Course Title: ADVANCED EPIDEMIOLOGIC RESEARCH METHODS WITH APPLICATION

Course Number: CRN57494 – EPID 0753J - 030

Course Location: SPH Building, 683 Hoes Lane West,
Piscataway, NJ, Room # 206

Course Date & Time: Tuesdays and Thursdays from 6:10 pm to 9:00 pm

Course Instructor: Kitaw Demissie, MD, PhD

Department of Epidemiology,
Rutgers School of Public Health
683 Hoes lane West; Room # 212
Piscataway, NJ 08854

Office Hours: By Appointment only

Course Assistant: Looking for one (please volunteer)

Required Course Text: No assigned textbook

Additional/Supplemental Readings/Resources: Will be provided during the lecture on power point and uploaded in advance to Moodle before class meets

Course Description: This is an advanced course in epidemiologic methods that helps students to have an in depth understanding of theories, concepts, and principles underlying epidemiologic study designs and analyses. The emphasis is on integrating the various epidemiologic concepts so that students will be able to clearly relate these to published or ongoing research studies. It also helps students to clearly see the interrelationship between epidemiologic methods and their application in real life research.

Selected Department Competencies Addressed: Each Department identifies competencies for each degree offered. The competencies addressed in this course for the PhD degree in the Department of Epidemiology include:

- Critique epidemiologic literature, assess its strengths and weaknesses and determine if conclusion(s) are supported
Formulate specific hypotheses and determine an appropriate study design and analysis plan using quantitative data analysis techniques
- Design and implement studies to investigate causes of disease
- Design and implement clinical trials as applied to public health research and interventions
- Design reliable and valid measurement instruments
- Design, implement and assess ordinary data collection systems for public health research, including quality control for data entry
- Originate, design and implement new studies in the field that are worthy of publication and grant support

Please visit the Department webpages on the School of Public Health’s website at http://sph.rutgers.edu/ for additional competencies addressed by this course for other degrees and departments.

Course Objectives: By the completion of this course, students will be able to:
- To be able to define epidemiology as a discipline of occurrence research in medicine
- To clearly articulate measures of disease occurrence and association in population studies
- To explain the logic and philosophy behind causes and causal inference in epidemiology
- To clearly explain the concepts behind etiologic fraction and synergy between causes
- To identify the sources of random and systematic errors in designing an epidemiological study and to describe methods of reducing them
- To be able to quantify the magnitude of selection, information, and confounding biases and calculate the true estimates after adjusting for them
- To clearly explain the concepts of reliability and validity of a measuring instrument and relate them to random and systematic errors
- To conceptualize the theoretical basis for the design and analyses of randomized controlled trials, case-control, and cohort studies.

Course Requirements and Grading: Course evaluation and grading will comprise of the following activities:

1. *Class attendance and contribution to discussion* 20 pts.
2. *Weekly homework assignments* 20 pts.
4. *Final Examination* 40 pts.
   Total: 100 pts.
• *Class attendance and participation are more important for this course than actually writing the exam. Because the pace of the class is very rapid, missing a one day class can put the student behind. Moreover, active participation in the class discussion and teaching will help to assess if the student is engaged and follows the material. Because of these, class attendance and contribution will carry 20 points of the overall grade.*

**Course Schedule:** *Include week by week listing of each class session:*

**May 23 – Review of Important Statistical Concepts and Measures of Disease Occurrence**

1. Measures of Disease Occurrence  
   a. Incidence, Incidence Rate/Density  
   b. Cumulative Incidence  
   c. Prevalence  
   d. Hazard  
2. Statistical Concepts  
   a. Types of distributions  
   b. Sampling variability  
   c. Descriptive statistics  
   d. Comparing Means and Proportions  
   e. Correlation and Regression

**May 25 – Causal Inference, and Synergy**

1. The Emergence of Epidemiology  
2. Role of Medicine and Statistics in Epidemiology  
3. Epidemiology and Science  
4. Philosophy of Scientific Inference  
5. Causal Inference in Epidemiology  
6. Etiologic Fraction and Synergy

**May 30 – Precision and Validity**

1. Objectives of Epidemiologic Study Design  
2. Precision  
3. Internal Validity  
   a. Selection Bias  
   b. Information Bias  
   c. Confounding Bias  
   d. External Validity
June 1 – Quantification of Bias – Part I
1. Selection Bias
2. Confounding Bias

June 6 – Quantification of Bias – Part II
1. More On Confounding Bias

June 8 – Sampling
1. Sample Surveys
2. Why Sampling?
3. Types of Sampling
4. Probability Sampling
5. Stratified Sampling
6. Cluster Sampling
7. Examples: NHANES

June 13 – Measurement
1. Measuring Subjective Outcomes
2. Definitions of Validity and Reliability
3. Reliability
4. Validity
5. Devising Items and Testing

June 15 – Midterm Exam

June 20 – Quantification of Bias – Part III
Information Bias

June 22 – Design and Analysis of RCTs – Part I
1. Why Clinical Trials
2. History of Clinical Trials
June 27 — Design and Analysis of RCTs – Part II

1. N-of-one Trials  
2. Group Randomize Trial  
3. Cluster Randomized Trials and the Stepped Wedge  
4. Sequential Design and Analysis  
5. Next Generation of Clinical Trials to Address Disease Heterogeneity

June 29 – Design of Cohort Studies

1. Design of the Study Base  
   - Membership of the Base Population  
     i. Admissibility  
     ii. Distribution Matrix  
     iii. Size  
2. Proportional Mortality Studies

July 6 – Design of Case-Control Studies

1. History of Case-Control Studies  
2. Stratified Sampling of the Cases  
3. Stratified Sampling of the Base  
4. The Ideal Reference Entity and Its Source  
5. Reference Series from Outside the Base

July 11 – Screening

1. Concepts in Screening  
2. Diseases Appropriate for Screening  
3. Screening tests  
   a. Validity  
   b. Reliability  
4. Feasibility and Efficacy  
5. Problems of evaluating effectiveness of screening in observational studies
6. Randomized trials of screening
7. Case-control studies of screening

July 13 – Final Exam

**School of Public Health Honor Code:** The School of Public Health Honor Code is found in the student bulletin (sph.rutgers.edu/academics/catalog/index.html). Each student bears a fundamental responsibility for maintaining academic integrity and intellectual honesty in his or her graduate work. For example, all students are expected to observe the generally accepted principles of scholarly work, to submit their own rather than another’s work, to refrain from falsifying data, and to refrain from receiving and/or giving aid on examinations or other assigned work requiring independent effort. In submitting written material, the writer takes full responsibility for the work as a whole and implies that, except as properly noted by use of quotation marks, footnotes, etc., both the ideas and the works used are his or her own. In addition to maintaining personal academic integrity, each student is expected to contribute to the academic integrity of the school community by not facilitating inappropriate use of her/his own work by others and by reporting acts of academic dishonesty by others to an appropriate school authority. It should be clearly understood that plagiarism, cheating, or other forms of academic dishonesty will not be tolerated and can lead to sanctions up to and including separation from the Rutgers School of Public Health.

**Policy Concerning Use of Recording Devices and Other Electronic Communications Systems:** When personally owned communication/recording devices are used by students to record lectures and/or classroom lessons, such use must be authorized by the faculty member or instructor who must give either oral or written permission prior to the start of the semester and identify restrictions, if any, on the use of mobile communications or recording devices.