CPH Exam Review Webinar

Evidence-Based Public Health

CPH Certified in Public Health

by National Board of Public Health Examiners

National Board of Public Health Examiners — Credentialing Public Health Leaders

6

CPH Study Resources

1. Content Outline
2. Sample Exam Questions
3. Practice Exams
4. Webinars
5. ASPPH Study Guide
6. APHA Study Guide

www.nbphe.org/cph-study-resources/

Content Outline

- Evidence-based Approaches to Public Health (10%)
- Communication (10%)
- Leadership (10%)
- Law and Ethics (10%)
- Public Health Biology and Human Disease Risk (10%)
- Collaboration and Partnership (10%)
- Program Planning and Evaluation (10%)
- Program Management (10%)
- Policy in Public Health (10%)
- Health Equity and Social Justice (10%)

Sample Exam Questions

Sample questions in the format of the CPH exam

Practice Exams

Online mini-exam of 50 questions from the CPH item-bank

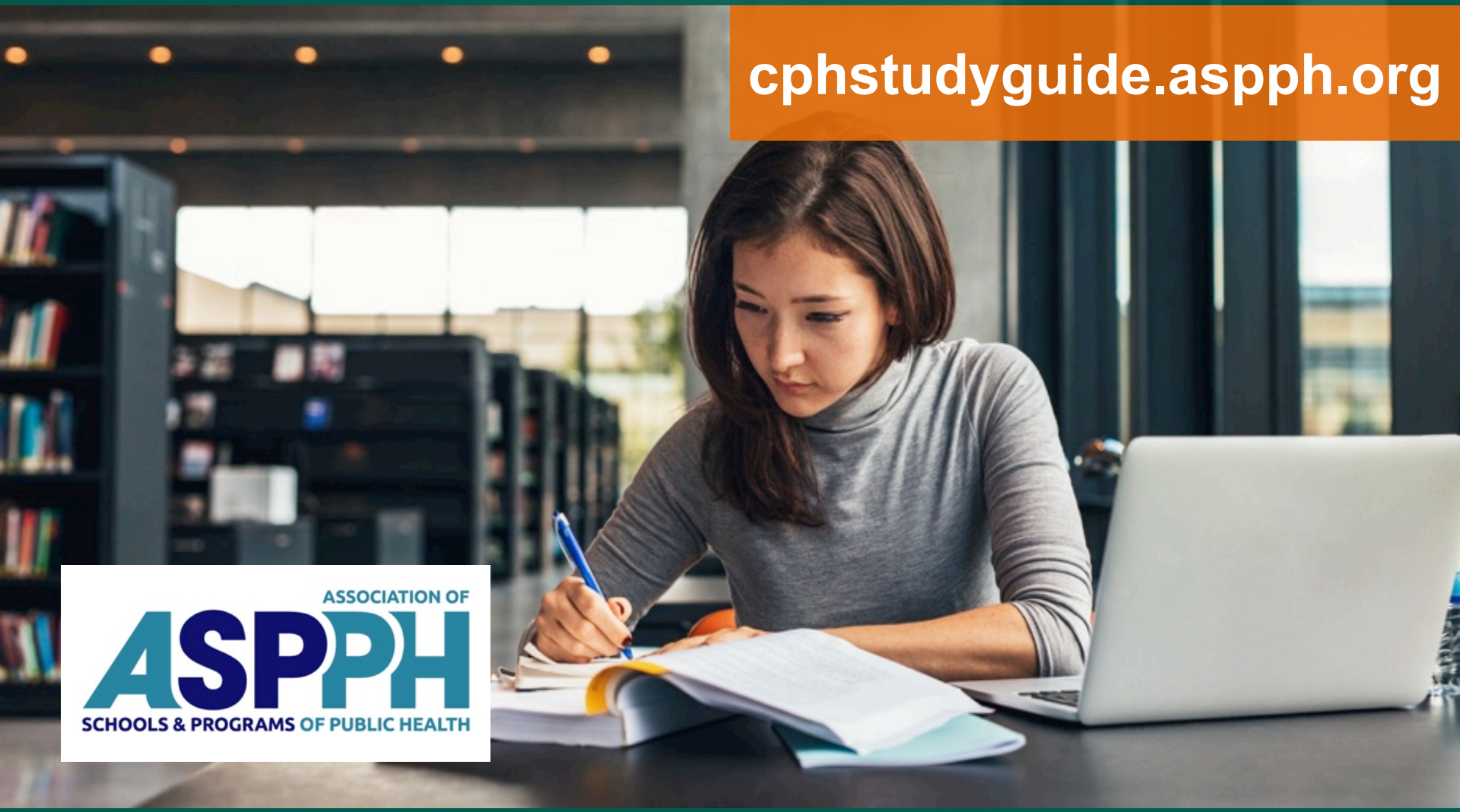
Study Webinars

Upcoming Webinars Lecture and Q&A

- **Evidence-Based Public Health - Epidemiology**
  July 31, 1-3pm ET
- **Health Equity, Social Justice and the Application of Theory**
  August 7, 1-3pm ET
- **Planning and Evaluation and Collaboration and Partnerships**
  August 14, 1-3pm ET
- **Public Health Systems, History and Leadership**
  August 28, 1-2pm ET
- **Public Health Law**
  September 10, 1-2 pm ET
- **Health Policy Process**
  September 17, 1-2 pm ET
- **Public Health Biology and Human Disease Risk**
  September 27, 1-3 pm ET

These and all past webinars /presentations are posted on
https://www.nbphe.org/cph-study-resources/

ASPPH CPH Study Guide



cphstudyguide.aspph.org

ASSOCIATION OF ASPPH
SCHOOLS & PROGRAMS OF PUBLIC HEALTH

APHA Press Study Guide

AMERICAN PUBLIC HEALTH ASSOCIATION
For science. For action. For health.

Editors: Karen Liller and Jaime Corvin
University of South Florida College of Public Health

Corvin, J. and Liller, K. (2018). Certified in Public Health Exam Review Guide. 1st ed. Washington, DC: APHA.

$41.95 APHA member /$51.95 non member. eBook and print available


Let’s Get Started!

CPH Exam Review Webinar

Evidence-Based Public Health

Ronee Wilson, PhD, MPH, CPH
Janice Zgibor, RPh, PhD, CPH, FACE
University of South Florida College of Public Health

CPH Certified in Public Health
by National Board of Public Health Examiners

USF HEALTH

National Board of Public Health Examiners
Credentialing Public Health Leaders

Objectives

- To define and calculate measures of association in epidemiology.
- To distinguish incidence, prevalence, cumulative incidence, and incidence rate.
- To enumerate the most common study designs used in epidemiologic research.

Epidemiology

- Study (scientific, systematic, and data-driven) of the distribution (frequency, pattern) and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, global)

https://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson1/section1.html

Role for Epidemiology in Public Health

- Monitor health of a population
- Respond to emerging public health problems
- Promote research and use of evidence-based interventions
- Evaluate the effectiveness of interventions
- Findings provide foundations for public health policy
- Set funding priorities for research and intervention programs.

Checkpoint

Which component of epidemiology describes who gets the disease, where people with the disease are located and how these aspects of disease change over time?

- Determinants
- Distribution
- Frequency
- Control

Poll Question

CPH Certified in Public Health
by National Board of Public Health Examiners

Checkpoint

Which component of epidemiology describes who gets the disease, where people with the disease are located and how these aspects of disease change over time?

- Determinants
- **Distribution**
- Frequency
- Control

Measures of Association

Population

- A group of people with a **common** characteristic in terms of **person, place, and time** (e.g., age, sex, race, geography, religion, education, occupation, behaviors, life course, etc.)
  - Fixed: membership based on an event which is permanent
  - Transient/dynamic: membership based on a condition that can change

- **Mortality**: ***Epidemiologic term for death***
  - Crude MR: # of deaths from all causes
  - Age specific MR: # of deaths from all causes in a specific age group
  - Cause specific MR: # of deaths from a specific cause
  - Infant: # of deaths of infants less than 1 year of age
- **Morbidity**: ***Epidemiologic term for disease***
  - Prevalence rate: # of existing cases of disease
  - Incidence rate: # of new cases of disease
- **Disability**: ***Umbrella term for impairments, activity limitations, and participation restrictions***

Distribution

- ***Disease Frequency: Quantification of MMD in the population***
  - How often does the MMD occur in the population?

- ***Disease Distribution: Analysis of patterns***
  - Who is getting the MMD?
  - Where is the MMD occurring?
  - Does the number of MMD change over time?

