

Stopping the Spread

Patterns, Control & Prevention — reading the data, measuring frequency, breaking the chain of transmission, and stopping disease before it starts.

FROM DATA TO ACTION

Four Skills, One Goal

Once a Disease Detective can read the data and understand how disease spreads, the final job is turning that knowledge into action.

01

Reading the Data

Matching the right chart to the data, and spotting patterns and trends.

02

Measuring Frequency

Ratio, proportion, and rate — and the measures of disease and death built from them.

03

Strategies of Control

Breaking a link in the chain of transmission — and knowing control from elimination from eradication.

04

Strategies of Prevention

Five levels of prevention, mapped onto the natural history of disease.

The same outbreak can often be attacked with more than one strategy at once — and at more than one level.

READING THE DATA

Match the Chart to the Data

Every chart type has a job it's best at. Part of being a Disease Detective is matching the data to the display, then reading what it's actually saying.

LINE

Line Graph

Shows a trend over time. Semilog scale when values span huge ranges.

HIST

Histogram

Frequency of a continuous variable. An epi curve is a histogram of onset dates.

BAR

Bar Chart

Compares categories of one variable. Grouped or stacked bars compare two or three at once.

PIE

Pie Chart

Shows how the parts of a whole compare — like exposure routes in one outbreak.

SPOT

Spot Map

Pinpoints the exact location of each case — reveals geographic clustering.

AREA

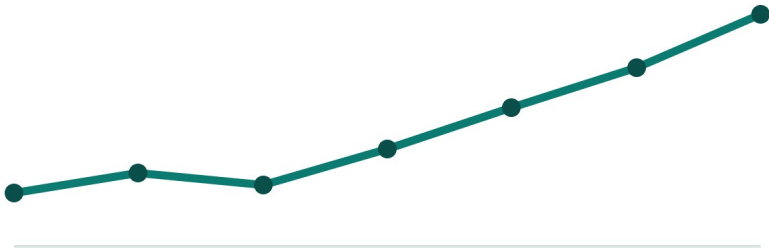
Area Map

Shades whole regions by rate or count, rather than plotting individual points.

READING THE DATA

Patterns Over Time

A Secular Trend



A gradual rise or fall over years or decades — often reflecting slow changes like an aging population or better diagnostic tools.

SEASONAL

Rises and falls on a predictable yearly cycle — like flu cases climbing every winter.

CYCLIC

Repeats regularly over a period longer than one year — like measles outbreaks recurring every few years in an unvaccinated population.

POINT-SOURCE

One sharp peak from a single shared exposure — everyone sickened by the same contaminated meal.

Tables deserve the same scrutiny: scan a subdivided table's rows and columns for which group has a strikingly higher count or rate before jumping to conclusions.

MEASURING FREQUENCY

Ratio, Proportion, Rate

Nearly every number an epidemiologist reports is one of these three. Telling them apart is mostly one question: is the numerator part of the denominator?

RATIO

Ratio

Compares any two values. The numerator does **not** have to be part of the denominator.

EXAMPLE

Death-to-case ratio: deaths ÷ new cases

PROPORTION

Proportion

Compares a part to the whole. The numerator **is always included** in the denominator.

EXAMPLE

Case-fatality rate: deaths ÷ everyone who had the disease

RATE

Rate

Measures how frequently something happens **over a specific span of time**.

EXAMPLE

70 new cases per 1,000 people per year

Fuzzy vocabulary, on purpose: epidemiologists often call something a "rate" even when it's technically a proportion — the language has stuck around for over a century. Check whether time is actually part of the calculation.

MEASURING FREQUENCY

Incidence: How Fast New Cases Appear

Incidence Proportion (Attack Rate)

$$\frac{\text{New cases during the period}}{\text{Population at risk at the start}}$$

The probability that someone in the group develops disease during that window. In outbreaks, this is called the **attack rate**.

Incidence Rate (Person-Time)

$$\frac{\text{New cases during the period}}{\text{Total person-time observed}}$$

Used when people are followed for different lengths of time — someone watched 6 months contributes less at-risk time than someone watched 3 years.

SEMILOG SCALE — A RELATED TERM

A graph axis where each equal step means multiplying by 10, instead of adding a fixed amount — used when values span a huge range, like 2 cases rising to 2,000 on one chart.

The Sunnyvale Flu Watch

The school nurse tracks a class of **40 students** through January. On Jan 1, **2 students** are already out sick with flu. During January, **6 more students** develop new flu symptoms. By Jan 31, **3 students** are currently sick.

Measure	Calculation	Result
Incidence proportion (attack rate)	6 new cases ÷ 38 not already sick	≈ 15.8%
Point prevalence (on Jan 31)	3 currently sick ÷ 40 total students	7.5%
Period prevalence (all of January)	8 sick at any point ÷ 40 total students	20%

Incidence only counts **new** cases at risk. Point prevalence snapshots everyone sick **right now**. Period prevalence adds up everyone sick **at any point** all month — the largest number here.

MEASURING FREQUENCY

Prevalence: How Many Are Currently Affected

Point Prevalence

$$\frac{\text{All current cases on one date}}{\text{Total population that date}}$$

A single-moment snapshot — includes both new and pre-existing cases.

Period Prevalence

$$\frac{\text{Cases present at any time in a period}}{\text{Total population during period}}$$

A wider window — anyone ill at any point counts, even if they've since recovered.

Easy to mix up on purpose: incidence = **NEW** cases only. Point prevalence = a snapshot of **NOW**, one specific day. Period prevalence = **ANYONE** sick during the **WHOLE** window, old or new.

