



Drexel University School of Public Health

Certificate in Epidemiology and Biostatistics

PBHL 701

Introduction to Descriptive Epidemiology and Biostatistics

3 credit hours

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Quarter offered: Winter 2009

Course Start: Jan 5th 2009

COURSE DESCRIPTION

Introduction to Descriptive Epidemiology and Biostatistics **provides an understanding of basic concepts and methods in epidemiology and biostatistics needed to conduct public health research and practice.** This course will cover epidemiology as a methodology for thinking about and designing research to address basic questions of interest in health and medicine and to address specific hypotheses regarding risk factors. Specifically, students will understand the science concerned with the occurrence, distribution, and causality of diseases and other health-related conditions in the world. Biostatistics concepts and methods to be covered include techniques for describing and summarizing observations, for assessing associations among variables, and for determining the extent to which chance may be explaining and/or influencing the observed results.

PRE-REQUISITE:

A bachelor degree and basic mathematical (basic algebra) skills are necessary. Basic computer skills in the use of Microsoft Word, Excel, and PowerPoint are necessary.

COURSE OBJECTIVES

Upon completion of this course, students should:

1. Be able to describe the role of epidemiology in public health practice and research and be able to articulate the types of questions and problems that are amenable to epidemiological investigation.
2. Be able to calculate, interpret, and communicate the following measures:
 - a. Cumulative incidence
 - b. Incidence density
 - c. Prevalence
 - d. Crude mortality rate
 - e. Age-, sex-, and cause-specific mortality rates
 - f. Mortality rates
 - i. adjusted for age by the direct and indirect method
 - ii. Infant mortality rate
 - g. Case-fatality rate
 - h. Proportionate mortality
 - i. Attack rate
 - j. Relative risk (risk ratio)
 - k. Relative odds (odds ratio)
 - l. Attributable Risk
3. Be able to define and, where appropriate, be able to calculate the following:
 - a. Validity
 - b. Reliability
 - c. Sensitivity
 - d. Specificity
 - e. Positive predictive value
 - f. Negative predictive value
 - g. Overall percent agreement
 - h. Kappa statistic
4. Be able to describe major characteristics (including relative strengths and limitations) of the following types of epidemiological research designs and their applicability to public health practice or research:
 - a. Ecologic or correlation study
 - b. Cross-sectional study
 - c. Case-control study
 - d. Cohort studies (Prospective and Retrospective cohort studies)
 - e. Randomized Clinical Trial
5. Be able to define: bias, confounding, and interaction or effect modification
6. Be able to define type I and type II error and the relationship between sample size and power in epidemiologic studies
7. Be able to describe epidemiological data by using basic biostatistical methods (frequency distribution, measures of central location, and confidence intervals for proportion and mean)
8. Be able to apply the logic of causal analysis
9. Be able to apply the statistical software SPSS to conduct simple descriptive analyses

TEXTBOOKS

Required

1. Gordis, Leon: Epidemiology. 4th Edition or 3rd Edition, Elsevier Inc. (USA):
4th edition (2008): ISBN 1-4160-4002-6, **OR**
3rd edition (2004): ISBN 1-4160-2530-8
2. Dawson B. and Trapp R.G.: Basic & Clinical Biostatistics, 4th edition, McGraw-Hill Companies, Inc., 2004, ISSN: 1045-5523
3. Paul R. Kinnear & Colin D. Gray: SPSS 16 Made Simple. Psychology Press, 2008, ISBN 978-1-84169-729-1.
For those who have never used SPSS, it is a useful book; however, if you have experience in SPSS, the book is not required and is only recommended if needed.

Supplementary

A good online text: Principles of Epidemiology. Some chapters have been assigned as required readings. It is available at: http://www.phppo.cdc.gov/PHTN/catalog/pdf-file/Epi_Course.pdf

A good online text in biostatistics is StatPrimer, Version 6.2 by B. Gerstman & Marg Innovera, available at: <http://www2.sjsu.edu/faculty/gerstman/StatPrimer/>
This text has useful exercises, some with answers provided.