The “emics”

- Epidemic: outbreak or occurrence of a DDD from a single source, in a group, population, community or geographical area, in excess of the usual level of expectancy
- Endemic: is the ongoing, usual level of, or constant presence of a DDD within a given population or geographic area
- Pandemic: an epidemic that is widespread across a country, continent, or a large populace, possibly world wide (HIV/AIDS)

Three Primary Measures of Association

Objective: To relate number cases of disease to the size of the population and time

- Ratio: division of one number by another, numbers don't have to be related
- Proportion: numerator is subset of denominator, often expressed as a percentage
- Rate: time is an intrinsic part of denominator, term is most misused

Prevalence = Number of existing cases of disease/ Number in total population (at a point or during a period of time)

- Ex. City A has 7000 people with arthritis on Jan 1st, 2009
- Population of City A = 70,000
- Prevalence of arthritis on Jan 1st

7000/70,000= .10 x 100=10%

Incidence: number of new cases of disease that develop in a population at risk during a specified time period

- Three key concepts:
  - New disease events, or for diseases that can occur more than once
    - usually first occurrence of disease
  - Population at risk (candidate population) - can't have disease already, should have relevant organs
  - Time must pass for a person to move from health to disease

Cumulative incidence (CI)

- Number of new cases of disease = numerator
- Number in candidate population over a specified period of time = denominator
- Cumulative incidence estimates the probability or risk that a person will develop disease DURING A SPECIFIED TIME.
- Note that the candidate population is comprised of people who are "at risk" of getting the disease
- Used mainly for fixed populations because it assumes that everyone is followed for the entire time period

Incidence Rate (IR)

- # new cases of disease in candidate population divided by person-time of observation

$$\frac{\#\text{new cases of disease}}{\text{person time of observation}}$$

- This measure is a true rate because it directly integrates time into the denominator.

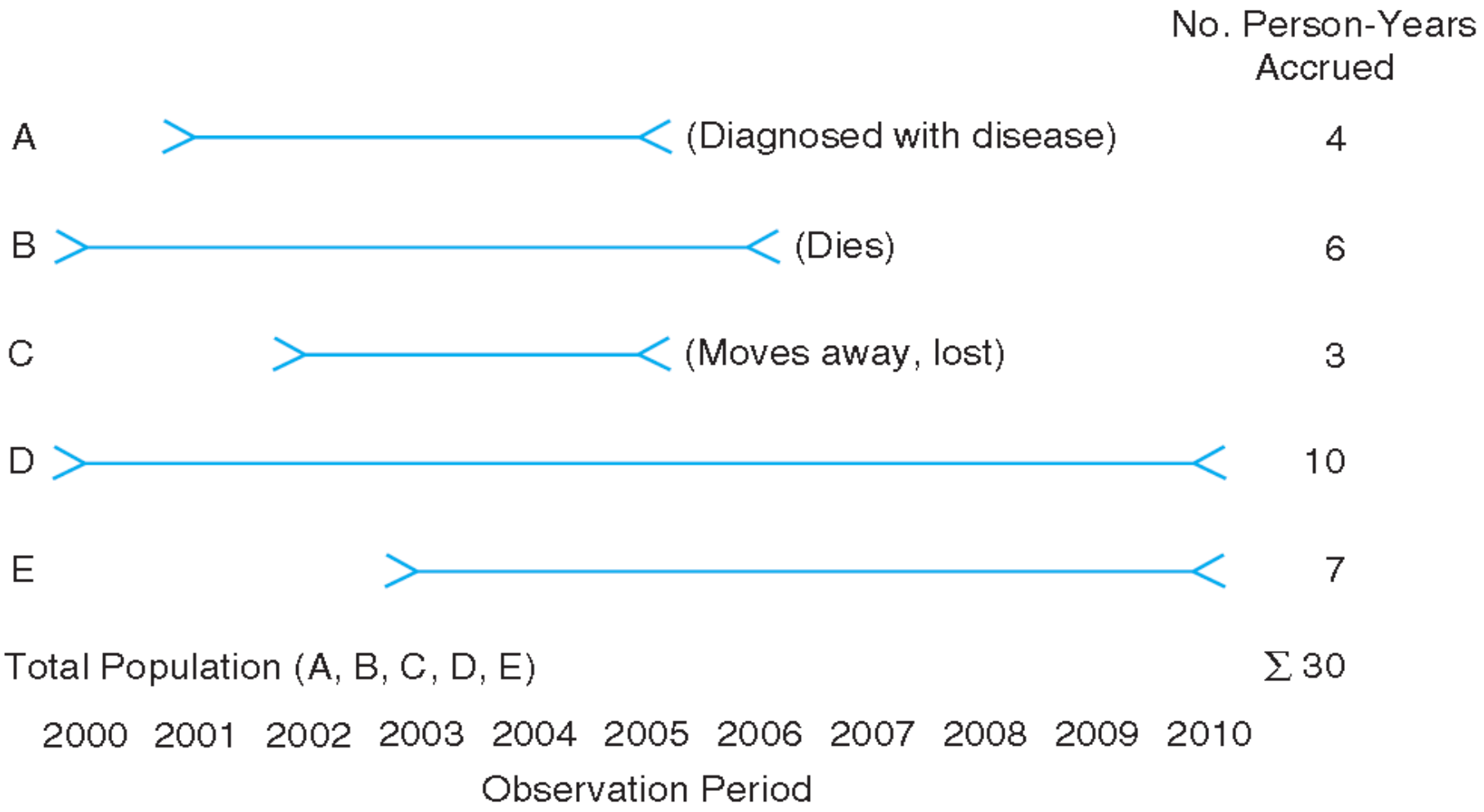


FIGURE 2–3 Measurement of Person-Time in a Hypothetical Population

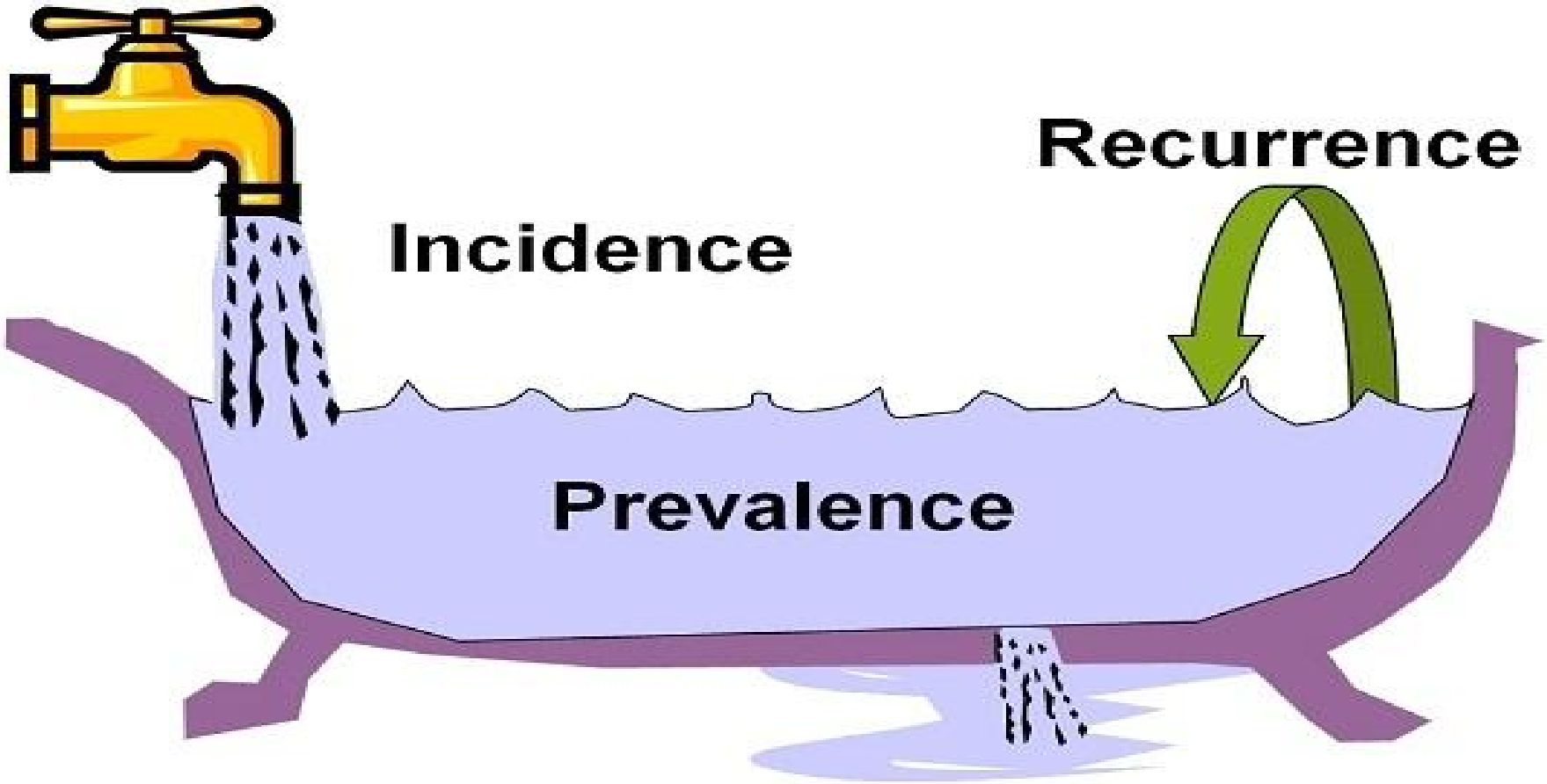
The relationship between incidence and prevalence

