



**Harvard University PhD Program in Health Policy  
Evaluative Science and Statistics Concentration  
2011-2012**

**General description of the evaluative science concentration:**

Training in this concentration will enable students to study the effects of a wide range of policies and health services (e.g., health insurance, health-care quality improvement, clinical decision-making, drug policy, cost-containment, and socioeconomic factors) on behaviors, access, processes and quality of health care, health outcomes, or costs. Students in this concentration will develop proficiency in experimental and quasi-experimental research design, statistics, relevant social sciences, and other methodological approaches (e.g., epidemiology, program evaluation, qualitative methods, and survey design). Previous students in this track have used innovative methodological and statistical approaches to study, for example:

**POLICY EVALUATION**

- [Impact of acquiring Medicare coverage on the health of previously uninsured adults](#)
- [Effects on health behavior of insurance restrictions on maternity lengths of stay](#)
- Effects of drug coverage on access to essential medications in Medicare
- Effects of regulatory changes in legal drinking ages on health and mortality

**QUALITY OF CARE AND CLINICAL DECISION-MAKING**

- [Effects of physician experiences with adverse medical events on under-prescribing of essential medicines](#)
- [A controlled natural experiment on the effectiveness of direct to consumer drug advertising](#)

**DISPARITIES**

- [Effects of near-universal Medicare coverage on disparities in cardiovascular disease and diabetes control](#)
- Methods to estimate racial/ethnic health care disparities and their effects on health

**COMPARATIVE HEALTH POLICY**

- International differences in health outcomes following medical care for acute myocardial infarction

**POPULATION HEALTH**

- Effects of unemployment on mortality

[Click to view descriptions of dissertation research for all graduates of the Evaluative Science and Statistics track.](#)

**Courses for students in the evaluative science concentration:**

The course requirements for the evaluative science and statistics concentration were selected to provide students with important skills needed for conducting original health policy research; at the completion of coursework, students should be able to propose feasible study designs to answer health policy questions, using both experimental and quasi-experimental designs, as well as identify the strengths and limitations of the various designs in their proposed work and in other published studies. They also will develop strong analytical skills, including the technical expertise required to analyze data as well as interpret results, identify the strengths and limitations of analyses, and the broader implications of results for future health policy.

The following course requirements encompass both statistics and research design. Students are required to take at least 5 credits of statistics; students should be proficient in linear, logistic and survival regression analyses upon completion of statistics-related coursework. Students are also strongly recommended to develop skills in hierarchical modeling and analysis of survey data, either through coursework or outside study. Incoming students should also be aware that many of the intermediate and advanced courses have prerequisites, some courses are only offered in alternative academic years, and that scheduling conflicts do occur. Due to these issues, incoming students are recommended to plan a tentative 2-year course program early in the first year, and to consult with more senior students about their tentative program for additional feedback and suggestions. In planning such a program, students are encouraged to follow a basic sequence of courses *within a particular school or department* (i.e., Biostatistics, Statistics, Economics, or HKS) as opposed to selecting from multiple schools/departments (See pg. 4 for suggested sequences). This is recommended in order to facilitate a more coherent presentation of the fundamentals. Subsequently, students are encouraged to choose courses based on interests and career objectives from among all

schools/departments. Evaluative science and statistics course requirements are in addition to, but may overlap with the core requirements required of all students.

- REQUIRED COURSES
- STATISTICS COURSE REQUIREMENTS
- EVALUATIVE SCIENCES COURSE REQUIREMENTS
- FACULTY MEMBERS
- COURSE DESCRIPTIONS

**Required Courses** (Note: 1 credit = 1 semester):

❖ **Social Sciences/Related Fields (2 credits)**

- Economics (program requirement)
- Law
- Political Science
- Psychology
- Sociology/Organizational Behavior

❖ **Statistics (5 credits)**

- Probability Theory (1 credit)
- Statistical Inference (1 credit)
- Regression (1 credit)
- Other Data Analyses (2 credits)