Additional readings for each week studies

Prepared by the instructors

Directions for downloading and installing SPSS v. 16.0.

In week 8, you will download (free) the Student version of SPSS from the Drexel website. Step-by-step directions as below:

1. Go to <https://software.drexel.edu>
2. A box will pop up asking for you userid and password
3. Enter in userid by typing **drexel\your userid (such as LL85)**
4. Enter in your normal password

You are now at the software site. From here you can follow the appropriate links for your software. And to navigate to Students > PC Software > SPSS13 > SPSS13_Student.exe

Be sure to take a look at the license_info.txt file in the SPSS link because it contains important instructions on how to install and register the software.

If you have any questions about the software site, please contact Drexel computer help desk by email at: consult@drexel.edu, or call at 215-895-2698.

TEACHING METHODS

The main framework for presenting the course content is online lectures. Students access the online course materials at your own convenience; there are no set times when you are required to be online. There is a wealth of information covered here and in your course textbook. Students are expected to devote 6 – 16 hours to complete course requirements each week, depending on your technical abilities. This course allows you to arrange your class "attendance" around your schedule. Although you can work on the modules in any order, we recommend that you go through them in the order we present them. We also encourage you to communicate and collaborate with your fellow students throughout the course, using the Communication features in Blackboard and email.

In each week, the following content is included:

- 1). Weekly Brief. It is a brief introduction of what we will study in this week.
- 2). Lecture Notes: It aims to help understand the concepts of the assigned Chapter(s).
- 3). Recommended Reading Materials.
- 4). Assignment

OFFICE HOURS

The instructor can be reached by email (LL85@drexel.edu) or via telephone 215-762-1370. **Email questions are encouraged.** I will get back to you as soon as I can. I may respond to email questions by sending the response to the entire class. This way you can all benefit from these inquires of other classmates. Of course, if the question is a personal one, then I will respond only to the questioner.

STUDENT ACTIVITIES AND EVALUATION

There are **Self-Tests** (homework) each week (except Week 1) and three **Graded Assignments** (weeks 4, 7 and 10).

Graded Assignments are due exactly 7 days after the assigned date. Graded assignments should be turned in via email to the Instructor (LL85@drexel.edu), and incomplete assignments will result in points being deducted. Answers will be made available after the assignment has been turned in.

Please pay attention to the dates of Graded Assignments, and let me know before these dates are reached if you have any specific circumstances, such as a serious illness/injury, etc., that would affect your ability to complete the assignment in a timely manner. An agreement indicating what activities are expected and the dates for their completion will be agreed upon by the student and instructor.

EVALUATION METHODS

Final grades are based on Graded Assignments, and will be assigned in the following manner:

Grade	Grade Points	Definition
A	4.0	The student has exceeded the required standards and expectations.
A-	3.7	The student has met the required standards and expectations slightly below the exceptional level.
B+	3.3	The student has met the required standards and expectations slightly above the satisfactory level.
B	3.0	The student has met the required standards and expectations at a satisfactory level.
B-	2.7	The student has met the required standards and expectations slightly below the satisfactory level.
C+	2.3	The student met the required standards and expectations slightly above the marginally acceptable level.
C	2.0	The student has met the required standards and expectations at the marginally acceptable level.
F	0	The student has failed to meet the required performance standards and expectations.

