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Fall 2017

## PUBH 7890 - Individual Study: Statistical Methods in Diagnostic Medicine

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### Recommended Citation

Yin, Jingjing, "PUBH 7890 - Individual Study: Statistical Methods in Diagnostic Medicine" (2017). *Public Health Syllabi*. 196.

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## Individual study: Statistical Methods in Diagnostic Medicine

Fall 2017

**Instructor:** Jingjing Yin  
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**Email:** [jyin@georgiasouthern.edu](mailto:jyin@georgiasouthern.edu)  
**Class Meeting:** Wednesday 10:00am-11:00am  
**Office hours:** M and W 9-12.

**Course Description:** This course introduces the statistical concepts and methods for designing and analyzing biomarker data for diagnostic tests.

**Textbook:**

**Required:** *Statistical Methods in Diagnostic Medicine*, 2<sup>nd</sup> edition, Xiao-Hua Zhou, Nancy A. Obuchowski, Donna K. McClish.

The lectures will often follow the general organization of the textbook, but with some differences in emphasis and detail. Students will be responsible for **whatever material is covered in the lectures**, whether or not it is treated in the text.

### Master of Public Health

#### MPH

#### ***Cross-cutting Competencies***

1. Demonstrate effective written and oral skills for communicating with different audiences in the context of professional public health activities. (Communication and Informatics)
2. Use information technology to access, evaluate, and interpret public health data. (Communication and Informatics)
3. Describe the roles of history, power, privilege and structural inequality in producing health disparities. (Diversity and Culture)
4. Explain how professional ethics and practices relate to equity and accountability in diverse community settings. (Diversity and Culture)

5. Develop public health programs and strategies responsive to the diverse cultural values and traditions of the communities being served. (Diversity and Culture)

### ***Biostatistics Concentration***

1. Provide the biostatistical components of the design of a public health or biomedical experiment by: clarifying the research objectives or questions; determining data and endpoints to be collected appropriate for the objectives; translating the objectives into biostatistical questions via hypothesis testing or confidence interval frameworks; determining the appropriate sample size; and writing the statistical analysis section of the experiment.
2. Apply appropriate statistical analysis methods using SAS to analyze both categorical and quantitative data.
3. Develop written and oral reports to communicate effectively to research investigators pivotal aspects of a study, including its design, objectives, data, analysis methods, results, and conclusions ensuring that results and conclusions are valid and reliable and address the research objectives.
4. Create a collaborative environment for working on written and oral reports and developing critical thinking skills.
5. Describe key concepts and theory underlying biostatistical methodology used in probability and inferential, analytical, and descriptive statistics.

### **Performance-Based Objectives (PBO) Linked to Course Activities (Note: Activities Described in Next Section)**

At the end of this course, students will be able to thoroughly understand and apply the following statistical concepts and methods (among others):

1. Understand the basic concepts about measures of test accuracy (e.g., ROC, sensitivity, specificity, AUC, etc) and study design for evaluation of the diagnostic tests. Competency of this objective will be measured by Activities 1, 2, 3 and 4.
2. Apply statistical inference methods for estimating and testing the accuracy measures for a single test and comparing two tests' accuracies under various study designs. Competency of this objective will be measured by Activities 1, 2, 3 and 4.

3. Apply regression analysis approach for adjusting covariates in the evaluation of a single test. Competency of this objective will be measured by Activities 1, 3 and 4.
4. Understand the concept of verification bias and methods for correcting it. Competency of this objective will be measured by Activity 4.
5. Understand the concept of imperfect gold stander bias and methods for correcting it. Competency of this objective will be measured by Activity 4.

### **Assessment of Student Learning**

Activity 1: Assignments (Specific PBO and Comp, see table of Schedules)

Activity 2: Perform literature review on selected topics and conduct some innovative methodological research (including statistical simulation) in ROC analysis and give an oral presentation for the research project. (PBO 1 to 6; Comp1 to 5)

### **Topics and Schedules:** (subject to change)

Chapter	Topic	Assignments
Week 1: Chapters 1-2	Basic concepts in diagnostics	
Week 2: R	Introduction to R and simulation	
Week 3: Chapter 4	Inference for a single test	
Week 4: R	R practice: Introduction to R and simulation	
Week 5: Chapter 4	Inference for a single test cont.	
Week 6: R	R practice: Inference for a single test	
Week 7: Chapter 5	Inference for two correlated tests	
Week 8: R	R practice: Inference for two correlated tests	
Week 9: Chapter 8	Regression for single test	
Week 10: R	R practice: Regression for single test	
Week 11: Chapter 9	Linear combination of multiple tests	
Week 12: R	R practice: Linear combination of multiple tests	
Week 13: Chapter 10	Verification bias	
Week 14:	R practice: Verification bias	

Week 15: Chapter 11	Imperfect gold standard bias	
Week 16:	Student presentation and discussion	

**Grading Scheme:**

Project paper: 50%

Simulation assignments: 50%

**Grading Scale:**

A 90 - 100%

B 80 - 89%

C 70 - 79%

D 60 - 69%

F 0 - 59%

**Homework:** Homework accounts for 50% of your course grade. Assignments are to be handed in **by the end of the lecture the day it is due**, unless otherwise announced in class. **Late homework will not be accepted** unless advanced permission was given by the instructor under extraordinary circumstances (e.g., serious illness/accident, death in the family, etc.).