❖ **Evaluative Sciences (4.5 credits)**

- Research Design and Methods (2 credits)
- Specific Methodological Approaches (2.5 credits)
  - Decision Sciences (program requirement)
  - Epidemiology (program requirement)
  - Program Evaluation
  - Qualitative Research
  - Survey Research Methods
  - Other

### Minimum Course Requirements: Statistics

	Semester	Time
<b>Probability Theory (1 credit)</b>		
Statistics 110: Introduction to Probability	Fall	<i>M, W, F, 12–1</i>
Economics 2110 <sup>1</sup> : Introductory Probability and Statistics for Economists	Fall	<i>M, W, 10–11:30</i>
BIO 222 <sup>1</sup> : Basics of Statistical Inference	Fall	<i>Tu, Th, 8:30–10:20</i>
Statistics 210: Probability Theory	Fall	<i>M, W, 2:30–4:00</i>
Biostatistics 230 / BIO 230: Probability Theory and Applications I	Fall	<i>M, W, 1:30–3:20</i>
<b>Statistical Inference (1 credit)</b>		
Statistics 111: Introduction to Theoretical Statistics	Spring	<i>Tu, Th, 1–2:30</i>
Economics 2110 <sup>1</sup> : Introductory Probability and Statistics for Economists	Fall	<i>M, W, 10–11:30</i>
BIO 222 <sup>1</sup> : Basics of Statistical Inference	Fall	<i>Tu, Th, 8:30–10:20</i>
Statistics 211: Statistical Inference	Spring	<i>M, W, 2:30–4</i>
Economics 1127: Statistical Methods for Evaluating Causal Effects	Spring	<i>Tu, Th, 2:30–4</i>
Statistics 220: Bayesian Data Analysis	Fall	<i>Tu, Th, 10–11:30</i>
Biostatistics 231/ BIO 231: Statistical Inference I	Spring	<i>M, W, 10:30–12:20</i>
API-209: Advanced Quantitative Methods I: Statistics	Fall	<i>Tu, Th, 10:10–11:30</i>
<b>Regression (1 credit)</b>		
Statistics 139: Statistical Sleuthing Through Linear Models	Fall	<i>Tu, Th, 11:30–1</i>
BIO 211: Regression and Analysis of Variance	Fall	<i>Tu, Th, 3:30–5:20</i>
BIO 213: Applied Regression for Clinical Research	Fall	<i>M, W, 8:30–10:20</i>
GHP 525: Econometrics for Health Policy	Spring	<i>Tu, Th, 8:30–10:20</i>
Economics 1123: Introduction to Econometrics	Fall/Spring	<i>(F) Tu, Th, 11:30–1; (S) Tu, Th, 1–2:30</i>
Biostatistics 235/ BIO 235 <sup>2</sup> : Regression and Analysis of Variance	Fall	<i>M, W, 10:30–12:20</i>
Economics 2120: Introduction to Applied Econometrics	Spring	<i>Tu, Th, 2:30–4</i>
API-210: Advanced Quantitative Methods II: Econometric Methods	Spring	<i>Tu, Th, 10:10–11:30</i>
<b>Other Data Analyses (2 credits)</b>		
BIO 210: Analysis of Rates and Proportions	Fall/ Spring	<i>(F) M, W, 8:30–10:20; (S) Tu, Th, 8:30–10:20</i>
Biostatistics 233/ BIO 233: Methods II	Spring	<i>M, W, 8:30–10:20</i>
EDU S-052: Applied Data Analysis	Spring	<i>Tu, Th, 10–11:30</i>
Biostatistics 232: Methods I / BIO 232	Fall	<i>M, W, 10:30–12:20</i>
BIO 223: Applied Survival Analysis and Discrete Data Analysis	Spring	<i>Tu, Th, 10:30–12:20</i>
BIO 226: Applied Longitudinal Analysis	Spring	<i>Tu, Th, 1:30–3:20</i>
<b>EDU S-077: Applied Longitudinal Data Analysis</b>	Spring	<b>(Not offered 2011–12)</b>
Statistics 131: Time Series Analysis and Forecasting	Fall	<i>Tu, Th, 1–2:30</i>
<b>Economics 2130: Applied Econometrics</b>	<b>Spring</b>	<b>(Not offered 2011–12)</b>
Economics 2140: Econometric Methods	Spring	<i>Tu, Th, 11:30–1</i>
Statistics 149: Statistical Sleuthing Through Generalized Linear Models	Spring	<i>M, W, 1–2:30</i>
Government 2001: Advanced Quantitative Research Methodology	Spring	<i>M, 2–4</i>
Statistics 160: Design and Analysis of Sample Surveys	Fall	<i>M, W, 2:30–4</i>
<b>Calculus/Linear Algebra (Not required)</b>		
Math 1b: Calculus, Series, and Differential Equations	Fall/Spring	<i>(F) M, W, F, 9 or 10 or 11 or 12 or Tu, Th, 10–11:30 or 11:30–1 (S) M, W, F, 10 or 11 or 12 or Tu, Th, 10–11:30 or 11:30–1</i>
Mathematics 20. Algebra and Multivariable Mathematics for Social Sciences	Fall	<i>M, W, F, 9</i>

