

## Teaching Biostatistics in a Physician Assistant Program

**AMATYC Conference  
November 17, 2001  
Toronto, Canada**

## Dr. Janice Dykacz

Community College of Baltimore County -  
Essex campus  
7201 Rossville Blvd.  
Baltimore, MD 21237.

phone: (410) 780-6688  
e-mail: [jdykacz@ccbc.cc.md.us](mailto:jdykacz@ccbc.cc.md.us)

## Web Sites

<http://www.ccbc.cc.md.us>, Essex, Faculty  
Pages, Dr. Janice Dykacz,  
AMATYC 11/2001

<http://www.ccbc.cc.md.us>, Essex, Academics,  
Physician Assistant (under Certificate Career  
Programs)

## Physician Assistant Program

- Began in 1972
- PA is a dependent practitioner, i.e. needs supervision of a physician
- But, the physician can authorize many functions
- Over time, the PA position has grown in autonomy and in the breadth of activities.

## Now a program with Towson University

- Students obtain a Masters degree from Towson and a PA certification from CCBC when finished.
- Students take all courses at CCBC-Essex.
- 62 hours are credited to CCBC
- 36 graduate hours are credited to Towson
- Courses at CCBC had to meet Towson's requirements, including a review by the academic committee at Towson.

## Advantages to both CCBC & Towson

- PA program students now need a Masters degree, which Towson University can offer.
- PA program at CCBC is well-respected. Towson can offer the program without the cost of development.

### First in Maryland

- Only such arrangement in Maryland.
- Red Rocks Community College in Colorado has a similar arrangement.
- Hudson Community College in Albany, NY is working on a similar arrangement.

### PA Program at CCBC-Essex

- 26 months in length, begins in the summer
- Prerequisites: BA college degree including a basic course in statistics and at least one year of medical experience,
- 35 people in each cohort

- Passing a national accreditation exam required in the state of Maryland.
- (National Commission for the Certification of Physician Assistants)
- High exam passing rate (about 97% over the past thirty years)
- 100% placement rate

- Students are placed in Maryland
- In other states (about 1/4 are out-of-state)
- In other countries - rural areas of Bolivia & Peru, India, Cambodia, New Guinea, Bosnia

### Expectations

- Students are expected to be able to read and interpret the medical literature.
- And to contribute to medical research
- Students now take a course in Research Methods and develop a project, which is of high quality and can be published.

### Evidence-Based Medicine

- How do you know it works?
- Need to show why a method works
- Need more than anecdotal evidence
- Need to continually update notes
- Need statistics
- Need to be able to read journals such as JAMA and NEJM

### What is new?

- Research Methods is offered during two summers.
- A new module on bioterrorism is now included in the public health course.

### What is new?

- A new module on bioterrorism is now included in the public health course.
- Topics include the role of the CDC (Centers for Disease Control), anthrax, smallpox, and other possible agents.
- The Internet is used extensively to obtain up-to-date information.
- Students now are required to read the weekly updates from the CDC.

### Challenge in Teaching Biostatistics to this audience

- Need to get right to the point
- Need to explain techniques that are used in medical journal articles
- Cannot develop probability theory
- No time to talk about probability distributions.

### First topic: Types of Studies

- Cross-sectional studies
- Cohort or prospective studies
- Case-Control or retrospective studies
- Observational Studies
- Experiments: **RCT, the Randomized Clinical Trial**

### Cross-sectional Studies

- Snapshot of the population
- Used to make hypotheses about the possible causes of a disease
- x-variable(s): explanatory variables or factors, includes the demographic variables of gender, race, and age, & variables such as smoking status, exposed & not exposed
- y-variable: outcome or response variable (the effect or disease)

### Cross-sectional Studies

	Disease Present	Disease Absent	
Exposed			
Not Exposed			
			Total

### Cohort or Prospective Studies

- Also called longitudinal studies
- People observed **over time** (not just a snapshot)
- **Start with the explanatory variables or the possible cause**
- Over time, the effect (disease) is observed
- Relative Risk can be calculated.

### Cohort or Prospective Studies

	Disease Present	Disease Absent	
Exposed			Total
Not Exposed			Total

### Case-Control or Retrospective Studies

- **Start with the disease (the effect)**
- Go back in time and observe the explanatory variables for the cases (those with the disease) and the controls (those without the disease)
- Used when a disease is rare.
- Odds ratio is used.

### Case-Control or Retrospective Studies

	Diseased (Cases)	Disease Free (Controls)
Exposed		
Not Exposed		
Total	Total (Cases)	Total (Controls)

### Cohort Studies vs. Case-Control Studies

- Cohort or prospective studies are more expensive and generally take longer.
- These studies are not used to study a rare disease.
- Cohort or prospective studies provide a direct estimate of the risk of developing the disease.
- Many diseases can be examined.