MEASURING FREQUENCY

Mortality: Measuring Deaths

Measure	What It Divides	Worked Example
Crude death rate	All deaths ÷ total population	45 deaths in 30,000 → 1.5 per 1,000
Cause-specific death rate	Deaths from one cause ÷ total population	Deaths from heart disease ÷ population
Case-fatality rate	Deaths from a disease ÷ people who had it	4 deaths among 200 diagnosed → 2%

A death rate is a rate; a case-fatality rate is a proportion. The crude death rate's denominator is the whole population — the case-fatality rate's denominator is only the people who actually got sick.

STRATEGIES OF CONTROL

Breaking the Chain of Transmission

Every control strategy is an attempt to break one link in the chain. The same outbreak can often be attacked at more than one link at once.

Link in the Chain	Example Control Strategy
Infectious agent	Disinfect surfaces; treat infected people or animals; recall contaminated products
Reservoir	Treat or cull infected animals; identify and treat human carriers
Portal of exit	Cover coughs and sneezes; safely dispose of contaminated waste
Mode of transmission	Improve sanitation; treat water supplies; control insect/animal vectors; safe food handling
Portal of entry	Wear masks or gloves; use insect repellent; practice safe food prep
Susceptible host	Vaccinate; improve nutrition and general health; give prophylactic medication

Isolation vs. quarantine: isolation separates people who are already sick; quarantine separates people who may have been exposed but aren't yet sick. Both target the portal of exit and mode of transmission.

STRATEGIES OF CONTROL

Control, Elimination, Eradication

Three increasingly ambitious goals — and they are not interchangeable.

01

Control

Reducing disease to a locally acceptable level. Ongoing effort keeps it there.

EXAMPLE

Seasonal flu in the U.S. today

02

Elimination

Reducing new cases to zero in a defined area. Measures continue to keep it out.

EXAMPLE

Polio, eliminated from the Americas

03

Eradication

Permanently reducing new cases to zero worldwide, forever.

EXAMPLE

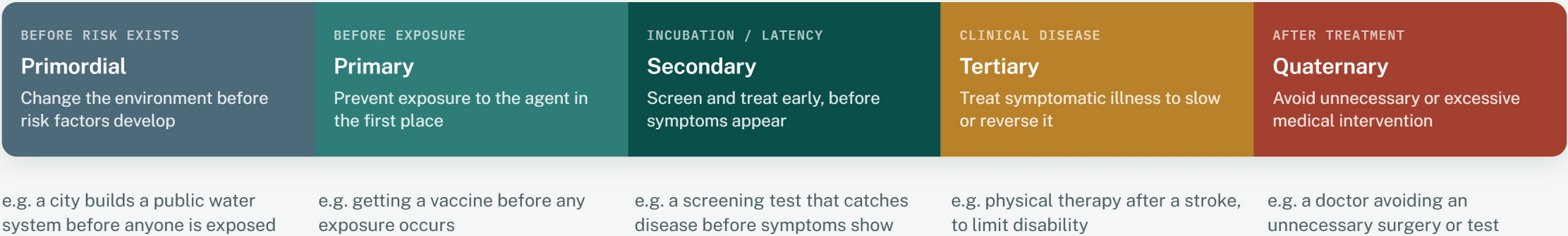
Smallpox, eradicated globally in 1980

Why this shows up on tests: "zero U.S. cases, but travelers still bring it in occasionally" is elimination, not eradication — the disease still exists somewhere in the world.

STRATEGIES OF PREVENTION

Five Levels, One Timeline

Each level of prevention is aimed at a different point along the natural history of disease.



Matching Prevention to Level

A town discovers its well water is contaminated with bacteria that cause severe diarrhea. Which level of prevention does each response represent?

PRIMORDIAL

Installing a permanent water treatment system for the whole town

PRIMARY

Telling residents to boil water before drinking it until the well is fixed

SECONDARY

Testing residents for infection even before they feel sick

TERTIARY

Giving IV fluids to residents already severely dehydrated from illness

Notice how the same outbreak can be attacked at every single level at once.

Quick Reference Card

Everything from this unit, condensed

Choosing a Chart

Line = trend over time · Histogram/epi curve = frequency distribution · Bar = compare categories · Pie = parts of a whole · Spot/area map = geography

Ratio · Proportion · Rate

Ratio = any two values · Proportion = numerator is part of denominator · Rate = frequency over a span of time

Frequency Formulas

Incidence proportion = $\text{new cases} \div \text{population at risk}$ · Incidence rate = $\text{new cases} \div \text{person-time}$ · Prevalence = $\text{current cases} \div \text{population}$ · Case-fatality rate = $\text{deaths} \div \text{people with disease}$

Breaking the Chain

Agent: treat/disinfect · Reservoir: treat carriers · Exit: cover, dispose safely · Transmission: sanitation, vectors · Entry: PPE, safe prep · Host: vaccinate, prophylaxis

Control → Elimination → Eradication

Control = reduced, needs upkeep · Elimination = zero in one area · Eradication = zero worldwide, forever

Levels of Prevention

Primordial: before risk exists · Primary: before exposure · Secondary: screen & treat early · Tertiary: treat active illness · Quaternary: avoid over-treatment

FOUNDATIONS • INVESTIGATION • PREVENTION — COMPLETE

You've Covered All Three Study Units

Ready to put it into practice? Work a full case simulation, sharpen your speed with the games and drills, or print the quick reference sheet before your next meet.