Prevalence is related to incidence and duration

1. Incidence decreases but people are living longer with the disease = increased prevalence

2. The incidence increases but the duration is short = decreased prevalence

3. The incidence decreases and the duration is short = decreased prevalence



Checkpoint

Which of the following is calculated by dividing the number of new cases of disease by the total population at risk?

- Cumulative Incidence
- Incidence Density
- Point Prevalence
- Prevalence Rate

Poll Question

CPH Certified in Public Health
by National Board of Public Health Examiners

Checkpoint

Which of the following is calculated by dividing the number of new cases of disease by the total population at risk?

- **Cumulative Incidence**
- Incidence Density
- Point Prevalence
- Prevalence Rate

Measures of Association

Relative Risk

Odds Ratio

2 X 2 Table

	Disease	**No disease**	
Exposed	A	B	A+B
Unexposed	C	D	C+D
	A+C	B+D	A+B+C+D

Relative Risk

	Disease	No disease	
Exposed	A	B	A+B
Unexposed	C	D	C+D
	A+C	B+D	A+B+C+D

$$RR = \frac{a/(a+b)}{c/(c+d)} \text{ or } \frac{\text{Rate in exposed}}{\text{Rate in unexposed}}$$

Rate/Risk Ratio/Relative Risk

- RR=1.0 - no association between exposure and disease
- RR=2.0 - two times the risk of disease in the exposed compared to the unexposed
- RR=1.6 - 1.6 times the risk of disease in the exposed compared to the unexposed or 60% increased risk of disease in the exposed (1.6 - 1.0 = .60 = 60%)
- RR = 0.5 - 0.5 times or ½ the risk of disease in exposed compared to unexposed.

Example: Cohort study of hypertension and cardiovascular morbidity and mortality (Nurses Health Study)

RR= a/(a+b) or Rate in exposed
c/(c+d) Rate in unexposed

Non-Fatal Heart Attack

Hypertension	Yes	No	Total
Yes	117	13,305	13,422
No	125	106,416	106,541
Total	242	119,721	119,963

$$RR = CI_{exp} / CI_{unexp} = \frac{117/13,422}{125/106,541} = \frac{.00872}{.00117} = 7.5$$

Interpretation: Women with hypertension have 7.5 times the risk of having a non-fatal heart attack compared to women without hypertension .

Odds Ratio

- The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure.

- Odds ratios are most commonly used in case-control studies; however they can also be used in cross-sectional and cohort study designs as well.

Odds Ratio

	Disease	No disease	
Exposed	A	B	A+B
Unexposed	C	D	C+D
	A+C	B+D	A+B+C+D

$$OR = \frac{a/b}{c/d} \text{ or } \frac{ad}{bc}$$

Checkpoint

Which condition must be met in order for the Odds Ratio to approximate the Relative Risk?

- The disease must be common
- The disease must be rare
- The exposure must be common
- The exposure must be rare

Poll Question

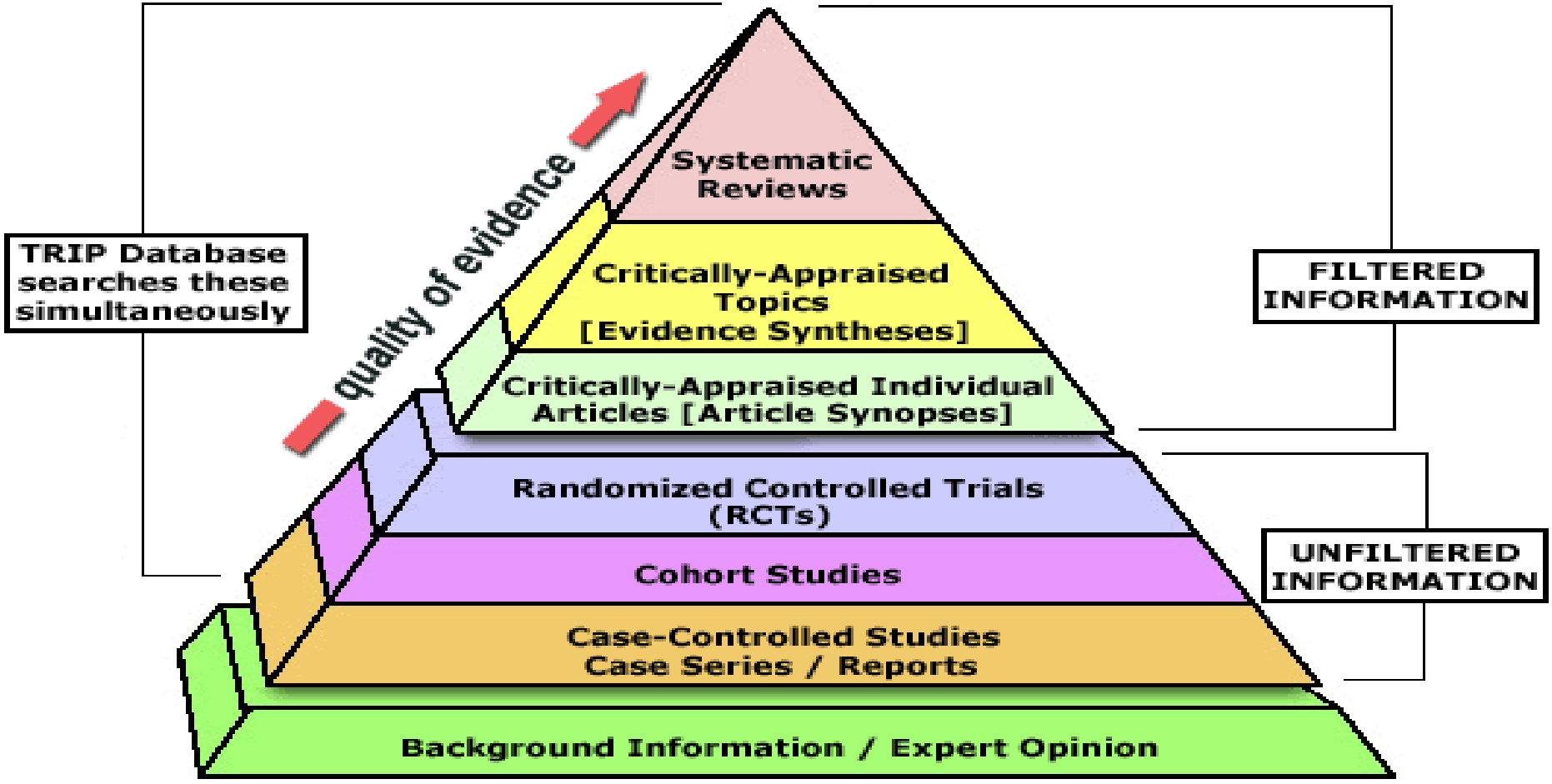
CPH Certified in Public Health
by National Board of Public Health Examiners

