EPHD 310
Basic Biostatistics
Graduate Course
Fall 2017
Department of Epidemiology and Population Health
Faculty of Health Sciences
American University of Beirut

Instructors

Name : Dr. Jaffa M., Associate Professor of Biostatistics
Office : 214 Van Dyck
Office Hours : Mon 5:20 PM - 6:00 PM (After common lecture)
Tues 1:10 PM - 1:40 PM (After Tuesday lab)
Thurs 7:40 PM- 8:00 PM (After Thursday lab)
Frid 2:10 PM – 2:30 PM (After Friday lab)

Or by appointment

Email : ms148@aub.edu.lb
Extension : 4603

ClassTimes

Lecture: Mon 3:30 PM _ 5:10 PM Van Dyck _ Amphi
Lab: Tues 11:00 AM _ 1:00 PM Van Dyck _ Lab/room 201
Thurs 5:30 PM _ 7:30 PM Van Dyck _ Lab/room 101
Frid 12:00 PM _ 2:00 PM Van Dyck _ Lab/room 101

Course Material

Lecture notes : Will be provided by the instructors via AUB Moodle
References : Biostatistics; Wayne W. Daniel; 9th or 10th ed.
Fundamentals of Biostatistics; Bernard Rosner; 5th ed.

Course Description:
This course is an introduction for graduate students to statistical techniques applied to health sciences and related fields. The objectives are twofold: *descriptive statistics* which encompass techniques for organizing and summarizing data, and *inferential statistics* which embody decisions about a study population by examining a sample of it. Focus is on problems that are commonly encountered in Health services and biomedical/medical research. The course introduces the role of Biostatistics in public health and medicine and

basic sciences and elaborates on the importance of biostatistics in different areas of studies. The importance of honoring integrity and ethics in data analysis and manipulation, and the proper description and presentation of the data under investigation numerically and graphically are all emphasized. Moreover, identifying and carrying out appropriate statistical analyses that suit the study design and reaching out proper inferences concerning the study population form the major component in the course. Assessing and interpreting biostatistical results accurately are also key concepts that are covered, in addition to the intensive training on SPSS, a commonly used statistical software package for conducting biostatistical analysis. Critical appraisal of the biostatistical aspects of published health related literature and the proper training on critical thinking when choosing the proper method of analysis and selecting alternative methods when assumptions for traditional common approaches are not met are also given special emphasis in the course.

Course Learning Objectives (LOs)

By the end of this course students are expected to be able to conduct the following tasks:

BIOS 1: Describe the role of biostatistics in the discipline of public health.

BIOS 2: Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions

BIOS 3: Apply descriptive techniques commonly used to summarize public health data.

BIOS 4: Describe basic concepts of probability, random variation and commonly used statistical probability distributions.

BIOS 5: Apply common statistical methods for inference.

BIOS 6: Describe preferred methodological alternatives to commonly used statistical methods when assumptions are not met.

BIOS 7: Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question.

BIOS 8: Interpret results of statistical analyses found in public health studies.

BIOS 9: Apply ethical principles to data management and analysis. *(This LO is discussed in lecture 1 and is strongly emphasized throughout the course and assessed in test 1)*

BIOS 10: Apply statistical software for describing and analyzing public health data.

CCt: Demonstrate ability to think critically. *(This LO is embedded throughout the course)*

Roadmap and Topics

(Weeks 1-2) Lectures 1A and 1B
Introduction to biostatistics, role of biostatistics in public health and biomedical field. Basic definitions in biostatistics such as predictors, outcomes, population, sample, random sample, inferences, variables, random variables, and types of variables. Discussion of the methods for summarizing and describing data numerically and graphically: mean, median mode, variance, coefficient of variation, percentiles, frequency tables, graphs and charts. *(Bios 1,2,3,9,10)*

(Week 3) Lecture 2
Basic concepts of probabilities, conditional probability and its link to diagnostic tests: sensitivity, specificity, PV+, PV-, Relative Risk, Prevalence. *(Bios 4)*

(Weeks 4-5) Lectures 3 and 4
Types of data distributions (discrete and continuous): Random variables, probability mass function for a discrete random variable, cumulative distribution function of a discrete random variable, expected value of a discrete random variable, variance of a discrete random variable, discrete Uniform distribution, Binomial distribution, Poisson distribution, continuous random variables, Probability Density Function (pdf) of a continuous random variable, Cumulative Distribution Function (CDF) of a continuous random variable, expected value and variance of a continuous random variable, Normal distribution, Standard normal distribution, standardization, probabilities and Tables for distributions, percentiles of standard and normal distributions. *(Biost 4)*

(Weeks 6-7) Lectures 5 and 6
Sampling distributions and estimation (point and interval): Point estimation, expected value and variance of the mean, sampling and sampling distribution of the mean, standard error of the mean, central limit theorem, confidence interval estimation for the mean (case of known variance), confidence interval estimation for the mean (case of unknown variance), t Distribution, estimation of the variance of a distribution point estimation, Chi-Square distribution, confidence interval estimation for the variance of a distribution, estimation for the Binomial distribution point estimation and interval estimation using Normal-Theory Methods. *(Bios 4,5,8)*

(Week 8) Lecture 7
Hypothesis testing: One-Sample: Methods of hypothesis testing P-value method, critical-value method. One-sample test for the mean of a normal distribution: one- sided alternative unknown variance case and known variance case. One-sample test for the mean of a normal distribution: two-sided alternatives unknown variance case and known variance case. Hypothesis Testing using the Confidence Interval Method. One sample test for a binomial proportion two sided alternative using normal theory method. *(Bios 5,7,8)*

