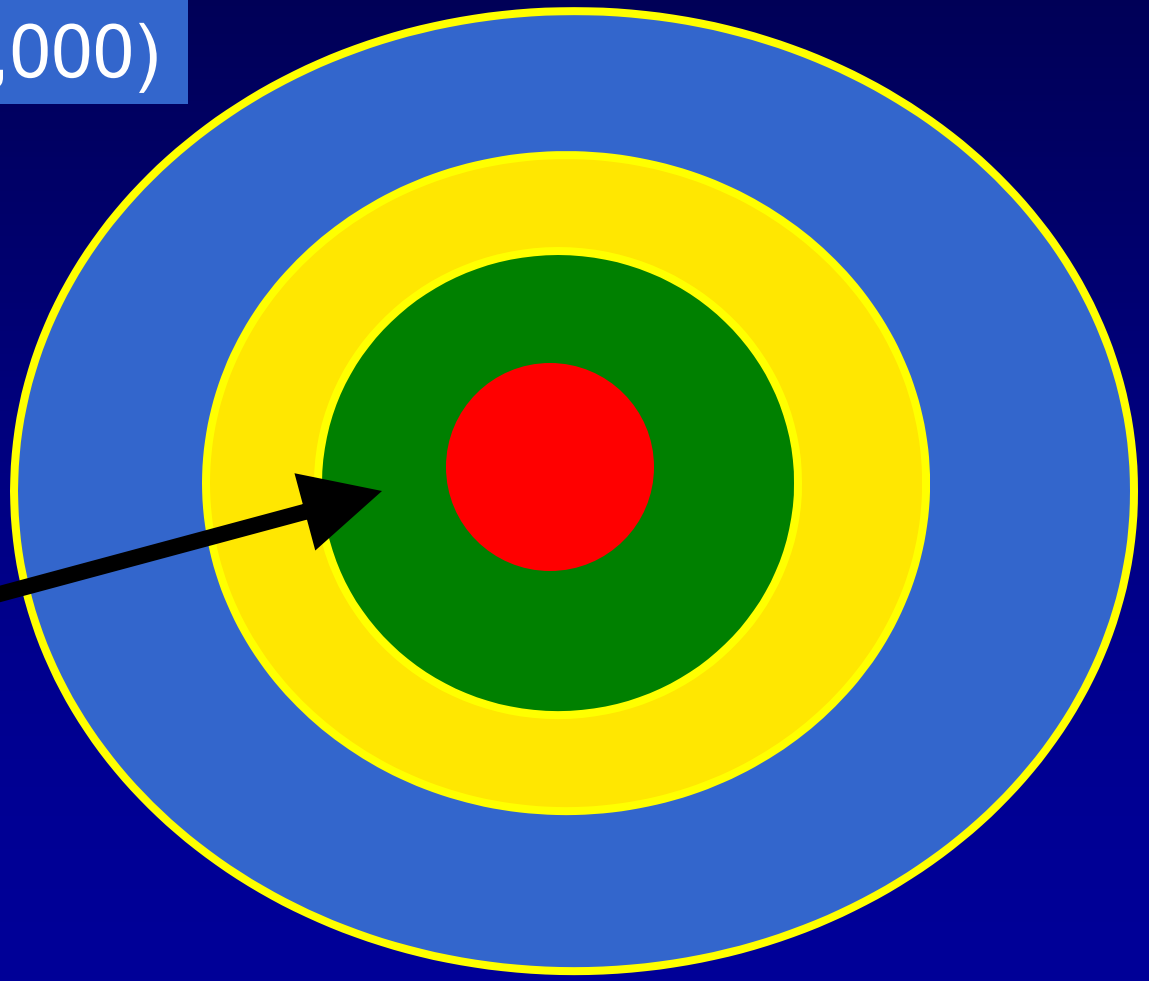
Source Population

Town residents (39,000)

Students (12,000)

