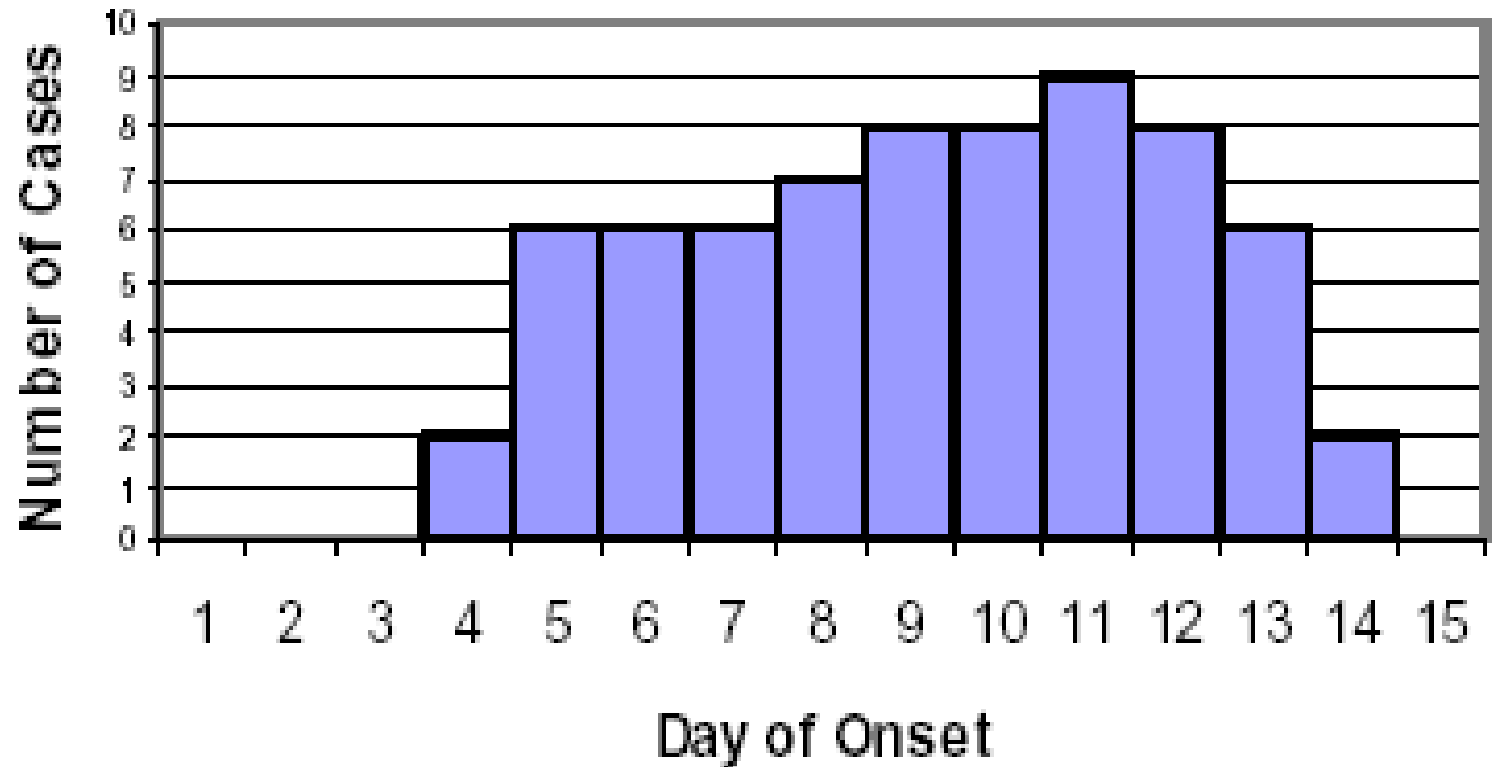
Common Source Outbreak - Point Source Exposure



Common Source Outbreak - Intermittent Exposure



Common Source Outbreak - Continuous Exposure



Why Investigate?