(Week 9) Lecture 8
Hypothesis testing for two-sample inferences: Paired t test for matched dependent study design, independent t test for independent study design with independent samples and equal variances, independent t test for independent samples with unequal variances: "Satterthwaite's Method", testing the equality of variances between two independent samples: The F Test, F distribution, Pearson's Correlation. *(Bios 4,5,6,7,8,10)*

(Weeks 10-11) Lecture 9A and 9B
Multi-sample inference using one-way ANOVA, Hypothesis testing for categorical data with independent study design: One-Way analysis of variance (ANOVA) for normally distributed data and large sample sizes, Two-sample test for binomial proportions for independent study design: Chi_Square Test and Fisher's Exact Test for categorical data with large and small sample sizes respectively, hypothesis testing for categorical data with dependent matched study design: Two-sample test for binomial proportions for matched-pair data: McNemar's Test. (Binomial data) and The Kappa statistic. *(Bios 5,6,7,8,10).*

(Week 12) Lecture 10
Simple and multiple linear regression and logistic regression: Estimation of slopes point and confidence interval, hypothesis testing, inferences, interpretation of slope and its confidence interval, predictions. coefficient of determination, odds ratio (OR) estimation point and confidence interval, interpretation of OR and its confidence interval, hypothesis testing, inferences, risk factor versus protective factor. *(Bios 5,7,8,10).*

(Week 13)   Lecture 11
Nonparametric data analysis: Describing these methods as alternatives to commonly used approaches when assumptions such as normality and large sample sizes are not met. Tests to be covered include: Wilcoxon Signed-Rank Test, Wilcoxon Rank-Sum Test (or Mann-Whitney U Test), Kruskal Wallis. *(Bios 6.)*

Introduction to Sample Size Calculation: Overview.

(Week 14) Wrap up for the course and review for final test.

Academic Integrity/Dishonesty:

Copying and sharing lectures with others is totally forbidden. Copies can be made just for your personal use. Lectures and course material are the property of the professor and cannot be shared with others.

Copying of homework solution from previous years is forbidden and falls under cheating and will have repercussions as per the code of conducts for students.

Cheating and plagiarism will not be tolerated. Review the Student Code of Conduct in your handbook and familiarize yourself with definitions and penalties. If you're in doubt about what constitutes plagiarism, ask your instructor because it is your responsibility to know. The American University of Beirut has a strict anti-cheating policy. Penalties include failing marks on the assignment in question, suspension or expulsion from University and a permanent mention of the disciplinary action in the student's records.

Class Rules and Regulations:

- Attendance is mandatory and attendance will be taken in each lecture and lab session.
- Each student should attend the section in which she/he is enrolled in. Students attending a section other than their section will be listed as absent.
- Late arrival to class is not accepted what so ever and will result in reduction of the course grade from the percentage allocated to attendance and participation.
- In class participation is recommended.
- Questions and clarifications related to the lecture are always welcomed at the end of the class where 10 minutes will be allocated for questions and clarifications.
- Side conversation and class disruption are intolerable and will lead to reduction in the course grade from the percentage allocated to classroom participation.
- Leaving classroom before the class is dismissed is forbidden.
- In case a vacation takes place on the day of the one of the training sessions, students enrolled in this session are required to attend one of the two other training sessions that works with their schedule.
- Tests and review sessions for the tests will be held on Saturdays and not during class time.

Tentative Grading and Dates: "Subject to change"

Homework assignments 1-7 covering lectures 1-7: 4% *(Bios 1,2,3,4,7,8,9,10)*

Homework assignments 8-10 covering lectures 8, 9A, 9B, 10, 11 : 6% these HWs involve data analysis so they are given heavier weight than the theoretical HWs. *(Bios 4,5,6,7,8,9,10)*

Midterm 1: 28%   *(Bios 1,2,3,4,9,10)*
    (Lectures 1A, 1B, 2, and 3 covered in weeks 1 to 4 till discrete distribution)

Review for Midterm 1: Saturday October 7 (venue and time to be decided upon soon)

Midterm 1: Saturday October 14 from 4:00 PM till 6:00 PM Room 300

Midterm2: 28% *(Bios 4,5,7,8)*
   (Lectures 4, 5, 6, and 7 covered in weeks 5 to 8 till one sample hypothesis testing)

Review for Midterm 2: Saturday November 4 (venue and time will be announced soon)

Midterm 2: Saturday November 11 from 4:00 PM till 6:00 PM Room 300

Midterm3: 29% *(Bios 4,5,6,7,8,9,10)*
   (Lectures 8, 9A, 9B,10,11) covered in weeks 9 to 13 till Nonparametric analysis)

Review for Midterm 3: Monday December 4 class time Nabil Boustani Amphi Theater

Midterm 3:To be decided by the registrar's office.

Attendance and Class participation: 5%

<u>**Makeup Session:**</u> Given that Friday September 22nd is a holiday, students enrolled in this section are asked to attend either the section on Tuesday September 19th from 11:00 AM to 1:00 PM or Thursday September 21st from 5:30 PM to 7:30 PM.

"AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: : <u>accessibility@aub.edu.lb</u>; +961-1-350000, x3246; West Hall, 314".
"AUB is committed to facilitating a campus free of all forms of discrimination including sex/gender-based harassment prohibited by Title IX. The University's non-discrimination policy applies to, and protects, all students, faculty, and staff. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at <u>www.aub.edu.lb/titleix</u>. To report an incident, contact the University's Title IX Coordinator Trudi Hodges at 01-350000 ext. 2514, or <u>titleix@aub.edu.lb</u>. An anonymous report may be submitted online via EthicsPoint at <u>www.aub.ethicspoint.com</u>."