Checkpoint

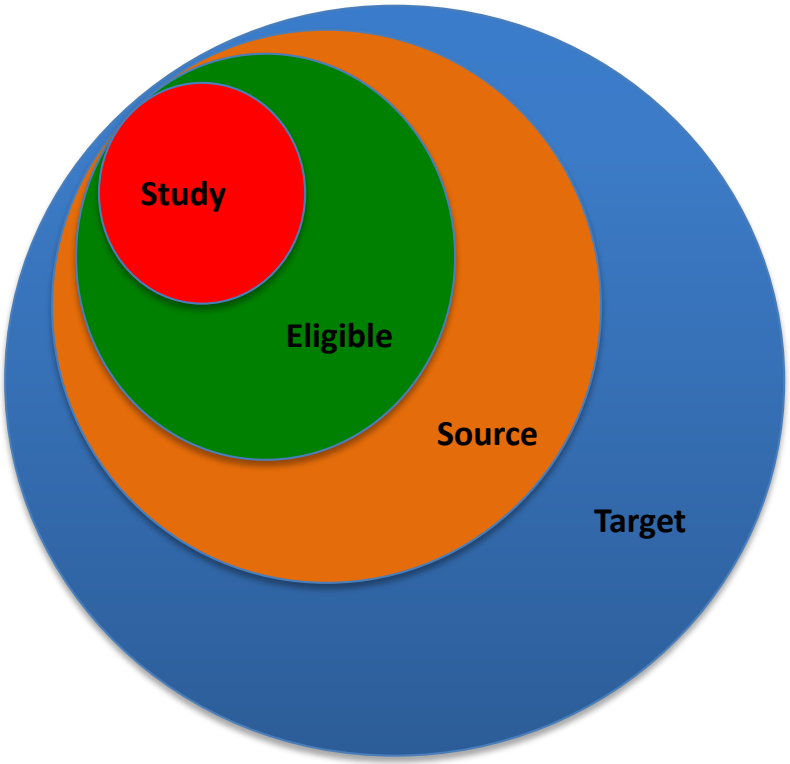
Which condition must be met in order for the Odds Ratio to approximate the Relative Risk?

- The disease must be common
- **The disease must be rare**
- The exposure must be common
- The exposure must be rare

Study Design



Populations



Ecological Study/(Correlational)

- Unit of analysis: Population or groups
- Exposure status: Based on the population
- Time can vary
- Ecological Fallacy: making assumptions about the individual based on finding at the level of the population

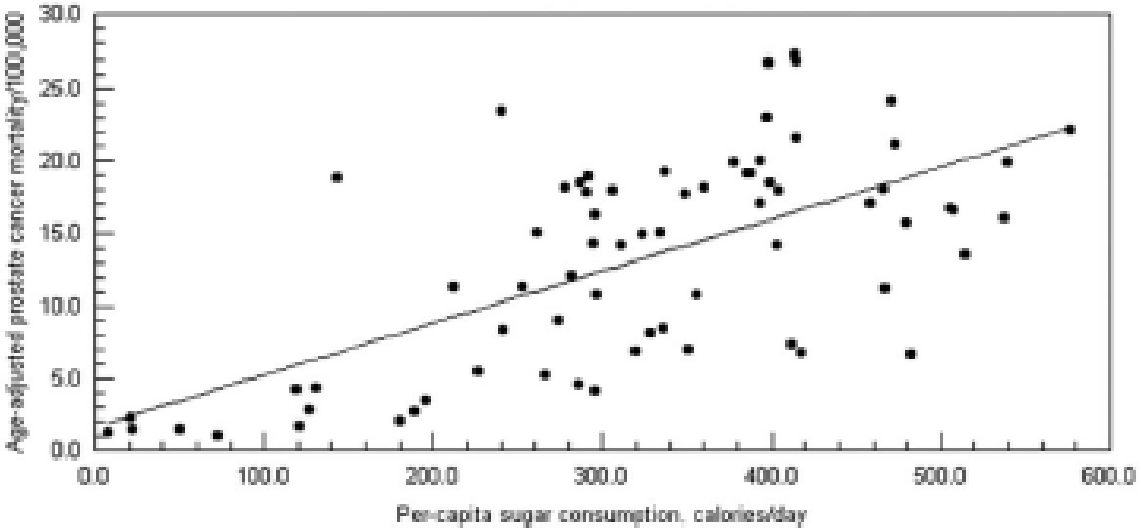
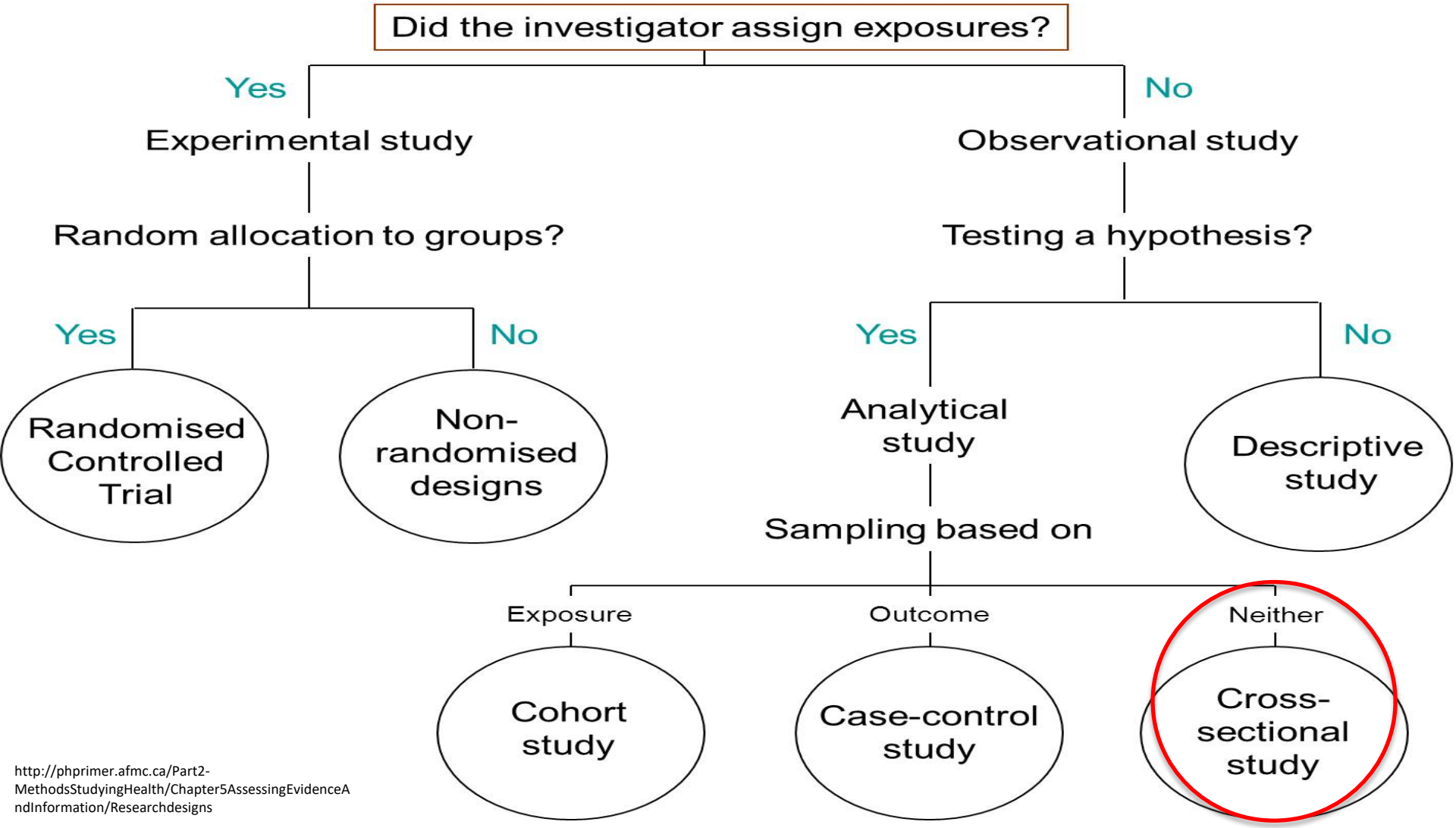


Fig. 1. Prostate cancer mortality versus sugar consumption in 71 countries.