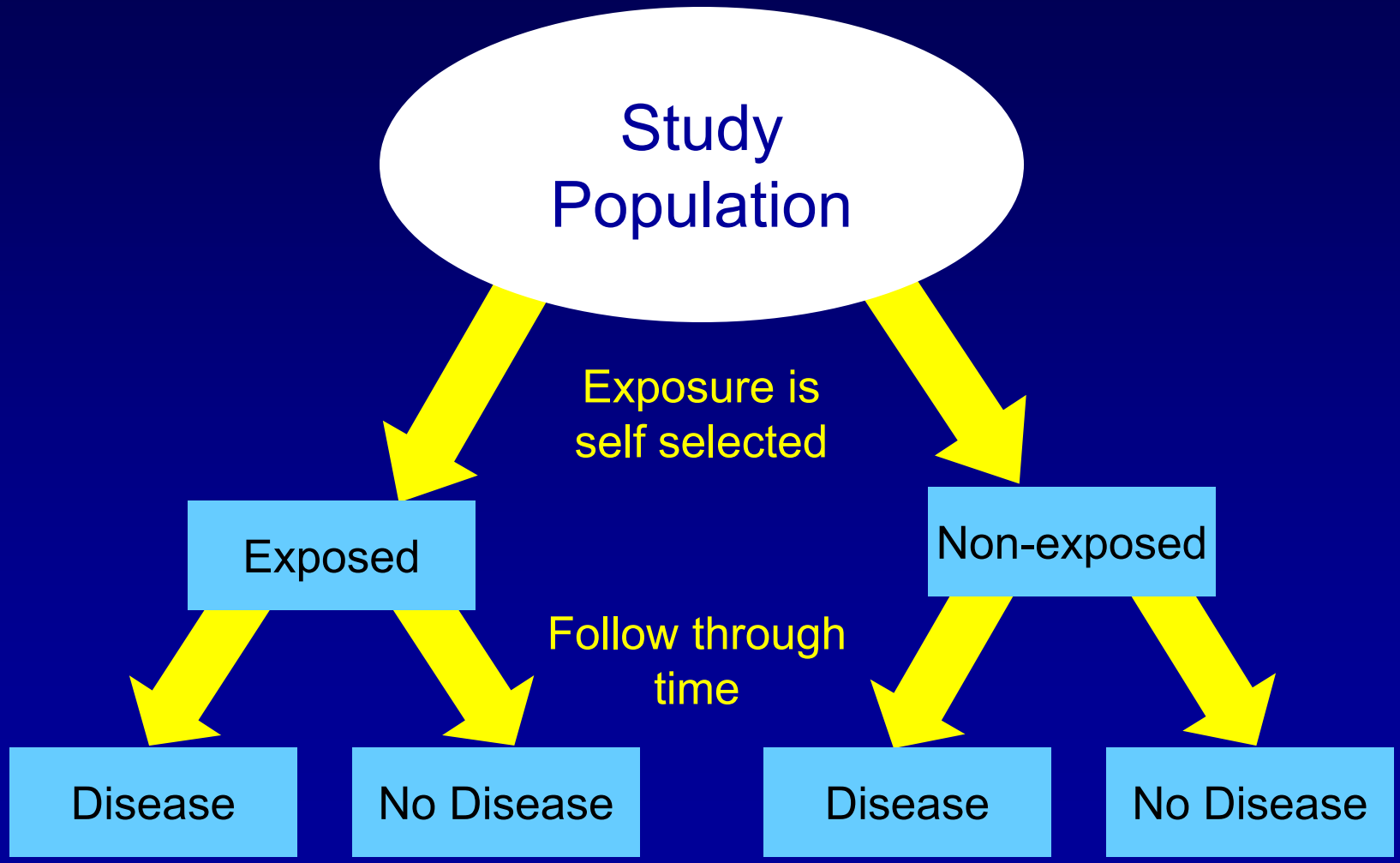
2400 on campus

2000 meal plan



Which Study Design?

Cohort Studies



Cohort Studies: Prospective vs. Retrospective

	Exposure	Outcome
Prospective	Assessed at beginning of study	Followed into the future for outcome
Retrospective	Assessed at some point in the past	Outcome has already occurred

Cohort:
Forward Directionality

Cohort Timeline

Research Timeline

Cohort Study

Steps in a Cohort Study:

1. Identify Cohort
2. Administer Questionnaire
3. Analyze Data

Cohort Study

Step 1 – Identify cohort

- Entire student body (n=12,000)
- On-campus students (n=2400)
- On campus students with meal plan who mainly ate at cafeteria (n=2000)
- Sick students (n=75)

❖ Do not select cohort so that either *everyone* is exposed or *everyone* is diseased

Cohort Study

Step 2 – Administer questionnaire

- Step 2a – Determine exposure status
  - Main cafeteria
  - Deli bar
  - Food item
- Step 2b – Determine disease status
  - Importance of well-defined case definition

Cohort Study

Step 3 – Analyze data

	Ill	Not Ill	Total
Exposed	A	B	A+B
Unexposed	C	D	C+D
Risk Ratio	$\frac{[A/(A+B)]}{[C/(C+D)]}$		