*For statistics course descriptions, refer to pages 10-17.*

<sup>1</sup> Satisfies both probability theory and statistical inference course requirements

<sup>2</sup> Very theoretical and requires previous applied regression course

### Minimum Course Requirements: Evaluative Sciences

	Semester	Time
<b>Research Design and Methods (2 credits)</b> (The two courses listed below are required.)		
GHP 228 <sup>3</sup> : Quantitative Methods in Impact Evaluation	Spring	Tu, 3:30–6:30
Health Policy 3080hf: Graduate Reading Course: Evaluative Science and Statistics	Full Year	TBD
<b>Specific Methodological Approaches</b> (Take 2.5 credits from courses in any of the six categories below.)		
<u>Decision Sciences</u>		
API-302: Analytic Frameworks for Policy	Fall	Tu, Th, 10:10–11:30
RDS 280: Decision Analysis for Health and Medical Practices	Fall 2	Tu, Th, 1:30–3:20
RDS 282: Economic Evaluation in Health Policy and Program Management	Spring 2	M, W, 1:30–3:20
<u>Epidemiology</u> <sup>4</sup>		
EPI 500: Fundamentals of Epidemiology (program requirement)	Fall 1	Tu, Th, 1:30–3:20
EPI 202: Elements of Epidemiologic Research	Fall 2	Tu, Th, 10:30–12:20
EPI 207: Advanced Epidemiologic Methods	Fall 1	M, W, 3:30–5:20
<b>EPI 241: Measuring Health Status</b>	<b>Fall 2</b>	<b>(Not offered 2011–12)</b>
<u>Program Evaluation</u>		
GHP 228: Quantitative Methods in Impact Evaluation	Spring	Tu, 3:30–6:30
API-208: Program Evaluation: Estimating Program Effectiveness with Empirical Analysis	Spring	Tu, Th, 1:10–2:30
<u>Qualitative Research</u>		
EDU S-504: Introduction to Qualitative Research	Fall	F, 9–12
GHP 504: Applied Qualitative Methods for Global Health	Spring 1	F, 10:30–1:20
<b>SHDH 235: Qualitative Research Methods for Public Health</b>	<b>Spring 2</b>	<b>(Not offered 2011–12)</b>
SHDH 288: Qualitative Research Methods in Public Health	Fall 1	F, 9:30–12:20
EDU S-710 C1/C2: Interviewing in Qualitative Research	Fall 1	M, W, (C1) 10–11:30 or (C2) 12–1:30
HBS 4852: Seminar on the Craft of Inductive Qualitative Research	Full Year?	Fall: Sept 16, 2–5; Oct 14, 9–5; Nov 18, 2–5; Dec 9, 9–5; Spring schedule TBD
<u>Survey Research Methods and Sampling (highly recommended<sup>5</sup>)</u>		
BIO 212: Survey Research Methods in Community Health	Spring	W, 3:30–5:20
Statistics 160: Design and Analysis of Sample Surveys	Fall	M, W, 2:30–4
<u>Other</u>		
EPI 203: Study Design in Epidemiologic Research	Spring 2	Tu, Th, 3:30–5:20
EPI 204: Analysis of Case-Control and Cohort Studies	Spring 2	Tu, Th, 10:30–12:20
SHDH 263: Multilevel Statistical Methods: Concept and Application	Spring	M, W, 10:30–12:20
HBS 4070: Design of Field Research Methods	Spring	W, 11–2
<b>Statistics 140: Design of Experiments</b>	<b>Spring</b>	<b>(Not offered 2011–12)</b>
GOV 2010: Strategies of Political Inquiry	Fall	M, 10–12
Statistics 240: Matched Sampling and Study Design	Fall	W, 5–7

