

The Shoe-Leather Files

Background & Surveillance — how epidemiologists think, where this science came from, and how public health keeps watch over a community's health every single day.

TWO WAYS TO FIGHT DISEASE

Clinical Medicine vs. Public Health

Clinical Approach

Focus: the health of one individual.

Key question: "What's wrong with this patient, and how do I treat them?"

Tools: exams, individual lab tests, medical history.

Who: doctors, nurses, physician assistants.

Public Health Approach

Focus: the health of a whole population.

Key question: "Why is this happening, who else is affected, and how do we stop it spreading?"

Tools: surveillance data, statistics, community-wide studies.

Who: epidemiologists, health departments, the CDC.

Real case: in 1989, one physician's tip about three odd cases, plus population-wide surveillance, uncovered a brand-new illness within weeks — neither approach could have done it alone.

A SHORT HISTORY

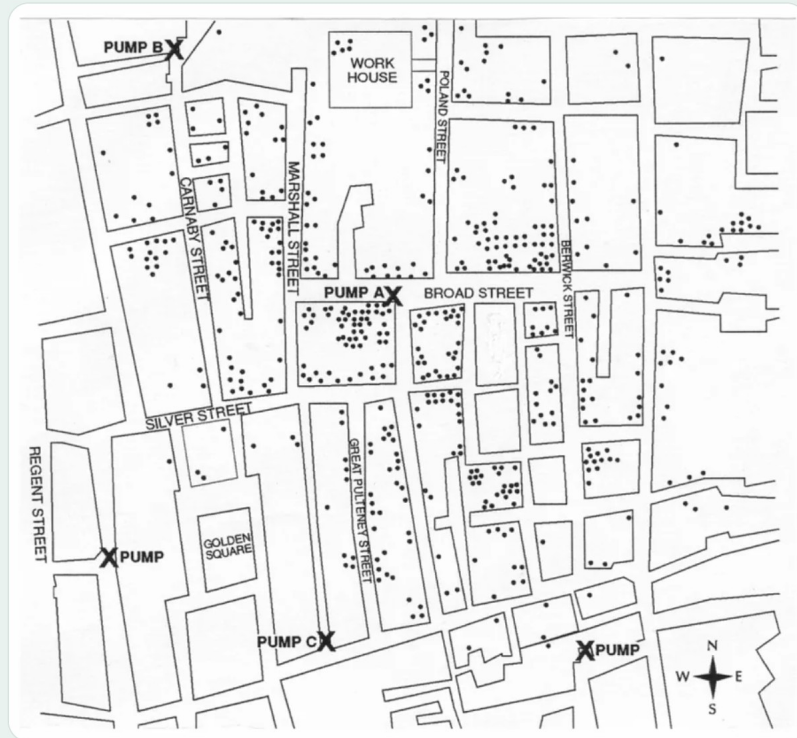
Disease Detectives, Then and Now

Year	Figure	Contribution
~400 BC	Hippocrates	Environment & behavior — not angry gods — cause disease
1662	John Graunt	First to find real patterns in death records
1800s	William Farr	Built the modern system for vital statistics
1854	John Snow	Traced cholera to one pump, disproving "bad air" theory
1854–56	Florence Nightingale	Cut death rates via hygiene in the Crimean War
1946–1980	CDC & Eradication	CDC founded; smallpox becomes the first eradicated disease
2001–today	Modern Era	Genomics, bioterrorism readiness, real-time surveillance

Where the name comes from: field epidemiologists earn the nickname "disease detectives" — and wear out actual shoe leather — going door to door, pump to pump, to find the cases the data alone can't show.

LANDMARK INVESTIGATION • 1854, LONDON

John Snow and the Broad Street Pump



Cholera tore through London's Golden Square — two decades before anyone had seen a bacterium under a microscope.

The dominant theory, **miasma**, blamed foul "bad air," not water. Snow doubted it. He mapped every death as a dot, then marked the pumps.

The dots clustered tightly around one pump on Broad Street. Snow had its handle removed. The outbreak collapsed — and field epidemiology was born.

WHAT EPIDEMIOLOGISTS DO

Six Core Functions

01

Surveillance

Continuously watching disease patterns so problems are caught early.

02

Field Investigation

Going out — literally, "shoe leather" — to find cases during an outbreak.

03

Analytic Studies

Running case-control or cohort studies to test a hypothesis.