Numerical scores will be determined by the Graded Assignments and weighted as follows:

Evaluation method	Proportion of final grade
Graded Assignment I	30%
Graded Assignment II	30%
Graded Assignment III (Final exam)	40%

COURSE SCHEDULE- Gordis 4th Edition

Week	Topic	Lecture/outline	Reading	Assignments
1	Introduction to Epidemiology	<ol style="list-style-type: none"> 1. Definition of Epidemiology 2. A brief history of Epidemiology Development 3. Four levels of prevention 4. Application of Epidemiology 5. Methods of Epidemiology 6. Introduction of Study Design 	<ol style="list-style-type: none"> 1. Gordis Chapter 1 2. Article: Origins of Epidemiology 3. John Snow and Broad Street Pump: 150 Years of Epidemiology 4. Article: How to Help Reporters Tell The Truth 5. What is Epidemiology? http://bmj.bmjournals.com/epidem/epid.1.html 6. Doctor John Snow Blames Water Pollution for Cholera Epidemic: http://www.ph.ucla.edu/epi/snow/fatherofepidemiology.html#ONE 	Introduce yourself to your classmates
2	<p>The Dynamics of Disease Transmission</p> <p>Measuring the Occurrence of Disease Morbidity</p>	<ol style="list-style-type: none"> 1. The epidemiological triad of a disease 2. Modes of disease transmission 3. Three terms used in describing a disease epidemic 4. Incidence and prevalence 5. Sources of public health data 	<ol style="list-style-type: none"> 1. Gordis Chapters 2 and 3 2. How disease transmission? http://www.engenderhealth.org/ip/disease/dt5.html 3. Rates Used in Public Health Assessment http://www.health.state.pa.us/hpa/stats/techassist/definitions.htm 4. Common Ratios http://www.health.state.pa.us/hpa/stats/techassist/commonratios.htm 5. Summary of surveys and data systems, National Center for Health Statistics (PDF file). 	<p>Self-test</p> <p>Gordis book:</p> <ol style="list-style-type: none"> 1. CH 2: RQ 1-5. 2. CH 3: RQ 1, 2, 6 and 7.
3	<p>Measuring the Occurrence of Disease Mortality</p> <p>The Natural History of Disease: ways of expressing prognosis</p> <p>Validity and Reliability</p>	<ol style="list-style-type: none"> 1. Mortality rates 2. Proportionate mortality 3. Case-fatality rate 4. Age-adjusted mortality (direct method) 5. Standardized mortality ratio 6. Month, year survival rates 7. Life-table & median survival time 8. Assessing the validity and reliability of diagnostic and screening tests 	<ol style="list-style-type: none"> 1. Read the following chapters from your Gordis textbook: Chapter 4 (page 59-64; page 67 to the end) Chapter 5 (page 85-88, page 96 to the end) Chapter 6 (page 109-124) 2. Rates Used in Public Health Assessment (see week 2) 3. Age Adjusted Rates http://www.health.state.pa.us/hpa/stats/techassist/ageadjusted.htm 4. Standardized Mortality Ratio http://www.health.state.pa.us/hpa/stats/techassist/stdmorratio.htm 	<p>Self-test</p> <p>Gordis book:</p> <ol style="list-style-type: none"> 1. CH 4: RQ 1-5, 8-11 2. CH 5: RQ 1-8 3. CH 6: RQ 1-5
4	Research designs in Epidemiology I: Observational studies	<ol style="list-style-type: none"> 1. Ecological study 2. Cross-sectional study 3. Case-control study 4. Cohort study (prospective and retrospective study) 5. Nest case-control study 	<ol style="list-style-type: none"> 1. Gordis Chapters 9, 10, 13, 14 (page 228-230) 2. Article: Cohort Studies: Marching Towards Outcomes 3. Article: Case-Control Studies: Research in Reverse 4. Case-control study and cross-sectional study http://www.bmj.com/collections/epidem/epid.8.dtl#pgfId=1006374 5. Ecological study http://www.bmj.com/collections/epidem/epid.6.dtl#pgfId=1002634 	Graded Exercise
5	Research designs in Epidemiology II: Experimental studies (Randomized Trials)	<ol style="list-style-type: none"> 1. Definition of randomized trial 2. Basic design of a randomized Trial 3. Crossover study 4. Factorial study 5. Type I and type II errors 6. Phases in testing of new drugs in the US 	<ol style="list-style-type: none"> 1. Gordis Chapters 7 and 8 2. Article: Which Clinical Studies Provide the Best Evidence? 3. Article: The Hierarchy of Research Designs 	<p>Self-test</p> <p>Gordis book:</p> <p>CH 8: RQ 1-8</p>
6	Evaluating Epidemiological Associations: Estimating Risk and the Potential for	<ol style="list-style-type: none"> 1. Absolute Risk, Incidences difference 2. Relative Risk 3. Odds Ratio 4. Attributable Risk 5. Attributable risk percent 	<ol style="list-style-type: none"> 1. Gordis Chapters 11 and 12 2. Odds: Odds: http://www.tufts.edu/~gdallal/odds.htm 3. Risk: http://www.health.state.pa.us/hpa/stats/techassist/risknotion.htm 4. Article: Understanding the odds ratio and the relative risk 	<p>Self-test</p> <p>Gordis book:</p> <p>CH 11: RQ 1-9</p> <p>CH 12: RQ 1-5</p>