*For evaluative science course descriptions, refer to pages 17-22.*

<sup>3</sup> Satisfies both research design and methods AND specific methodological approaches (program evaluation) course requirements

<sup>4</sup> Program Requirement

<sup>5</sup> Because survey data are frequently used in health policy research, students are strongly recommended to take at least one of the survey research methods and sampling courses

**Suggested sequences of statistics courses**

	<b>Fall 1<sup>st</sup> year</b>	<b>Spring 1<sup>st</sup> year</b>	<b>Fall 2<sup>nd</sup> year</b>	<b>Spring 2<sup>nd</sup> year</b>
Biostatistics (Level 1)	BIO 232 BIO 222	BIO 233 or BIO 210; BIO 211	BIO 226	BIO 223
Biostatistics (Level 2)	BIO 230 BIO 232	BIO 231 BIO 233	BIO 226	BIO 223 BIO 235
Statistics (Level 2)	STAT 110	STAT 111	STAT 139	STAT 149 GOV 2001
Statistics (Level 3)	STAT 210	STAT 211	STAT 220	STAT 214
Econometrics (Level 1)	API-209	API-210	ECON 2120	
Econometrics (Level 2)	ECON 2110	ECON 2120		STAT 214

**List of current students who have taken each course.**

	Chace	Cornell	Faden	Haffajee	Pande	Sanghavi
<b><i>Probability Theory (1 credit)</i></b>						
Statistics 110: Introduction to Probability		2010 (Blitzstein)				
Economics 2110: Introductory Probability & Stats for Economists						
Biostatistics 222: Basics of Statistical Inference	2007		2008	2010 (Li)	2007	2009
Statistics 210: Probability Theory						
Biostatistics 230 / BIO 230: Probability Theory & Applications I						
<b><i>Statistical Inference (1 credit)</i></b>						
Statistics 111: Intro to Theoretical Statistics						
Economics 2110: Introductory Probability & Stats for Economists						
BIO 222: Basics of Statistical Inference	2007		2008		2007	2009
Statistics 211: Statistical Inference						
Economics 1127 / Statistics 186: Statistical Methods for Evaluating Causal Effects						
Statistics 220: Bayesian Data Analysis						
Biostatistics 231/ BIO 231: Statistical Inference I		2011 (Betensky)				
API-209: Advanced Quantitative Methods I: Statistics				2010 (Levy)		2009
<b><i>Regression (1 credit)</i></b>						
Statistics 139: Statistical Sleuthing Through Linear Models						
BIO 211: Regression & Analysis of Variance in Exper Res	2005					
BIO 213: Applied Regression for Clinical Research			2008		2004	
PIH 525: Econometrics for Health Policy					2005	
Economics 1123: Intro to Econometrics						
Biostatistics 235/ BIO 235: Regression & Analysis of Variance						
Economics 2120: Intro to Applied Econometrics						
API-210: Advanced Quantitative Methods II: Econometric Methods						2010
GHP 525: Econometrics for Health Policy				2011 (Fink)		