04

Evaluation

Checking whether a program or intervention is actually working.

05

Linkages

Teaming up with labs, doctors, and other agencies — a team sport.

06

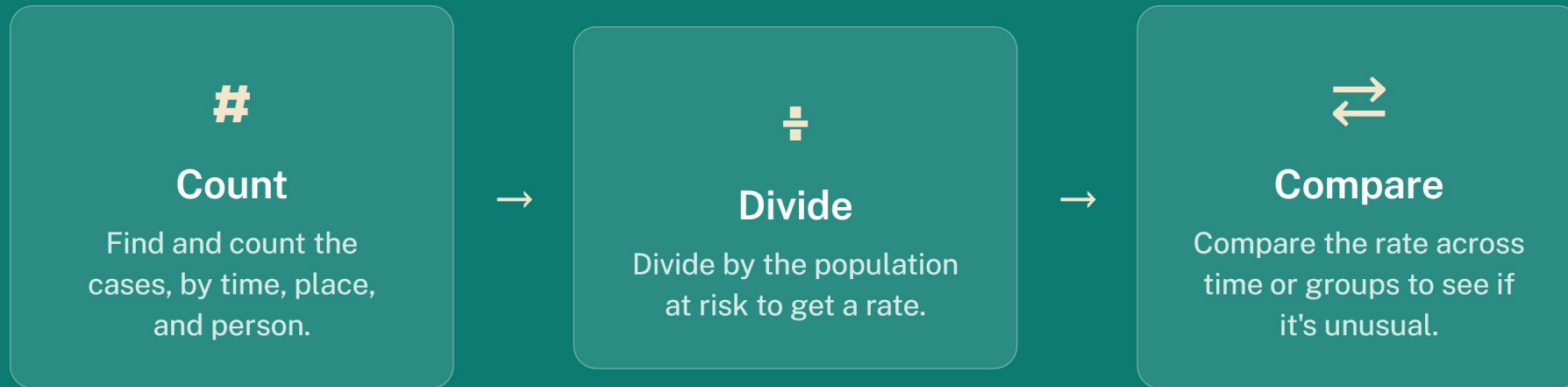
Policy Development

Turning evidence into recommendations and regulations.

A single epidemiologist might play all six roles over a career — sometimes all six in the same investigation.

THE EPIDEMIOLOGIC APPROACH

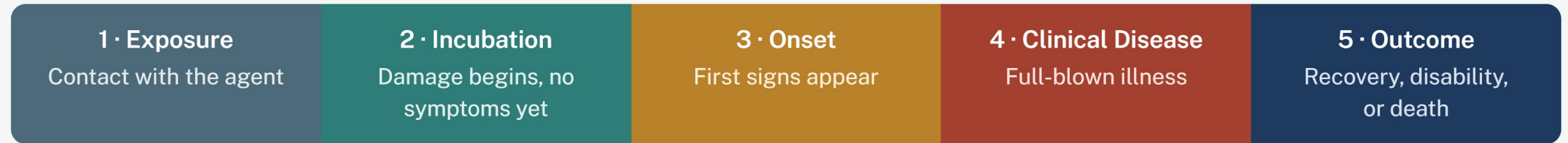
One logic every investigation follows



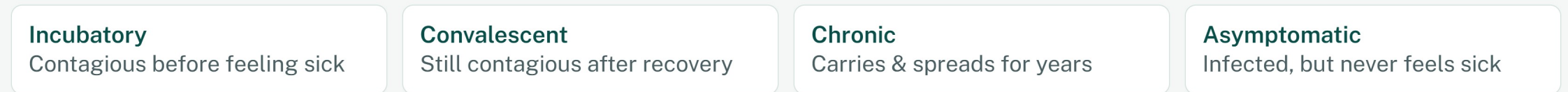
Step zero: agree on a **case definition** — the exact criteria that decide who counts as a case — so numbers stay comparable year to year.

DISEASE OVER TIME

The Natural History of Disease



Doctors usually only see the severe end — the "tip of the iceberg." Some carriers spread disease while never looking sick at all:



"Typhoid Mary": Mary Mallon, a chronic asymptomatic carrier of *Salmonella* Typhi, unknowingly infected dozens before officials tracked her down.