	Prevention	6. Population attributable risk 7. Population attributable risk percent	5. Article: Information Point: Odds ratio 6. Article: Yun YH et al: Relative and Absolute Risk	
7	The Interpretation of Research Data: Causation, Bias and Confounding	1. Approaches for studying disease etiology 2. Types of associations 3. Basic criteria used to evaluate relationships for possible causal associations 4. Basic concepts of bias, confounding and interaction	1. Gordis Chapters 14 and 15 2. Article: Bias and Causal Association in Observational Research 3. Read Epidemiological report: http://bmj.bmjournals.com/collections/epidem/epid.c.shtml 4. Cause & Effect: http://www.tufts.edu/~gdallal/cause.htm 5. Trying to Establish Cause: http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/Epidemiology.html	Graded Exercise
8	Introduction of Biostatistics: Descriptive Statistics Summarizing Data & Presenting Data	1. Introduction 2. Scales of measurement (nominal, numerical, & ordinal) 3. Measures of central location (mean, standard deviation, median, mode, range) 4. Frequency distributions 5. Normal distribution (Gaussian distribution) 6. Standard deviation of the mean 7. Confidence intervals for a population mean	1. Dawson and Trapp: Chapter 1, Chapter 2 (p7-18) Chapter 3 (p23-48) Chapter 4 (p68-72, p80-89) 2. Measurement and sampling (pdf file) 3. Frequency distribution (pdf file) 4. Summary statistics (pdf file) 5. Download SPSS software	Self-test Provided
9	Introduction of SPSS: Session I Inferential Statistics - Hypothesis testing and research questions about the mean in one group	1. Session I (the menu bar, starting SPSS, retrieving a SPSS data, a simple analysis, viewing your output, printing your output file, saving your output file, leaving SPSS) 2. Introduction of hypothesis testing 3. t distribution 4. Research question about the mean in one group 5. Means when the same group of subjects is measured twice (paired study design)	1. Dawson and Trapp: Chapter 5 (p95-109, 114-118) 2. Introduction to estimation (CH5. pages 1-9) (documents attached) 3. Introduction to hypothesis testing (CH6) (documents attached) 4. Statements of probability and confidence interval http://bmj.bmjournals.com/collections/statsbk/4.shtml 5. Type I and II error http://www.cs.uni.edu/~campbell/stat/inf5.html 6. SPSS tutorial: "Introduction", "Using the Help System", and Using distributed analysis sessions (from the downloaded SPSS)	Self-test Dawson: Chapter 5 Ex; 2 SPSS tutorial sessions
10	SPSS tutorial Review of PBHL-701	1. SPSS tutorial 2. Review of PBHL-701	1. SPSS tutorial: "Cross-tabulation" and "Modifying Data Values" session (from the downloaded SPSS) 2. Review Weeks 1-9 Lecture-Notes	Graded Exercise (Final exam)