Interpreting a Risk Ratio

The risk ratio is the ratio of the risk of disease in exposed individuals to the risk of disease in unexposed individuals

- RR=1.0 = no association between exposure and disease
- RR>1.0 = positive association
- RR<1.0 = negative association

Interpreting a Risk Ratio

Example: *Outbreak of conjunctivitis at Dartmouth College*

- RR = 2.5
- Disease = Conjunctivitis
- Exposure = Attended a fraternity / sorority party

"Students who attended a fraternity or sorority party had 2.5 times the risk of having conjunctivitis compared to students who did not attend a fraternity or sorority party"

Cohort Study Examples

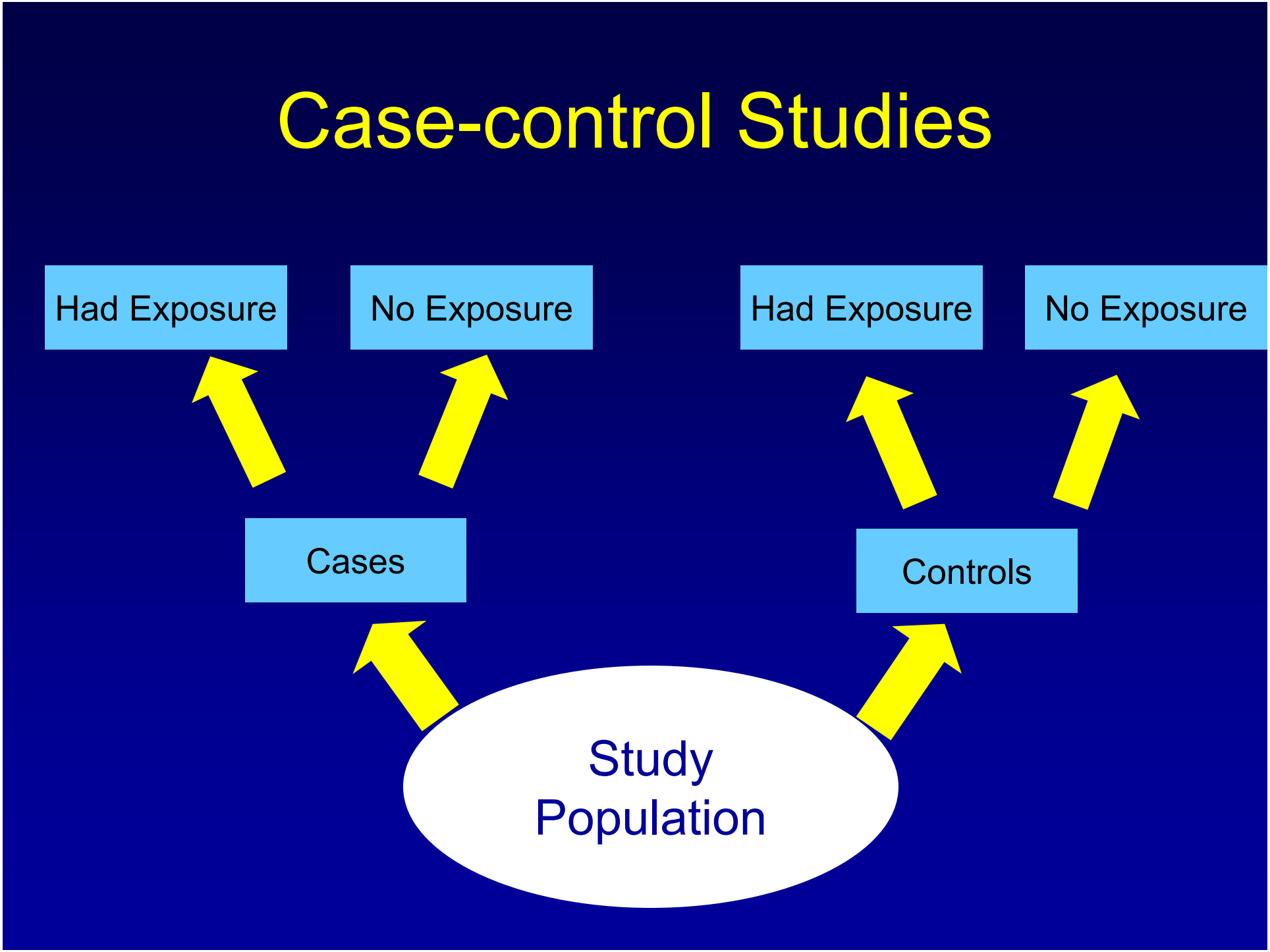
- Shigellosis among swimmers in a Georgia park
  - Used park registry to identify park visitors
- Whirlpools and Methicillin-Resistant Staphylococcus aureus
  - Occurred on a college football team