- Undertake appropriate intervention
- Avoid the wrong intervention
- Use most effective control or prevention measures
- Efficient and wise use of resources
- Program considerations
- vaccination, medicines, treatment
- Public / political / legal concerns
- Training

Outbreak Investigation - *Purpose*

- Stop the outbreak
 - Identifying the agent, reservoir, source, and/or mode of transmission
 - Determining who is at risk for disease, place, time
 - Identifying the exposures or risk factors that increase risk of disease
- Prevent future outbreaks
- Improve surveillance and outbreak detection

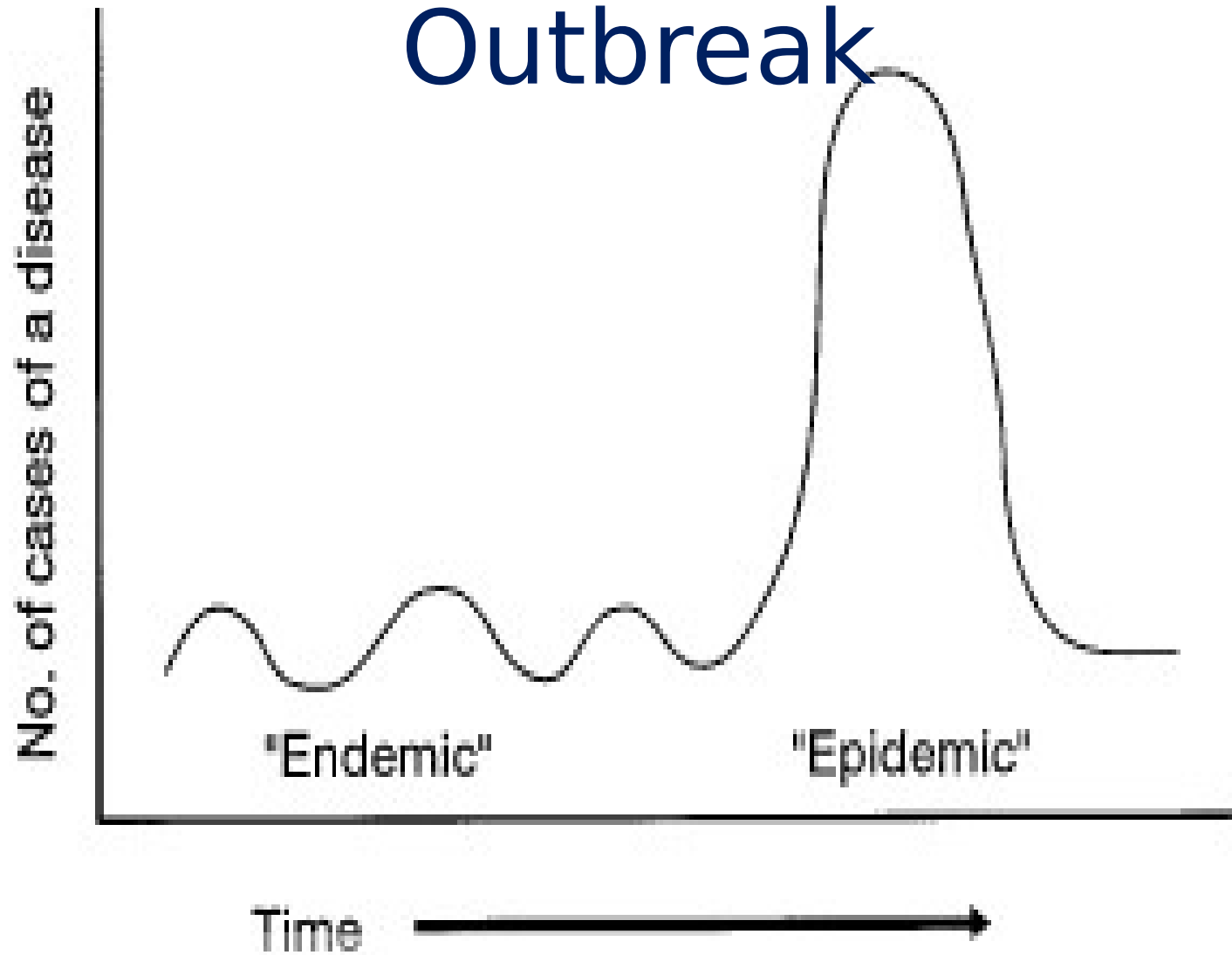
How are Outbreaks Detected?

- Observation of a single event or cluster of events by
 - ✓ Medical staff (doctors and nurses)
 - ✓ Laboratory personnel
 - ✓ Surveillance officers
 - ✓ Community workers
- Report of one or more patients
- Routine surveillance activities
- Reports in media outlets

Steps of an Outbreak Investigation

1. Confirm existence of an outbreak
2. Prepare for field work
3. Verify the diagnosis
4. Establish case definition; identify, count cases
5. Tabulate data by person, place, and time
6. Develop hypotheses
7. Evaluate hypotheses (analytical studies)
8. Refine hypotheses (additional studies)
9. Implement control and prevention measures
10. Communicate findings

1. Confirm Existence of Outbreak



2. Prepare for Field Work

- Investigation needs
 - Expertise
 - Sample questionnaires, supplies
 - Laboratory
 - Plan of action
- Management / operational issues
 - Team composition, role of each
 - Communications plan
 - Where to go / whom to meet

3. Verify the Diagnosis

- Ensure proper diagnosis
 - Rule out laboratory error
- Examine / see case-patients
- Review medical records

4. Case Definition

- In epidemiology a case is an event
- An event is something that happens:
 - To a person;
 - In a given place;
 - At a given time.
- Cases are difficult to consider if you lack:
 - Information on the person
 - Information of the place
 - Information about the onset date

Case Definition Categories

- **Confirmed cases**-verified by lab analysis
- **Probable cases**-clear clinical picture or linked epidemiologically to a confirmed cases
- **Possible cases**-Indicative clinical picture with out being a confirmed or probable cases

5. Find Cases Systematically

- Conduct surveillance using case definition
 - Active surveillance
 - Use case data collected prior to your arrival
 - Try to identify all cases
- Collect data on case-patients
- Create line listing

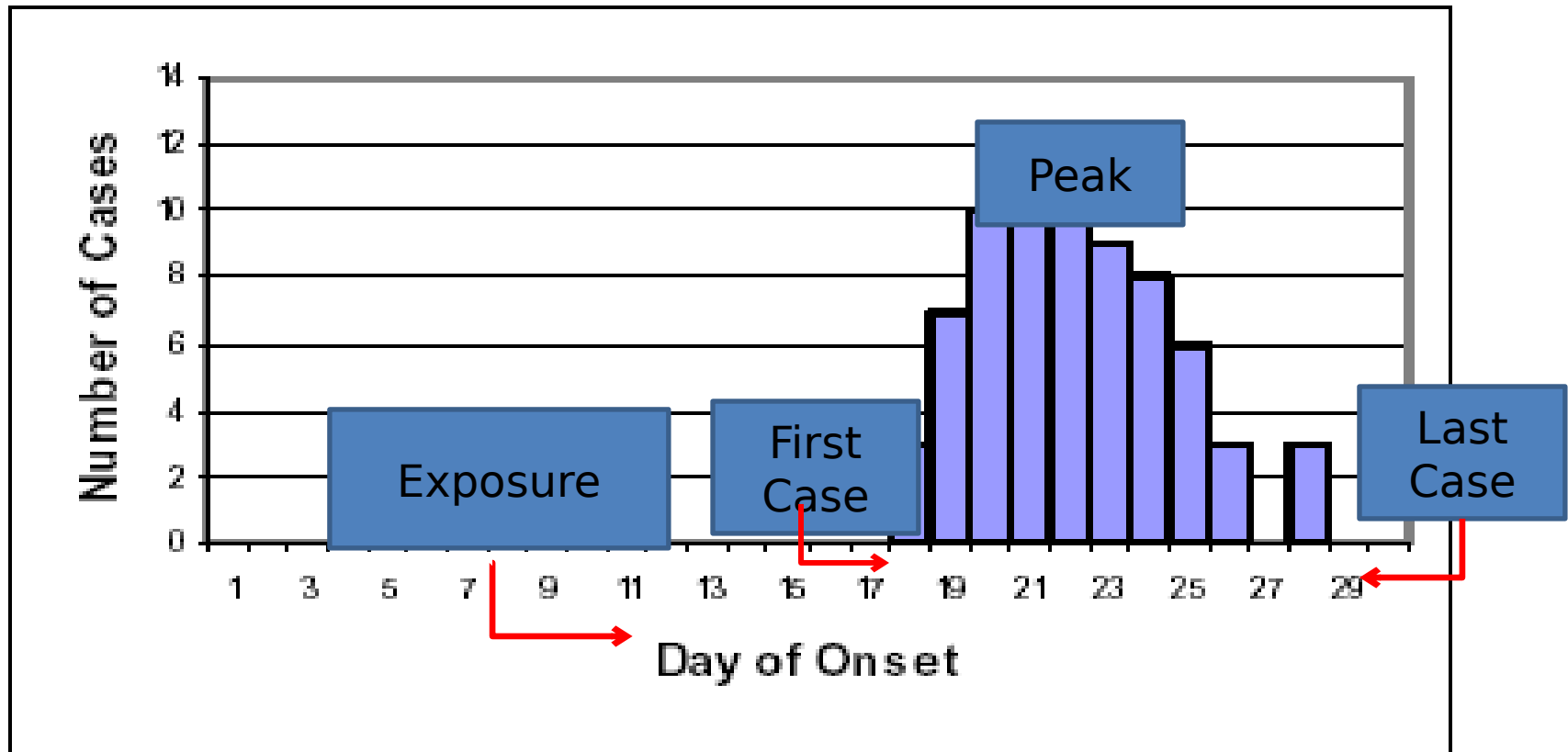
Case Classification

- Primary case
 - The person who **introduces** the disease into the population.
- Index case
 - The first case to come to the **attention** of investigators.
- Secondary cases
 - Cases occurring among contacts, within an incubation period following exposure.

Data by Time, Place, Person

- Time (epidemic curve)
 - Ideally, when were they infected?
 - More practically, when did they become ill?
- Place (spot map, shaded map)
 - Ideally, where were they infected?
 - More commonly, where do they live, work?
- Person (tables)
 - Who was infected?
 - Numerators and denominators
 - What do the cases have in common?

Epidemic Curve - Course of the Epidemic



6. Develop Hypotheses

- Subject matter knowledge – known sources, vehicles, transmission modes
- Review descriptive epidemiology – what would account for most?
- Talk to case-patients – what do they think?
- What do local health officials think?

Outliers

- Outliers may have had a different type of exposure to the source of infection
 - Different timing
 - Different intensity
 - Different location
- Outliers may be source patients
- Outliers may correspond to errors in data collection

From Developing to Testing

- Hypothesis generating
 - Characteristics that are common among cases lead to the generation of hypotheses
 - More than one hypotheses must be generated
 - There may be more than one source
 - The investigator may be following a red-herring /deviation.
- Hypothesis testing
 - Sort out the characteristics that are also common among non-cases from

7. Evaluate Hypotheses

- Usually Analytic Epidemiology
 - cohort study & risk ratio
 - case-control study & odds ratio
 - must have comparison group
 - non-sick or controls
- Otherwise, compare facts with hypotheses

Standard Two-by-Two Table

	Ill	Well	Total	Risk
Exposed	a	b	H_1	a / H_1
Unexposed	c	d	H_0	c / H_0
Total	V_1	V_0	T or N	

Odds ratio = ad/bc

8. Refine Hypotheses

- Conduct additional studies
 - Environmental sampling
 - Laboratory-based
- If analytic study results are conclusive, don't wait for positive samples before implementing prevention.

9. Implement and evaluate control measures

- Prevent further exposure and future outbreaks by eliminating or treating the source
- Work with regulators, industry, and health educators to institute control measures
- Create mechanism to evaluate both

10. Communicate Findings

- Summarize investigation
- Make recommendations
- Disseminate report
- No report means little contribution of improving scientific and public health knowledge.

Control vs Further Investigation

Source/Mode of Transmission

Known

Unknown

**Known
causative
agent**

Investigation +
Control +++

Investigation+++
Control +

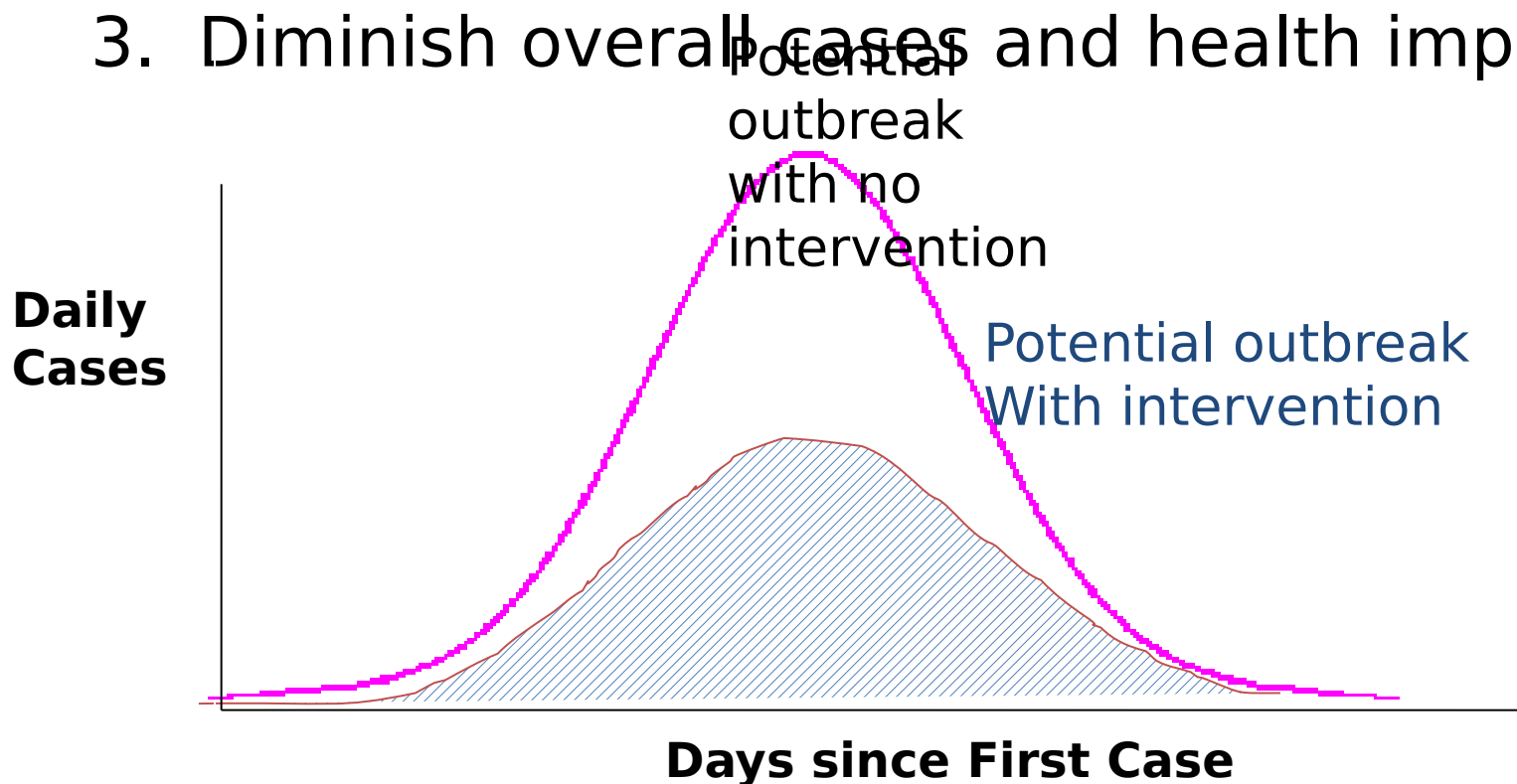
**Unknown
Causative
agent**

Investigation++
+
Control +++

Investigation+++
Control+

Impact of Interventions

1. Delay disease transmission and outbreak peak
2. Decompress peak burden on healthcare infrastructure
3. Diminish overall cases and health impacts



Important Considerations

- Be systematic; listen to the data
- Establish priorities; move quickly to control
- *“The perfect is the enemy of the good”*
- In outbreaks, roughly right and timely is better than precisely right and late.

Thank you!
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