CAUSES OF DISEASE

Infectious vs. Noninfectious

Most infectious agents are living things that spread from a source to a new host:

Bacteria

Salmonella — food poisoning

Viruses

Influenza — the flu

Fungi

Histoplasmosis — a lung infection

Protists

Malaria — spread by mosquitoes

Prions

Misfolded proteins — always fatal

Others never spread from person to person at all:

Accidents

Falls, car crashes, drowning

Exposures

Radiation, extreme heat/cold

Toxicities

Lead, carbon monoxide, poisons

Chronic disease

Heart disease, cancer, diabetes

CORE VOCABULARY

Incidence vs. Prevalence

Incidence

The number of **new** cases occurring in a population during a set time period.

Example: 42 new flu cases diagnosed in October.

Prevalence

The number of **all existing** cases — new and old — at one point in time.

Example: 310 people currently living with diabetes county-wide.

Morbidity

The rate of illness in a population.

Mortality

The rate of death in a population.

Case Fatality Rate

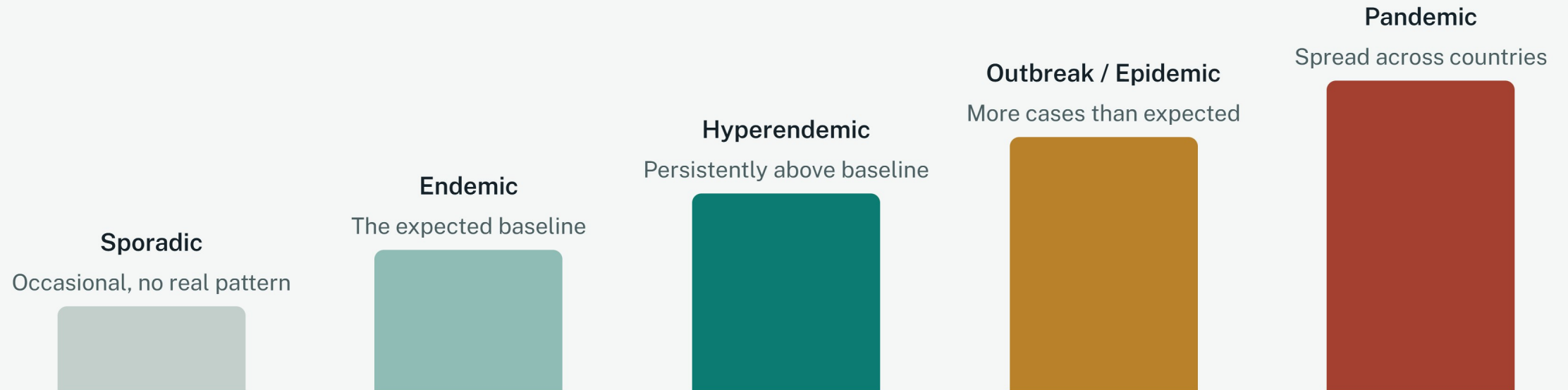
Of the sick, the % who die.

Attack Rate

% of an exposed group that gets sick.

CORE VOCABULARY

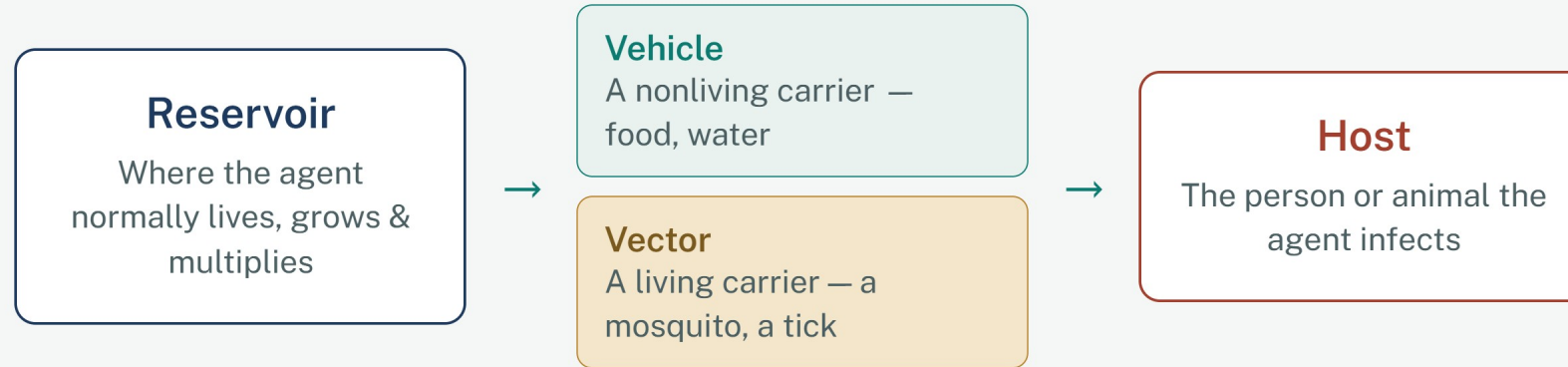
How Much Disease Is "Normal"?