COURSE SCHEDULE- Gordis 3rd Edition

Week	Topic	Lecture/outline	Reading	Assignments
1	Introduction to Epidemiology	<ol style="list-style-type: none"> 1. Definition of Epidemiology 2. A brief history of Epidemiology Development 3. Four levels of prevention 4. Application of Epidemiology 5. Methods of Epidemiology 6. Introduction of Study Design 	<ol style="list-style-type: none"> 1. Gordis Chapter 1 2. Article: Origins of Epidemiology 3. John Snow and Broad Street Pump: 150 Years of Epidemiology 4. Article: How to Help Reporters Tell The Truth 5. What is Epidemiology? http://bmj.bmjournals.com/epidem/epid.1.html 6. Doctor John Snow Blames Water Pollution for Cholera Epidemic: http://www.ph.ucla.edu/epi/snow/fatherofepidemiology.html#ONE 	Introduce yourself to your classmates
2	<p>The Dynamics of Disease Transmission</p> <p>Measuring the Occurrence of Disease Morbidity</p>	<ol style="list-style-type: none"> 7. The epidemiological triad of a disease 8. Modes of disease transmission 9. Three terms used in describing a disease epidemic 4. Incidence and prevalence 5. Sources of public health data 	<ol style="list-style-type: none"> 1. Gordis Chapters 2 and 3 2. How disease transmission? http://www.engenderhealth.org/ip/disease/dt5.html 3. Rates Used in Public Health Assessment http://www.health.state.pa.us/hpa/stats/techassist/definitions.htm 4. Common Ratios http://www.health.state.pa.us/hpa/stats/techassist/commonratios.htm 5. Summary of surveys and data systems, National Center for Health Statistics (PDF file). 	<p>Self-test</p> <p>Gordis book:</p> <ol style="list-style-type: none"> 1. CH 2: RQ 1-5. 2. CH 3: RQ 1, 2, 6 and 7.
3	<p>Measuring the Occurrence of Disease Mortality</p> <p>The Natural History of Disease: ways of expressing prognosis</p> <p>Validity and Reliability</p>	<ol style="list-style-type: none"> 1. Mortality rates 2. Proportionate mortality 3. Case-fatality rate 4. Age-adjusted mortality (direct method) 5. Standardized mortality ratio 6. Month, year survival rates 7. Life-table & median survival time 8. Assessing the validity and reliability of diagnostic and screening tests 	<ol style="list-style-type: none"> 1. Read the following chapters from your Gordis textbook: Chapter 4 (page 48-52; page 55 to the end) Chapter 5 (page 71- 74; page 82 to the end). Chapter 6 (page 95-108) 2. Rates Used in Public Health Assessment (see week 2) 3. Age Adjusted Rates http://www.health.state.pa.us/hpa/stats/techassist/ageadjusted.htm 4. Standardized Mortality Ratio http://www.health.state.pa.us/hpa/stats/techassist/stdmorratio.htm 	<p>Self-test</p> <p>Gordis book:</p> <ol style="list-style-type: none"> 1. CH 4: RQ 1-5, 8-11 2. CH 5: RQ 1-8 3. CH 6: RQ 1-5
4	Research designs in Epidemiology I: Observational studies	<ol style="list-style-type: none"> 1. Ecological study 2. Cross-sectional study 3. Case-control study 4. Cohort study (prospective and retrospective study) 5. Nest case-control study 	<ol style="list-style-type: none"> 1. Gordis Chapters 9, 10, 13, 14 (page 204-206) 2. Article: Cohort Studies: Marching Towards Outcomes 3. Article: Case-Control Studies: Research in Reverse 4. Case-control study and cross-sectional study http://www.bmj.com/collections/epidem/epid.8.dtl#pgfId=1006374 5. Ecological study http://www.bmj.com/collections/epidem/epid.6.dtl#pgfId=1002634 	<u>Graded Exercise</u>
5	Research designs in Epidemiology II: Experimental studies (Randomized Trials)	<ol style="list-style-type: none"> 1. Definition of randomized trial 2. Basic design of a randomized Trial 3. Crossover study 4. Factorial study 5. Type I and type II errors 6. Phases in testing of new drugs in the US 	<ol style="list-style-type: none"> 1. Gordis Chapters 7 and 8 2. Article: Which Clinical Studies Provide the Best Evidence? 3. Article: The Hierarchy of Research Designs 	<p>Self-test</p> <p>Gordis book:</p> <p>CH 8: RQ 1-8</p>
6	Evaluating Epidemiological Associations: Estimating	<ol style="list-style-type: none"> 1. Absolute Risk, Incidences difference 2. Relative Risk 3. Odds Ratio 4. Attributable Risk 	<ol style="list-style-type: none"> 1. Gordis Chapters 11 and 12 2. Odds: Odds: http://www.tufts.edu/~gdallal/odds.htm 3. Risk: http://www.health.state.pa.us/hpa/stats/techassist/risknotion.htm 	<p>Self-test</p> <p>Gordis book:</p> <p>CH 11: RQ 1-9</p>