J.L. Colli, A. Colli / Urologic Oncology: Seminars and Original Investigations 24 (2006) 184–194

Cross Sectional

- Time: Snap-shot in time
  - If a particular point in time=point prevalence
- Population: individual level
- Population: selected without regard to exposure or disease status
- Measure: Prevalence of disease
- Measure of association: OR
- Cannot determine cause and effect



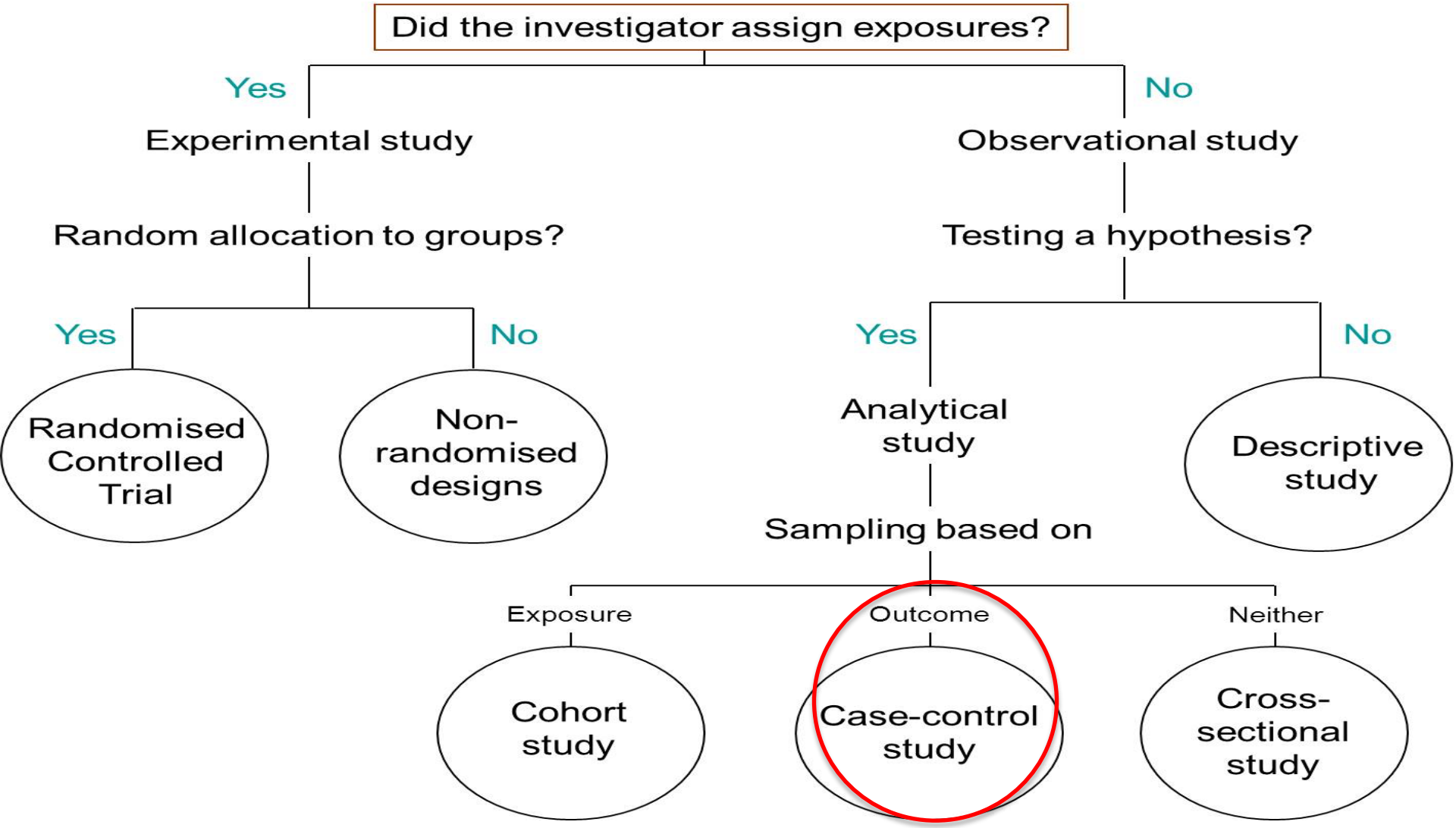
http://phprimer.afmc.ca/Part2-MethodsStudyingHealth/Chapter5AssessingEvidenceAndInformation/Researchdesigns

Example

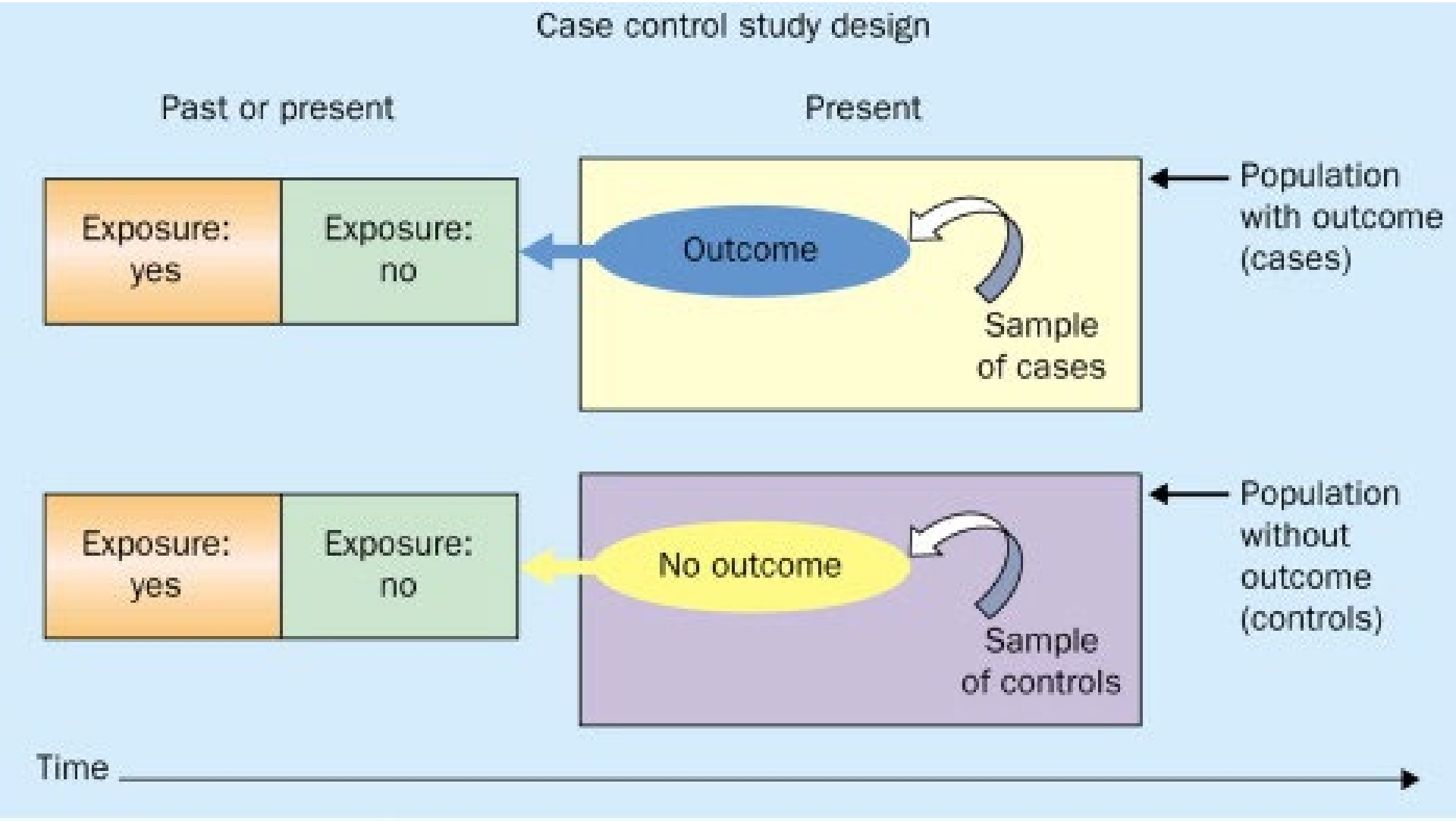
- A study that compares the prevalence of high blood pressure among current Massachusetts Turnpike toll booth collectors with the current prevalence of high blood pressure of current Turnpike office workers.