Please describe and justify your answers with detailed reasoning, an answer with merely a final number receives no credit even it is correct. If SAS or R is used, please attach the commented code at the end of the homework, which I should be able to run and reproduce your results.

You may work together or individually on these assignments, however each student must submit his/her own assignment and state with whom he/she worked, if applicable. What does ‘working together’ mean? You are welcome to solve problems and discuss explanations in groups, however it is not acceptable to submit assignments with identical wordings and explanations. I will cheerfully address any homework questions during office hours. Emailing me about homework questions is not referred, but if you do, please allow me one business day to respond.

**Academic Integrity:** Students are expected to follow guidelines outlined in the *Student Conduct Code* policy regarding academic dishonesty. Any student found in violation of academic honesty will receive a grade of ‘F’ for the course. It is the student’s responsibility to familiarize him/herself with the student policies and expectations set forth in the *GSU Student Conduct Code*

**Attendance Policy:** Due to the nature and structure of this course, class attendance is of utmost importance. You are responsible for any material covered or distributed in class, including any announcements made in class, whether or not you are present. Furthermore, federal regulations require attendance be verified prior to distribution of financial aid allotments. Attendance will not be recorded after this initial period. However, if you are going to miss one class, it is recommended that you notify the instructor prior to the start of the class so that I could help you to make up for the lecture you have missed.

**Class Participation & Etiquette:** Attendance, attention, and participation are expected for each class! Note that although class participation is not a formal part of your course grade, I will use it as a factor if your final grade is on the border between two letter grades.

On a final note of etiquette, please do not text or use your cell phones during class, and silent your cell phones since ring tones are disruptive to others. If you have to use the cell phone, you may leave the classroom so that you do not interrupt others. And please do not chat or make noises while the instructor or your classmate is talking.

**Disclaimer:** The contents of this syllabus are as complete and accurate as possible. The instructor reserves the right to make any changes necessary to the syllabus and course material. The instructor will make every effort to inform you of changes as they occur. It is the responsibility of the student to know what changes have been made in order to successfully complete the requirements of the course.

**Plagiarism**

"According to the Academic Dishonesty Policy of GSU, Plagiarism includes (but is not limited to):

- A. Directly quoting the words of others without using quotation marks or indented format to identify them.
- B. Using published or unpublished sources of information without identifying them.
- C. Paraphrasing material or ideas without identifying the source.
- D. Unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic material.

If you are accused of plagiarism by a JPHCOPH, the following policy, as per the Judicial Affairs website ( <http://students.georgiasouthern.edu/judicial/faculty.htm> ) will be enforced:

**PROCEDURES FOR ADJUDICATING ACADEMIC DISHONESTY CASES**

**First Offense - In Violation Plea**

1.If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is a first violation of academic dishonesty. The incident will be reported via the following website:

<http://students.georgiasouthern.edu/judicial/faculty.htm>

2. If it is a first violation, the professor should talk with the student about the violation. If the student accepts responsibility in writing and the professor decides to adjudicate the case, the following procedures will be followed:

- a.The student will be placed on disciplinary probation for a minimum of one semester by the Office of Judicial Affairs.
- b.The student will be subject to any academic sanctions imposed by the professor (from receiving a 0 on the assignment to receiving a failing grade in the class).
- c.A copy of all the material involved in the case (Academic Dishonesty Report Form and the Request For Instructor to Adjudicate Form) and a brief statement from the professor

concerning the facts of the case and the course syllabus should be mailed to the Office of Judicial Affairs for inclusion in the student's discipline record.

#### **First Offense - Not In Violation Plea (student does not admit the violation)**

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is the first or second violation of academic dishonesty. The student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case. If the student is found responsible, the following penalty will normally be imposed:

- a. The student will be placed on Disciplinary Probation for a minimum of one semester by the Office of Judicial Affairs.
- b. The student will be subject to any academic sanctions imposed by the professor.

#### **Second Violation of Academic Dishonesty**

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, and if it is determined this is the second violation, the student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case.

If the student is found responsible, the following penalty will normally be imposed:

- a. Suspension for a minimum of one semester or expulsion.
- b. The student will be subject to any academic sanctions imposed by the professor.

#### **NOT RESPONSIBLE FINDING**

When a student is found not responsible of academic dishonesty, the work in question (assignment, paper, test, etc.) would be forwarded to the Department Chair. It is the responsibility of the

Department Chair to ensure that the work is evaluated by a faculty member other than the individual who brought the charge and, if necessary, submit a final grade to the Registrar. For the protection of the faculty member and the student, the work in question should not be referred back to the faculty member who charged the student with academic dishonesty.

In the case of a Department Chair bringing charges against a student, an administrator at the Dean's level will ensure that the student's work is evaluated in an appropriate manner.

#### **CONFIDENTIALITY**

In accordance with provisions of the Family Educational Rights and Privacy Act of 1974 and the Georgia Open Records Act, any information related to a violation of academic dishonesty or the outcome of a judicial hearing regarding academic dishonesty, is prohibited and must be treated as confidential by members of the faculty."