A **cluster** is a group of cases in time and place that seems greater than expected — even before anyone knows the "normal" number for certain.

CORE VOCABULARY

How An Agent Reaches A New Host



Agent — the thing that causes disease: a bacterium, virus, chemical, or other cause.

Carrier — an infected person who can spread the agent, whether or not they feel sick.

CORE VOCABULARY

Separating The Sick From The Exposed

Quarantine

Restricts the movement of people who **may** have been exposed, to see if they become sick.

Isolation

Separates people who **are already** sick from those who are healthy.

Surveillance

Ongoing data collection to guide action.

Risk

The probability a health event happens.

Notifiable Disease

One providers must report by law.

Susceptible

Lacking immunity — at risk.

Herd Immunity

Enough immunity to block spread.

Index Case

The first identified case, "patient zero."

KEEPING WATCH

The 5-Step Surveillance Process

Surveillance is "information for action" — Alexander Langmuir



This isn't a one-time checklist — step 5 always loops back into step 1, keeping the watch going continuously.

KEEPING WATCH

Four Types Of Surveillance

Passive

Providers report cases on their own, by standard rule. Simple and cheap, but can be incomplete.

Example: a doctor mails in a form for each case.

Active

The health department asks for reports instead of waiting. More complete, more costly.

Example: staff call every hospital weekly.

Sentinel

A pre-arranged network of providers agrees to consistently report specific conditions.

Example: doctors nationwide report flu weekly.

Syndromic

Tracks symptoms or proxies — not confirmed diagnoses — to catch problems earlier.

Example: a spike in cold-medicine sales.

WHY TIMELINESS MATTERS

One Exposure, Traced By Passive Reporting Alone

- Day 2** Feels feverish, buys medicine at a pharmacy.
- Day 3** Develops a cough, calls the doctor's office.
- Day 4** Sees a physician, diagnosed with "the flu."
- Day 5** Feels worse, goes to the ER — sent home.
- Day 6** Admitted to the hospital with pneumonia.
- Day 7** A chest X-ray reveals the cause; the health department is finally notified.

It took a full week to learn about one exposure — a syndromic system tracking pharmacy sales, 9-1-1 calls, or ER visits could have flagged it days sooner.

KEEPING WATCH

What Makes A Surveillance System "Good"?

Timeliness

Data arrive fast enough to act on.

Sensitivity

Catches most real cases out there.

Specificity

Doesn't flag people who are unaffected.

Simplicity

Easy to operate and report into.

Flexibility

Adapts to new problems cheaply.

Representativeness

Reflects the real pattern of disease.

Acceptability

People are willing to participate.

Stability

Reliable — doesn't crash or lose data.

A trade-off in action: a more sensitive system catches more real cases — but often flags more false alarms too, which wastes resources chasing cases that aren't real.

QUICK REFERENCE

Everything From This Unit

The Epidemiologic Approach

1. Count cases by time, place, person
2. Divide by population at risk → rate
3. Compare the rate across groups

6 Functions Of Epidemiology

1. Surveillance
2. Field investigation
3. Analytic studies
4. Evaluation
5. Linkages
6. Policy development

4 Types Of Surveillance

- **Passive** — providers report on their own
- **Active** — health dept. asks for reports
- **Sentinel** — a fixed reporting network
- **Syndromic** — tracks symptoms/proxies

Disease Frequency, Low → High

1. Sporadic (no pattern)
2. Endemic (constant baseline)
3. Hyperendemic (above baseline)
4. Outbreak / Epidemic
5. Pandemic (multi-country)

WRAP - UP

"Surveillance is information for action."

— Alexander Langmuir

COMING UP NEXT • TOPIC 2

Chasing the Curve — Outbreak Investigation