Case Control

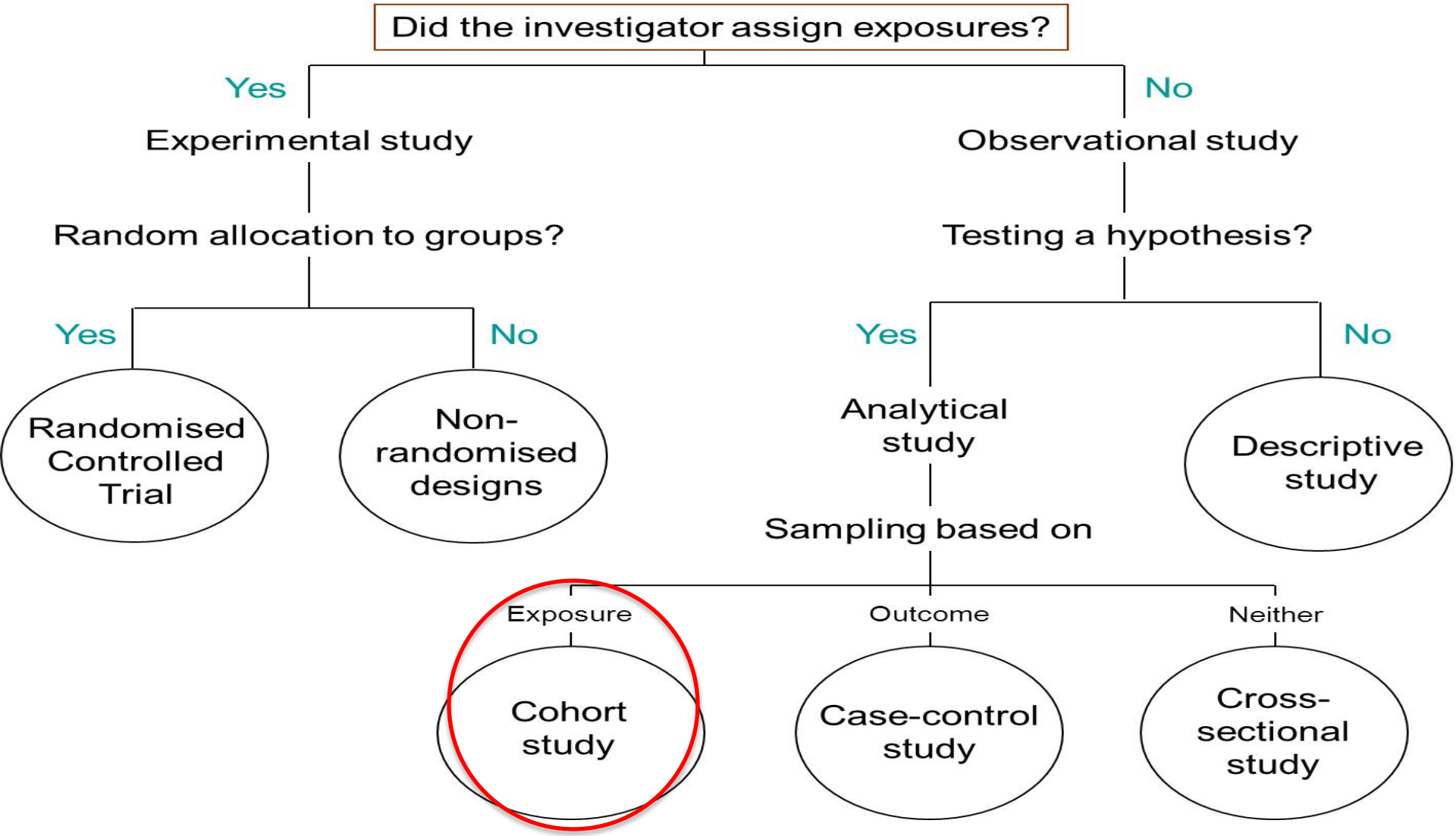
- Disease is rare
- Disease has a long induction and latent period
- Little is known about the disease
- Selection of the cases
- Selection of controls



http://phprimer.afmc.ca/Part2-MethodsStudyingHealth/Chapter5AssessingEvidenceAndInformation/Researchdesigns



Cohort Study



http://phprimer.afmc.ca/Part2-MethodsStudyingHealth/Chapter5AssessingEvidenceAndInformation/Researchdesigns

Cohort Study

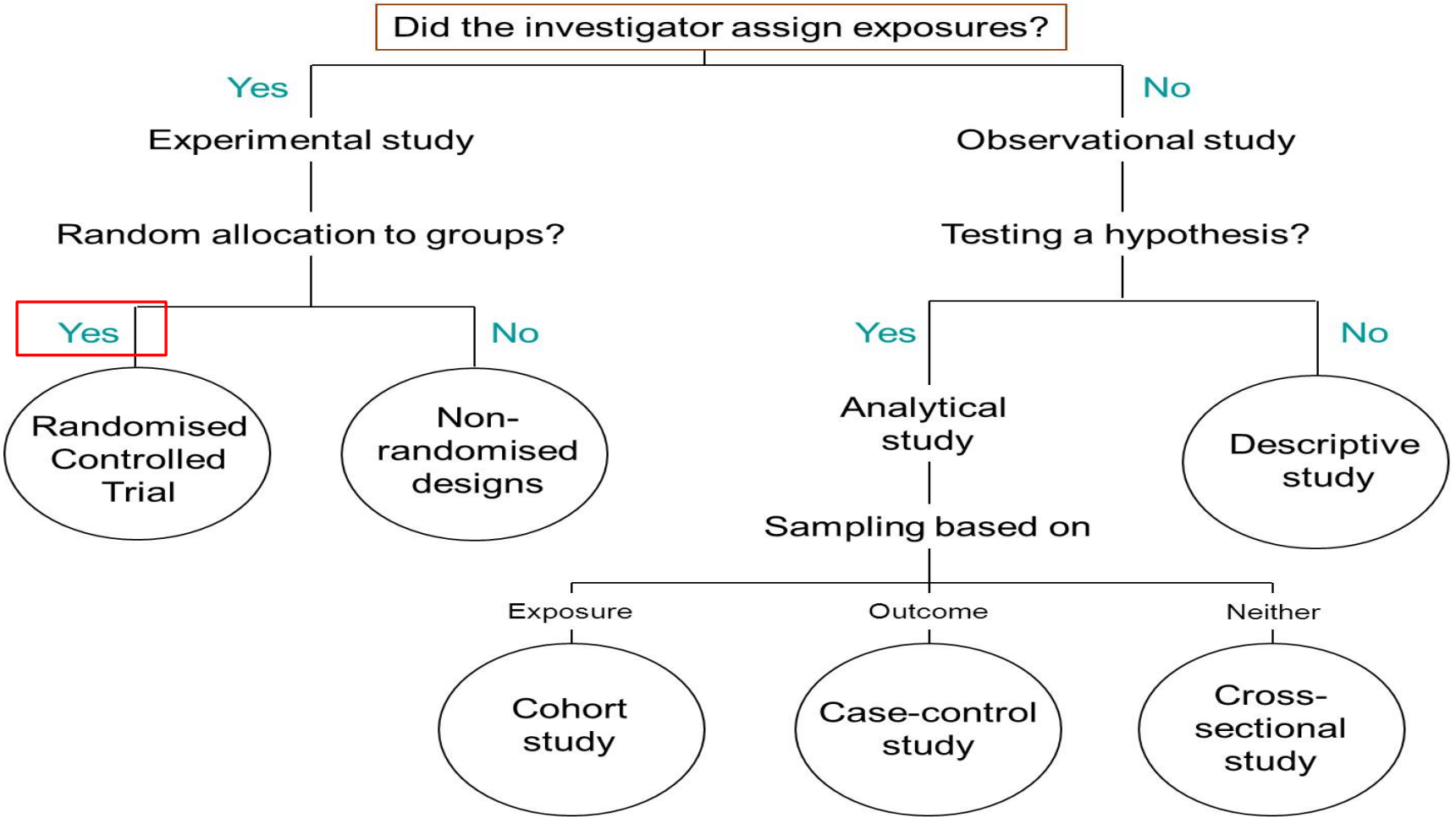
- Definition: A study in which two or more groups of people that are free of disease and that differ according to the extent of exposure (e.g. exposed and unexposed) are compared with respect to disease incidence

- Cohort studies are the observational equivalent of experimental studies but the researcher cannot allocate exposure

Cohort Study

- Purpose: Studies causes, preventions and treatments for diseases
- Key Feature: Investigator selects subjects according to their exposure levels and follows them for disease/outcome
- Setting: Trial not ethical, feasible, or too expensive. Moderate or large effect expected. Little known about exposure and so can evaluate many effects of an exposure. Exposure is rare.

Randomized Controlled Trials



http://phprimer.afmc.ca/Part2-MethodsStudyingHealth/Chapter5AssessingEvidenceAndInformation/Researchdesigns

RCT

- Investigate the role of some “agent” in the prevention or treatment of disease
- The agent can be a treatment, screening program, intervention, etc.
- The investigator ”controls” the agent
- It is because of this “control” that the RCT is considered the “gold standard”.

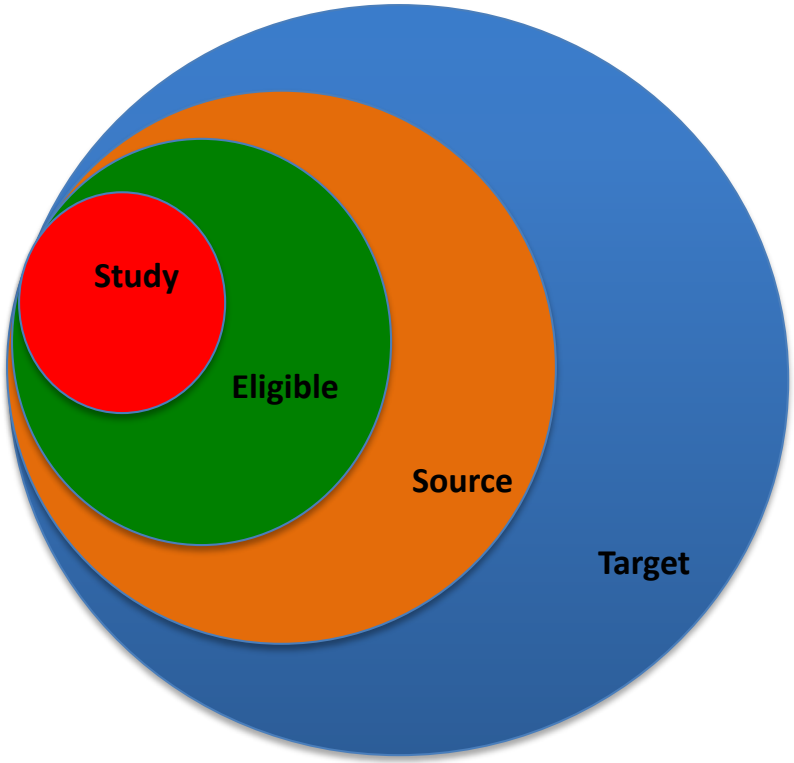
Overall Conduct

- Hypothesis formed
- Study subjects recruited based on specific inclusion/exclusion criteria and their informed consent is sought
- Subjects are randomly allocated to receive one of the two or more interventions being compared
- Study groups are monitored for outcome under study (recurrence of disease, first occurrence of disease, getting better, side effects)
- Rates of the outcome in the various groups are compared

Goal of Randomization

- To achieve baseline comparability between compared groups on factors related to outcome
- Compared groups are the same EXCEPT for the "treatment."
- Randomization provides balance between the groups with respect to known and unknown factors.
- The larger the groups, the better randomization works.

Populations



Retaining Participants

- Study requires active participation and cooperation of participants
  - Why would participants drop out of a study?
- What if you an unequal number of drop outs in each group?
- What are strategies for increasing compliance?
  - Design
  - Throughout the study

Use of Placebo and Blinding: Goals

- Placebos are used to make the groups as comparable as possible
- Blinding: subjects do not know if they are receiving treatment or placebo (single blind); neither subjects nor investigators know who is receiving treatment or placebo (double blind).
- Purpose of blinding: To avoid bias in ascertainment of outcome
- Placebo allows study to be blind

Ascertaining the Outcome

A) Goals

- High follow-up rates: don't lose people
- Uniform follow-up for compared groups: must be equally vigilant in follow-up in all compared groups

B) Penalty of non-uniform ascertainment of outcome is BIAS

Analysis of Data from Experimental Studies

- Once randomized always analyzed-intention to treat
- Data set up: familiar 2 x 2 table
- Measure of treatment effect: RR or RD

	Disease	**No disease**	
Exposed	A	B	A+B
Unexposed	C	D	C+D
	A+C	B+D	A+B+C+D

$$RR = \frac{a/(a+b)}{c/(c+d)} \text{ or } \frac{\text{Rate in exposed}}{\text{Rate in unexposed}}$$

Types of Validity

- Internal Validity
- External Validity

Threats to Internal Validity

- Why is it important?
  - Prevents the detection of spurious associations
  - Ensures valid conclusions are made

- Threats to internal validity can be lumped into three (3) categories
  - Bias
  - Chance
  - Confounding

Chance, Bias, and Confounding

- **Chance** is merely random variation
  - As we increase the sample size of our study, the impact of chance diminishes
- **Bias** is usually the *unintended* mistake of the researcher
  - Not lessened or otherwise affected by sample size
  - Often must prevent/minimize at the design stage, since control during analysis may be difficult/impossible
- **Confounding** is not a mistake but must be controlled
  - Also not impacted by sample size
  - Can be minimized/controlled for in the design and/or analysis phases of a study

Bias

- Bias: systematic error in the design or conduct of a study.
- The systematic error arises from flaws either in the method of selection of study participants (effect: Selection bias) or
- Procedures for gathering exposure/disease information (effect: misclassification bias)
- Effect of a bias: Erroneous results leading to misleading conclusions

Dealing with Bias

- Study design stage
  - Subject selection
  - Subject/study personnel blinded to subject status
  - Training
- Data collection
  - Definitions
  - Measurements
  - Standardization
  - Quality control

Confounding

Definition of Confounding

- A **distortion in the measure of the association** between exposure and outcome
- A **mixing of effects**
  - The association between exposure and disease is distorted because it is mixed with the effect of another factor that is associated with the disease.
- Confounding is a problem of comparison, a problem that arises when **important extraneous factors are differentially distributed** across groups being compared

Conceptual Examples of Confounding

You compare the effects of new handgun legislation in New York City on **total mortality** using Miami as a control population without the legislation

- *Problem*: NYC would have lower total mortality even without the new handgun legislation? Why?

Diagnostic Testing

Why is this topic important?

- Directs decision-making
  - Appropriate treatment
  - Prognosis
- Based on known information
  - What is the probability or likelihood of disease?
  - What is the probability or likelihood of no disease?

Diagnosis vs Screening

- Diagnosis
  - Patient presents with symptoms
  - Suspect a particular disease
  - Multifactorial
  - clinical decision making
- Screening
  - Testing is usually conducted independent of symptoms
  - Univariable
  - To classify individuals with respect to their likelihood of having a particular disease

Individualized Decision Making – Screening Value Judgment

- Risk of dying
- Benefits of screening
- Harms of screening
  - False positive results leading to unnecessary interventions and anxiety
  - Over-diagnosis
  - Cost
  - Discomfort
  - Embarrassment
- Values and Preferences

Walter et al., JAMA 2001:2750

WHO Recommendations for Screening – Policy Making

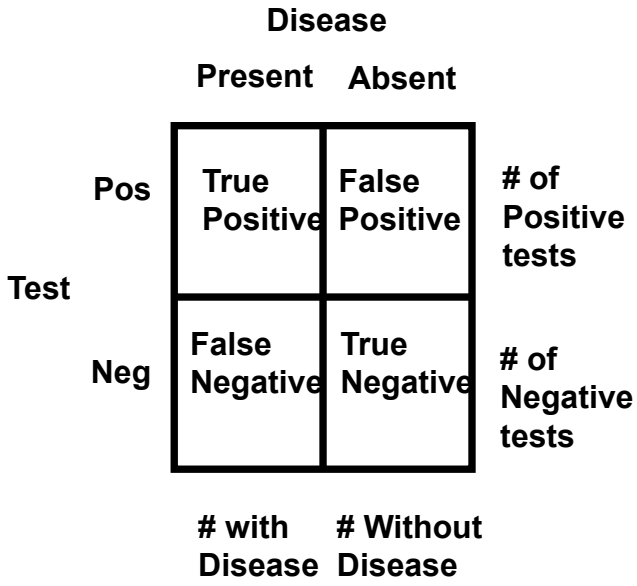
- The condition should be an important health problem (prevalence/severity).
- There should be a treatment for the condition.
- Facilities for diagnosis and treatment should be available.
- There should be a latent stage of the disease.
- There should be a test or examination for the condition.

WHO Recommendations for Screening – Policy Making

- The test should be acceptable to the population.
- The natural history of the disease should be adequately understood.
- There should be an agreed policy on who to treat.
- The total cost of finding a case should be economically balanced in relation to medical expenditure as a whole.
  - Financial, but also nonfinancial value (anxiety/inconvenience)
- Case-finding should be a continuous process, not just a "once and for all" project.