	Risk and the Potential for Prevention	5. Attributable risk percent 6. Population attributable risk 7. Population attributable risk percent	4. Article: Understanding the odds ratio and the relative risk 5. Article: Information Point: Odds ratio 6. Article: Yun YH et al: Relative and Absolute Risk	CH 12: RQ 1-5
7	The Interpretation of Research Data: Causation, Bias and Confounding	1. Approaches for studying disease etiology 2. Types of associations 3. Basic criteria used to evaluate relationships for possible causal associations 4. Basic concepts of bias, confounding and interaction	1. Gordis Chapters 14 and 15 2. Article: Bias and Causal Association in Observational Research 3. Read Epidemiological report: http://bmj.bmjournals.com/collections/epidem/epid.c.shtml 10. Cause & Effect: http://www.tufts.edu/~gdallal/cause.htm 5. Trying to Establish Cause: http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/Epidemiology.html	Graded Exercise
8	Introduction of Biostatistics: Descriptive Statistics Summarizing Data & Presenting Data	1. Introduction 2. Scales of measurement (nominal, numerical, & ordinal) 3. Measures of central location (mean, standard deviation, median, mode, range) 4. Frequency distributions 5. Normal distribution (Gaussian distribution) 6. Standard deviation of the mean 7. Confidence intervals for a population mean	1. Dawson and Trapp: Chapter 1, Chapter 2 (p7-18) Chapter 3 (p23-48) Chapter 4 (p68-72, p80-89) 2. Measurement and sampling (pdf file) 3. Frequency distribution (pdf file) 4. Summary statistics (pdf file) 5. Download SPSS software	Self-test Provided
9	Introduction of SPSS: Session I Inferential Statistics - Hypothesis testing and research questions about the mean in one group	1. Session I (the menu bar, starting SPSS, retrieving a SPSS data, a simple analysis, viewing your output, printing your output file, saving your output file, leaving SPSS) 2. Introduction of hypothesis testing 3. t distribution 4. Research question about the mean in one group 5. Means when the same group of subjects is measured twice (paired study design)	1. Dawson and Trapp: Chapter 5 (p95-109, 114-118) 2. Introduction to estimation (CH5. pages 1-9) (documents attached) 3. Introduction to hypothesis testing (CH6) (documents attached) 4. Statements of probability and confidence interval http://bmj.bmjournals.com/collections/statsbk/4.shtml 11. Type I and II error http://www.cs.uni.edu/~campbell/stat/inf5.html 12. SPSS tutorial: "Introduction", "Using the Help System", and Using distributed analysis sessions (from the downloaded SPSS)	Self-test Dawson: Chapter 5 Ex; 2 SPSS tutorial sessions
10	SPSS tutorial Review of PBHL-701	1. SPSS tutorial 2. Review of PBHL-701	1. SPSS tutorial: "Cross-tabulation" and "Modifying Data Values" session (from the downloaded SPSS) 2. Review Weeks 1-9 Lecture-Notes	Graded Exercise (Final exam)