### Observational Studies vs. Experiments

- In an experiment, people are randomly assigned to one of several groups.
- Randomization done to make the groups alike except for the treatment.

## The Randomized Clinical Trial (RCT)

- Placebo used as one of the treatments.
- Double-Blind: Neither the patients or the physicians observing the patients know in which group a patient belongs.
- Example: the Physicians' Health Study

## Physicians' Health Study

- A Randomized Clinical Trial (RCT) & longitudinal study
- Participants in the study were physicians
- Given either aspirin or a placebo
- Given either beta-carotene or a placebo
- Followed over time - cases of heart disease and cancer were observed in the four groups
- Video: For All Practical Purposes #6 (Overview)

## Physicians' Health Study

- Participants observed for several years. The study began in 1982 and the aspirin/placebo part was stopped in December 1987.
- We can compute the probability of myocardial infarction given the participant is in the aspirin group.
- Likewise for the placebo group.
- The ratio of the two probabilities is the relative risk.

## Physicians' Health Study Relative Risk (RR)

	MyoInfarc	No MyoInfarc	
Aspirin	104	10933	11037
Placebo	189	10845	11034

## Compute RR from previous slide

*Round to three decimal places.*

$$P(\text{MyoInfarc} \mid \text{Aspirin}) = 0.009$$

$$P(\text{MyoInfarc} \mid \text{Placebo}) = 0.017$$

*Round to two decimal places.*

$$RR = \frac{P(\text{MyoInfarc} \mid \text{Aspirin})}{P(\text{MyoInfarc} \mid \text{Placebo})} = 0.53$$

$$P(\text{MyoInfarc} \mid \text{Placebo})$$

## Meaning of Relative Risk

- $RR = 1$  No association between disease and exposure.
- $RR < 1$  Exposure is protective.
- $RR > 1$  Exposure is a risk factor.

## Smoking and Lung Cancer

- Video: Against All Odds - program #11
- Initially, observations of the correlation between smoking and lung cancer
- Retrospective or case-control studies
- Prospective or cohort studies
- Experiments with animals

## Criteria to Establish Causation (Smoking & Lung Cancer Video)

### 1. **Consistency of association**

Do the different methods of studying the association provide consistent results?

### 2. **Strength of association**

Are the lung cancer rates for smokers much greater than for non-smokers?

### 3. **Temporal relationship of the association**

Does the presumed cause, smoking, always precede the presumed effect, lung cancer?

### 4. **Coherence of the association**

Does the association make sense in light of what we know about the history and biology of the disease?

### 5. **Is there a dose-response relationship between the presumed cause and the disease?**

## Cohort & Case-Control Studies

- For a cohort study, the relative risk (RR) can be used to measure association between a disease and an explanatory variable.
- For a case-control study, the odds ratio (OR) is used to measure association between a disease and an explanatory variable.

# Quiz

1. From *U.S. College Students' Use of Tobacco Products*, JAMA, August 2000



Students at 119 US 4-year colleges were surveyed regarding gender, race, etc., college characteristics, and use of tobacco products.

This study is a

- a) cross-sectional study
- b) prospective study
- c) retrospective study
- d) randomized clinical trial

2. From *Effectiveness of St. John's Wort in Major Depression*. JAMA, April 2001



The objective of this study was to compare the efficacy and safety of a standardized extract of St. John's Wort with placebo in outpatients with major depression. Two hundred adult outpatients were randomly assigned to receive St. John's Wort or placebo.

This study is a

- a) cross-sectional study
- b) prospective study
- c) retrospective study
- d) randomized clinical trial

3. From *Cellular-Telephone Use and Brain Tumors*, N Engl JMed, January, 2001



We examined the use of cellular telephones in a case-control study of intracranial tumors of the nervous system. We enrolled 762 patients through hospitals, who had histologically confirmed glioma, meningioma, or acoustic neuroma. The controls were patients admitted to the same hospitals as the patients with brain tumors for a variety of nonmalignant conditions.

This study is a

- a) cross-sectional study
- b) prospective study
- c) retrospective study
- d) randomized clinical trial

4. From *Association of Coffee and Caffeine Intake with the Risk of Parkinson Disease*, JAMA, May 2000



Data were analyzed from 30 years of follow-up of 8004 Japanese-American men enrolled in the longitudinal Honolulu Heart Program. Caffeine intake was measured, and men were observed to determine whether they acquired Parkinson's Disease.

This study is a

- a) cross-sectional study
- b) prospective study
- c) retrospective study
- d) randomized clinical trial

How to Explain the Meaning of a Confidence Interval

Student project

Web site: [www.cccbc.cc.md.us](http://www.cccbc.cc.md.us), Essex, Faculty Pages, Kathleen Harmeyer, Perfect Little Programs, Confidence Interval

*The End*