	Chace	Cornell	Faden	Haffajee	Pande	Sanghavi
<b>Other Data Analyses (2 credits)</b>						
BIO 210: Analysis of Rates & Proportions	2005				2003	
Biostatistics 233/ BIO 233: Methods II						
EDU S-052: Applied Data Analysis	2008					2010 (Willett)
Biostatistics 232 / BIO 232: Methods I						
BIO 223: Applied Survival Analysis	2009		2009		2009	
BIO 226: Applied Longitudinal Data Analysis	2009		2009	2011 (Hughes)	2009	
EDU S-077: Applied Longitudinal Data Analysis						
Statistics 131: Time Series Analysis and Forecasting						
Economics 2130: Applied Econometrics						
Economics 2140: Applied Econometrics						
Statistics 149: Statistical Sleuthing Through Generalized Linear Models						
GOV 2001: Advanced Quantitative Research Methodology					2008	2011 (King)
Statistics 160: Design and Analysis of Sample Surveys	2007		2009			
<b>Calculus/Linear Algebra (Not required)</b>						
Math 1b: Calculus, Series, & Differential Equations						
Math 20: Intro to Linear Algebra & Multivariable Calculus						
<b>Evaluative Sciences</b>						
GOV 2010: Designing Political Inquiry						
SHDH 245: Social and Behavioral Research Methods, Part I					2007	
Psychology 2100: Research Methodology	2008		2010			2010
<b>Decision Sciences</b>						
API-302: Analytic Frameworks for Policy						
RDS 280: Decision Analysis for Health & Medical Practices	2004		2008		2007	
RDS 282: Cost-Effectiveness & Cost-Benefit Analyses					2009	
<b>Epidemiology</b>						
EPI 200: Intro to Epidemiology (program requirement)						
EPI 202: Elements of Epidemiologic Research					2003	

	Chace	Cornell	Faden	Haffajee	Pande	Sanghavi
EPI 207: Advanced Epidemiologic Methods						
EPI 241: Measuring Health Status (0.5 credit)						
<u>Program Evaluation</u>						
GHP 528: Quantitative Methods for Impact Evaluation			2010			
EDU S-013: Evaluation of Programs and Policies						
API-208: Program Evaluation	2008				2008	2011 (Abadie)
<u>Qualitative Research</u>						
EDU S-520: The Logic of Qualitative Research Methods						
EDU S-504: Introduction to Qualitative Research						2010 (Fong)
SHDH 235: Qualitative Research Methods					2008	
<u>Survey Research Methods and Sampling (highly recommended)</u>						
BIO 212: Survey Research Methods in Community Health						
Statistics 160. Survey Methods			2009			
<u>Other</u>						
EPI 203: Design of Case Control and Cohort Studies						
EPI 204: Analysis of Case Control and Cohort Studies						
SHDH 263: Multilevel Methods for Health and Social Behavioral Research					2005	
HBS 4070: Design of Field Research Methods						
Statistics 140: Design of Experiments						

## **Faculty Associated with the Evaluative Science and Statistics Concentration**

Stephen Soumerai

Co-chair, Professor of Population Medicine, Harvard Medical School

Alan Zaslavsky

Co-chair, Professor of Health Care Policy (Statistics), Harvard Medical School

Alberto Abadie

Professor of Public Policy, Harvard Kennedy School

John Z. Ayanian

Professor of Health Care Policy and Medicine, Harvard Medical School

Professor in the Department of Health Policy and Management, Harvard School of Public Health

Arnold M. Epstein

John H. Foster Professor of Health Policy and Management, Harvard School of Public Health

Professor of Medicine and Health Care Policy, Harvard Medical School

Majid Ezzati

Adjunct Associate Professor of International Health, Harvard School of Public Health

Guido Imbens

Professor of Economics, Faculty of Arts and Sciences

Gary King

Albert J. Weatherhead III University Professor, Faculty of Arts and Sciences

Mary Beth Landrum

Associate Professor of Health Policy (Biostatistics), Harvard Medical School

Dan Levy

Lecturer in Public Policy and Faculty Chair, MPA Programs, Harvard Kennedy School

Richard J. Light

Walter H. Gale Professor of Education, Harvard Graduate School of Education and Harvard Kennedy School

Barbara J. McNeil

Ridley Watts Professor of Health Care Policy, Harvard Medical School

Professor of Radiology, Harvard Medical School

Carl N. Morris

Professor of Statistics, Faculty of Arts and Sciences

Sharon-Lise Normand

Professor of Health Care Policy (Biostatistics), Harvard Medical School

Professor in the Department of Biostatistics, