

Public Health Surveillance – High Yield

Definition

- Surveillance = ongoing, systematic collection, analysis, interpretation, and dissemination of health-related data
 - Purpose: Information for Action
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Role of Surveillance

Provides data for descriptive epidemiology:

- Person → age, sex, occupation
 - Place → where cases occur
 - Time → date, season, trend
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Notifiable Diseases

Diseases that must be reported for early detection:

- Vaccine-preventable (measles, polio)
- Epidemic-prone (cholera, meningitis)
- High-impact (TB, hepatitis)
- Emerging infections (COVID-19)

👉 If one case threatens the community → disease becomes notifiable

Purposes of Surveillance

- 🚑 Early outbreak detection
- 📈 Monitor trends & forecasting
- ✅ Evaluate interventions (vaccination, hygiene)
- 💰 Guide resource allocation
- 🌐 Global health security

📌 Surveillance = backbone of public health

Key Components of Surveillance

1. Data Collection
 - From hospitals, labs, clinics
 - Case counts + demographic & clinical data
2. Data Analysis
 - By person, place, time
 - Detect unusual increases
3. Dissemination
 - Reports, alerts, press releases
 - Data → public health action

⚠ Data not analyzed and shared = useless

Case Definition

- Standard criteria to classify cases
- Includes:
 - Person
 - Place
 - Time
 - Clinical features

Types of Surveillance (VERY IMPORTANT)

1. Passive Surveillance

- Routine reporting by health providers
- Most common
- ✓ Cheap, simple
- ✗ Under-reporting, delays, incomplete data
- Example: TB notification system

2. Active Surveillance

- Public health staff actively search for cases
- Used in elimination/eradication programs
- Requires negative reporting
- ✓ Accurate, timely
- ✗ Expensive, resource-intensive
- Example: Polio door-to-door search

3. Sentinel Surveillance

- Selected sites represent whole population
- Can be active or passive
- ✓ High-quality, detailed data
- Example: HIV surveillance in antenatal clinics

4. Syndromic Surveillance

- Based on symptoms before lab confirmation
- ✓ Early detection of outbreaks
- Examples:
- Fever + rash → measles
- ER visits → bioterrorism (anthrax)

Syndromic Surveillance	Sentinel Surveillance	Active Surveillance	Passive Surveillance	Feature
Monitoring symptoms before diagnosis is confirmed	Selected sites monitor diseases to represent the population	Public health staff actively search for cases	Routine reporting of cases by healthcare providers	Definition
Emergency rooms, clinics, health systems	Selected clinics / hospitals (sentinel sites)	Public health workers	Physicians, hospitals, labs	Who reports?
Based on clinical syndromes	From specific representative sites	Proactive (visits, calls, surveys)	Regular, routine	Data collection
Moderate	Moderate	High	Low	Cost
Less specific	High-quality, detailed	High-quality, accurate	Often incomplete	Data quality
Very early detection	Fairly timely	Rapid	Delayed	Timeliness
Possible	Limited to sites	Rare	Common	Underreporting
Early outbreak detection	Trend estimation	Outbreaks, eradication programs	Routine disease monitoring	Use
Not required	Sometimes	Required	Not required	Negative reporting
Fever/rash for measles	HIV in antenatal clinics	Polio eradication	TB notification	Examples

Outbreak Investigation – High Yield

Why Investigate Outbreaks?

1. Control current outbreak
2. Prevent future outbreaks
3. Understand disease (incubation, transmission)
4. Detect new diseases (HIV, SARS, COVID-19)



Exam Tips ☆

- Passive = cheap but underreported
- Active = accurate but expensive
- Sentinel = representative, detailed
- Syndromic = early warning, not confirmed

10 Steps of Outbreak Investigation (MUST MEMORIZE)

1. Determine existence of outbreak
2. Confirm diagnosis
3. Define & identify cases
4. Collect information
5. Describe & analyze data
6. Develop hypothesis
7. Test hypothesis
8. Implement control measures
9. Communicate findings
10. Prepare report & follow-up

Step 1: Determine Existence of Outbreak

- Compare observed vs expected cases
- Consider:
 - Seasonal variation
 - Surveillance changes
 - Lab improvements
 - Increased awareness

📌 Suspicion ≠ outbreak until ruled out

Step 2: Confirm Diagnosis

- Clinical + laboratory confirmation
 - Test:
 - Patients
 - Suspected sources (food, water)
 - Environment
-

Step 3: Define & Identify Cases

Case definition includes:

- Event
- Person
- Place
- Time

Case classification:

- Confirmed → lab confirmed
- Probable → clinical only
- Possible → limited evidence

Case Classification in Outbreak Investigation			
Epidemiological Link	Laboratory Confirmation	Clinical Features	Case Type
May or may not be present	Required (positive lab test)	Typical symptoms present	Confirmed
Often present	Not available	Typical clinical features present	Probable
Not confirmed	Not available	Fewer or atypical symptoms	Possible

Exam Tip ★

- Confirmed = Lab
- Probable = Clinical
- Possible = Weak evidence

Step 4: Collect Information

Line Listing

Table with:

- ID & contact info
- Age, sex, status
- Date of onset, symptoms
- Lab results
- Risk factors (food, water, animals)

Step 5: Describe & Analyze Data

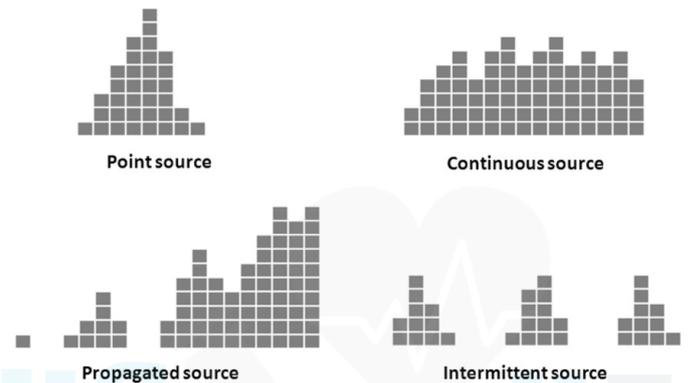
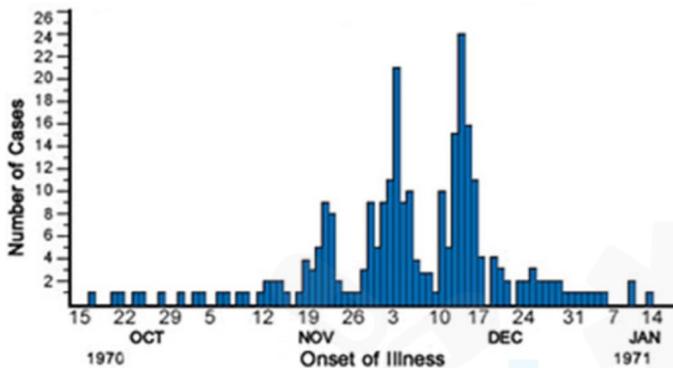
Person

- Age, sex, occupation, risk factors

Place

- Spot map → individual cases
- Area map → aggregated regions

Time → Epidemic Curve



- Histogram of cases over time
 - Gives clues about source & transmission

Types of Epidemic Curves (VERY IMPORTANT)

1. Common Source

- Point source: single exposure
- Sharp peak (food poisoning)
- Continuous source: prolonged exposure
- Plateau (contaminated water)

2. Intermittent Source

- Irregular peaks
- Example: restaurant contamination

3. Propagated

- Person-to-person
- Multiple waves
- Example: measles, COVID-19

Mixed Epidemic

- Common source → then propagated
- Example: cholera

Comparison of Epidemic Curve Patterns

Example	Incubation Periods	Shape of Epidemic Curve	Transmission	Source of Exposure	Outbreak Pattern
Food poisoning at a wedding	One incubation period	Sharp rise with a single peak followed by a rapid decline	Common source	Single exposure at one point in time	Point Source
Contaminated water supply	Multiple incubation periods	Plateau or gradual rise and fall	Common source	Ongoing exposure over time	Continuous Common Source
Sporadic food contamination	Multiple, irregular	Irregular peaks with gaps between cases	Common source	Irregular, repeated exposures	Intermittent Common Source
Measles, COVID-19, Influenza	Multiple generations	Multiple peaks (waves) separated by incubation periods	Person-to-person	No single source identified	Propagated Source
Cholera	Combination	Sharp initial peak followed by smaller successive peaks	Common source → person-to-person	Initial common source then propagated	Mixed Epidemic

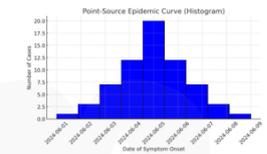
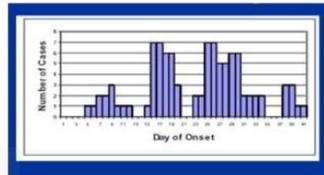
Quick Memory Tips ☆

- Point source → One peak
- Continuous → Plateau
- Intermittent → Irregular peaks
- Propagated → Waves
- Mixed → Peak + waves

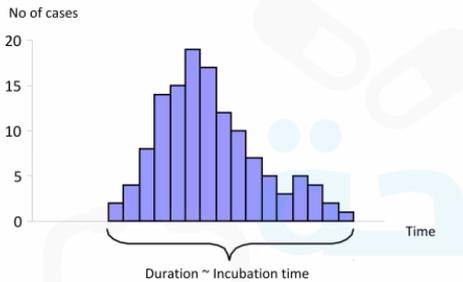
- ▶ **2. Intermittent Common Source**
- ▶ Exposure to the source occurs **intermittently** (not continuous or one-time).
- ▶ **Shape:** Irregular peaks separated by periods with no cases.
- ▶ **Example:** Sporadic contamination of food at a restaurant.

Three common types of outbreak patterns:

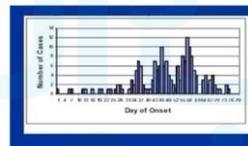
- ▶ **1. Common Source Outbreak**
- a) **Point Source Outbreak**
 - ▶ A single exposure event, all cases occur within one incubation period.
 - ▶ **Shape:** A sharp peak, followed by a decline.
 - ▶ **Example:** Food poisoning at a wedding.



Point source



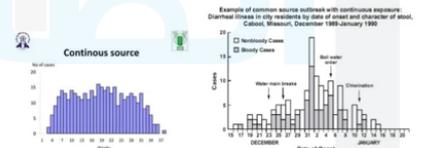
- ▶ **3. Propagated (Person-to-Person) Outbreak**
- ▶ Disease spreads from person to person.
- ▶ a single common source cannot be identified
- ▶ **Shape:** Multiple peaks (waves) occur, separated by incubation periods.
- ▶ Each wave represents new generations of transmission.
- ▶ **Example:** Measles, COVID-19, or influenza.



Patterns of Epi Curves:

Three common types of outbreak patterns:

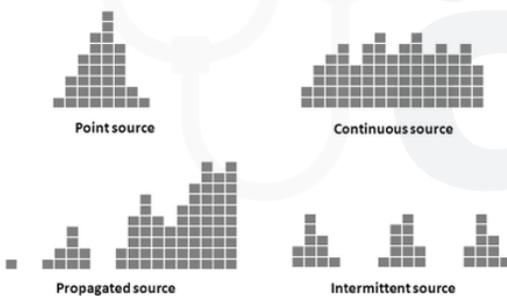
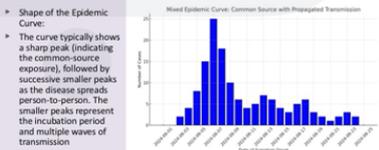
- ▶ **1. Common Source Outbreak**
- b) **Continuous Common Source**
 - ▶ Ongoing exposure to the source over a period. Multiple incubation periods.
 - ▶ **Shape:** A plateau or gradual rise and fall.
 - ▶ **Example:** Contaminated water supply.



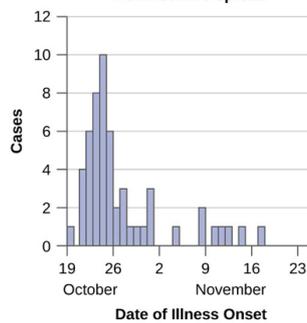
Mixed Epidemic

- ▶ Initial Common-Source Exposure:
- ▶ Many individuals are exposed to a single source of infection (e.g., contaminated food or water).
- ▶ Followed by secondary cases caused by (propagated) person-to-person transmission.

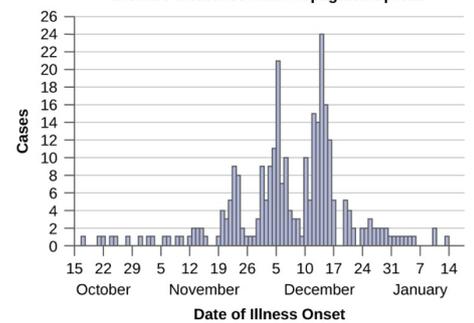
Example: Cholera: People exposed to contaminated water initially (common source) may later spread the infection within households (propagated).



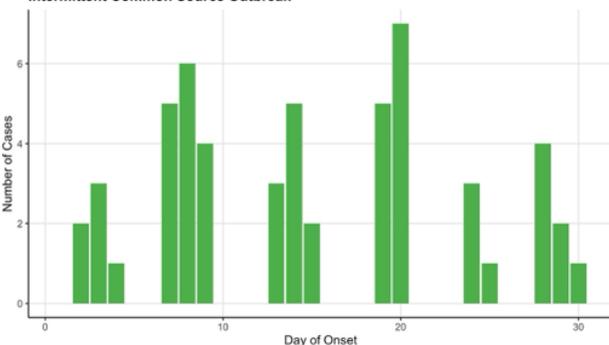
Disease Incidence with Point Source Spread



Disease Incidence with Propagated Spread

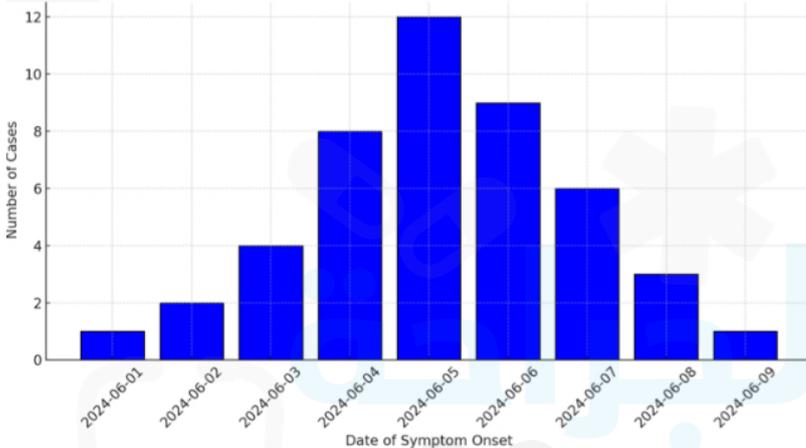


Intermittent Common Source Outbreak



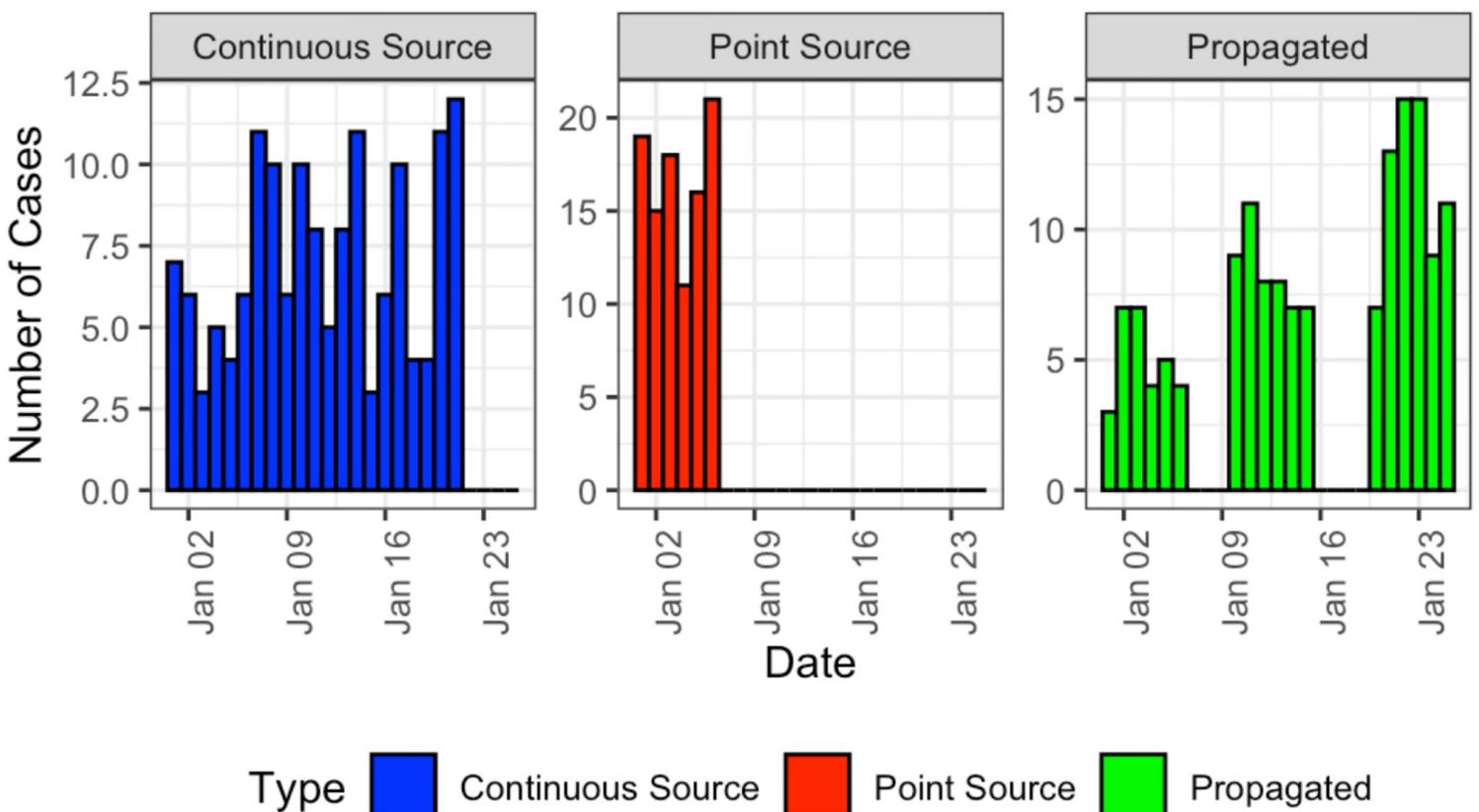
- Use the **Date** as the X-axis (time).
- Use the **Number of Cases** as the Y-axis (frequency of cases).
- Plot each date as a **bar**, where the height of the bar equals the number of cases.

Date	Number of Cases
June 1	1
June 2	2
June 3	4
June 4	8
June 5	12
June 6	9
June 7	6
June 8	3
June 9	1



- What is the peak date?
- June 5.
- If the incubation period is 3 days, when might the exposure have occurred?
- Count back 3 days from the peak (June 5 → June 2)
- What type of outbreak is this?
- Point source outbreak (sharp rise and fall of cases).

Types of Epidemic Curves



Steps 6–10 (Analytical Phase)

6. Develop Hypothesis

- Source, transmission, risk factors

7. Test Hypothesis

- Cohort study → Relative Risk
- Case-control study → Odds Ratio

8. Implement Control Measures

- Isolation, vaccination, sanitation

9. Communicate Findings

- Reports, graphs, maps, epi curves

10. Follow-Up

- Monitor effectiveness
- Prevent recurrence

Exam Pearls ★

- Surveillance = information for action
- Passive = cheap, under-reported
- Active = accurate, expensive
- Syndromic = early detection
- Epi curve shape = type of outbreak
- Peak – incubation = exposure date