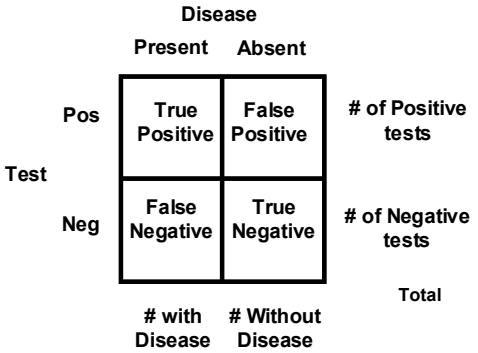
Standard 2x2 table of test results

- The 2x2 table at right provides a structure to evaluate virtually all common clinical tests
- However, the information isn't always presented in exactly the format that is clinically useful



Diagnostic test "performance"

- There are several potential methods for measuring the performance and clinical value of a test which are linked to characteristics of the test and of the population examined
  - prevalence = (TP + FN) / Total
  - sensitivity = TP / (TP + FN)
  - specificity = TN / (TN + FP)
  - positive predictive value (PPV) = TP / (TP + FP)
  - negative predictive value (NPV) = TN / (TN + FN)



Example

		TRUE HEALTH STATE: PCP	TRUE HEALTH STATE: No PCP	
Test Result:	"+"	21	4	25
	"-"	10	149	159
		31	153	184

- prevalence = (TP + FN) / Total
- sensitivity = TP / (TP + FN)
- specificity = TN / (TN + FP)
- positive predictive value (PPV) = TP / (TP + FP)
- negative predictive value (NPV) = TN / (TN + FN)

Example

prevalence = $31/184 = 0.17$

sensitivity = $21/31 = 0.68$

specificity = $149/153 = 0.97$

positive predictive value (PPV) = $21/25 = 0.84$

negative predictive value (NPV) = $149/159 = 0.93$

These are usually
Expressed as a percent
Each result is multiplied
By 100.

		TRUE HEALTH STATE: PCP	TRUE HEALTH STATE: No PCP	
Test Result:	"+"	21	4	25
	"-"	10	149	159
		31	153	184

Relationship Between Sensitivity and Specificity

1. Lowering the criterion of positivity results in increased sensitivity, but at the expense of decreased specificity.
2. Making the criterion of positivity more stringent increases the specificity, but at the expense of decreased sensitivity.
3. The goal is to have both high sensitivity and high specificity, but this is often not possible or feasible.
4. For continuous data, the decision for the cutpoint involves weighing the consequences of leaving cases undetected (false negatives) against erroneously classifying healthy persons as diseased (false positives).

www.pitt.edu/~super7/16011-17001/16981.ppt

Relationship Between Sensitivity and Specificity

5. Sensitivity should be increased when the penalty associated with missing a case is high (e.g. minimize false negatives)
   - when the disease can be spread
   - when subsequent diagnostic evaluations are associated with minimal cost and risk
6. Specificity should be increased when the costs or risks associated with further diagnostic techniques are substantial (minimize false positives – e.g. positive screen requires that a biopsy be performed).

www.pitt.edu/~super7/16011-17001/16981.ppt

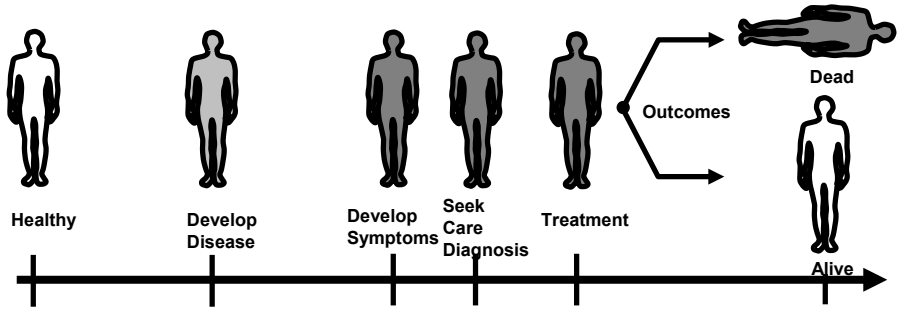
Benefits from the detection of early disease depends on…

- Can the disease can be detected early?
- What are the sensitivity and specificity of the test?
- What is the PPV?
- How serious is the problem of a false positive?
- What is the cost of early detection?
  - Funds, resources, emotional impact
- Are subjects harmed by the screening test?
- Is there benefit from early detection via screening?

-Gordis, Chapter 18

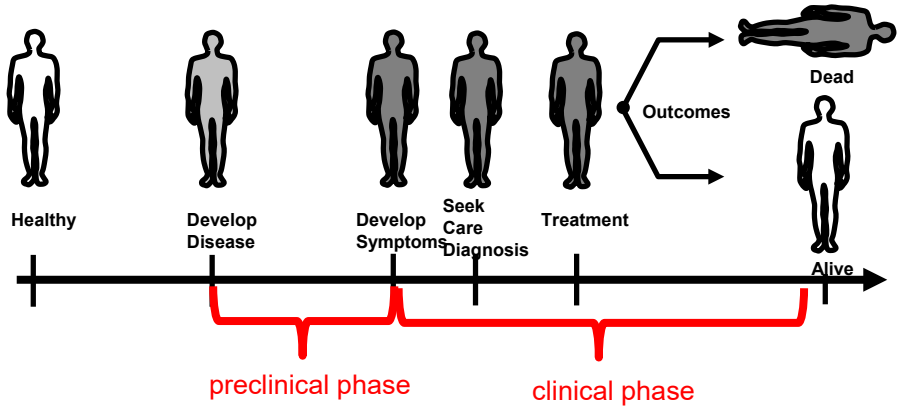
The natural history of disease

- Disease progression



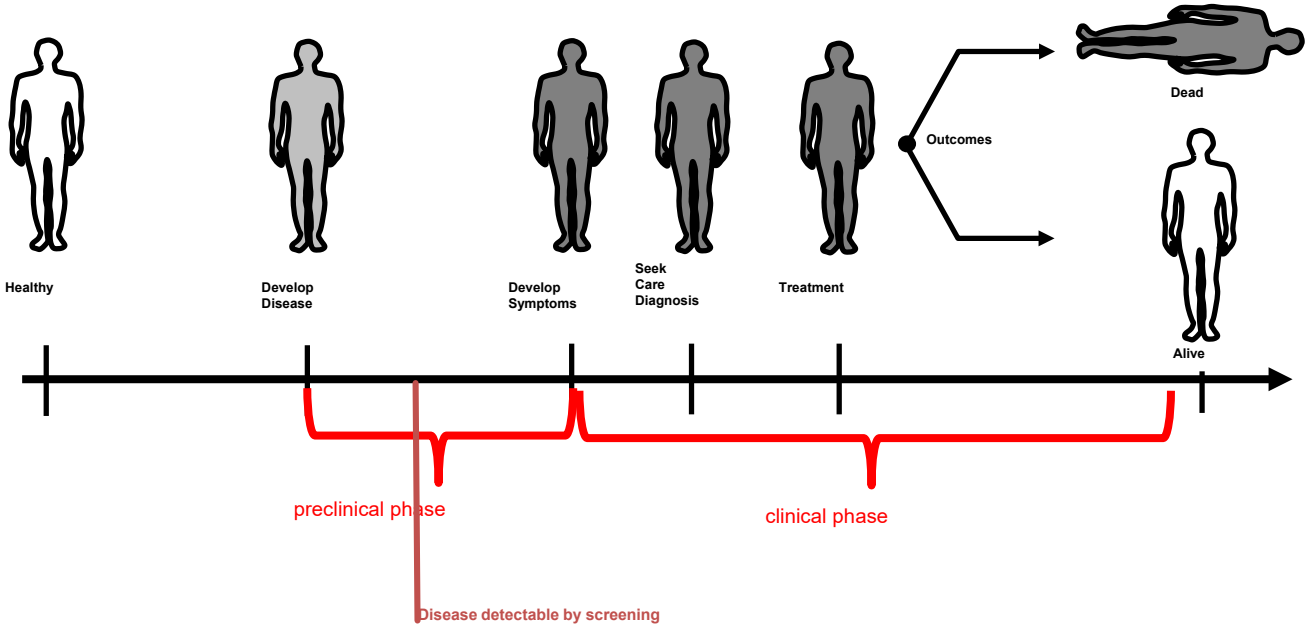
The natural history of disease

- Disease progression



The natural history of disease

- Disease progression



Checkpoint

What does the formula below represent:

$$\frac{\text{True Positives + False Negatives}}{\text{Total Sample Size}}$$

- False positive rate
- Prevalence
- Accuracy
- Sensitivity

Poll Question

CPH Certified in Public Health
by National Board of Public Health Examiners

Checkpoint

What does the formula below represent:

$$\frac{\text{True Positives + False Negatives}}{\text{Total Sample Size}}$$

- False positive rate
- **Prevalence**
- Accuracy
- Sensitivity

What questions do you have?