Question & Answer Opportunity

5 Minute Break

Case-Control Study

Case-control Studies



Case-Control: Backwards Directionality

Case-Control Study

Steps in a Case-Control Study:

1. Identify the source population
2. Establish a case definition and select cases
3. Select controls
4. Analyze data

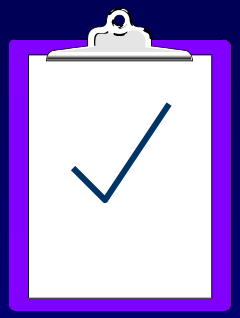
Case-Control Study

Step 1 - Identify source population

- Represents the population that gives rise to the cases; is similar to a cohort study

- In the Texas case study, the source population is: all students who live on-campus

Case-Control Study



Step 2 – Establish a case definition and select cases

- A standard set of criteria for deciding disease status
  - Clinical criteria, time, place, and person

Case Study Case Definition

Study Hypothesis

A viral infection spread by food(s) or beverage(s) served at the university's main cafeteria between March 5 and 10

Case definition

- Vomiting or diarrhea (≥3 loose bowel movements during a 24-hour period)
- Onset on or after March 5, 1998
- On-campus student seen at an emergency room or the Student Health Center

Case-Control Study

Step 3 – Select Controls

- Represent source population
  - On-campus students in Texas case study
- Collect same exposure information as for cases

Case-Control Study

Step 3 – Select Controls (cont'd.)

- Sources of controls
  - Random sample
  - Friends

Case-Control Study

Step 4 – Analyze Data

	Cases	Controls
Exposed	A	B
Unexposed	C	D
Odds Ratio	(A/C) / (B/D) = (A*D) / (B*C)	

Interpreting an OR

The odds ratio is interpreted in the same way as a risk ratio:

- OR=1.0 = no association between exposure and disease
- OR>1.0 = positive association
- OR<1.0 = negative association

Interpreting an OR

Example: Hepatitis A outbreak investigation

- OR = 12.0
- Disease = Hepatitis A
- Exposure = Eating at restaurant X in April 2003

"Among those with Hepatitis A, the odds of having eaten at restaurant X in April, 2003 is 12 times greater among the cases than among the controls."

Case-Control Study Examples

- Study to determine an association between autism and vaccination
- Study to determine an association between lung cancer and radon exposure
- Study to determine an association between salmonella infection and eating at a fast food restaurant

5 Minute Break

Cohort versus Case-Control Study

	Cohort Study	Case-Control Study
Preferred Study Design When . . .	Members are easily identifiable Members are easily accessible Exposure is rare There may be multiple diseases involved	Identifying entire cohort would be too costly or time consuming Accessing entire cohort would be too costly or time consuming Illness is rare
Study Group	Exposed persons	Persons with illness (cases)
Comparison Group	Unexposed persons	Persons without the illness (controls)

Study Design	Advantages	Disadvantages
Cohort	1. Least prone to selection bias 2. Can reasonable conclude that cause preceded disease 3. Can study several diseases at once 4. Can examine rare exposures 5. Retrospective can be low-cost	1. Prospective can be expensive, time-consuming 2. Prospective can lead to loss to follow up 3. Exposed may be followed more closely than unexposed, yielding invalid conclusions about causality
Case-Control	1. Less expensive and quicker than cohort 2. Can examine the effect of multiple exposures 3. Require a smaller sample population	1. Inefficient for studying rare exposures 2. Susceptible to selection bias 3. Cannot directly estimate the risk of disease 4. Cannot study several diseases at once

Measures of Association

	Cohort Study	Case-Control Study
Measure of Association	**Risk Ratio (RR)**: The ratio of the risk of disease in exposed individuals to the risk of disease in unexposed individuals	**Odds Ratio (OR):** The ratio of the odds that the cases were exposed to the odds that the controls were exposed
Interpreting the Measure of Association	**RR < 1.0** = negative association **RR = 1.0** = no association **RR > 1.0** = positive association	**OR < 1.0** = negative association **OR = 1.0** = no association **OR > 1.0** = positive association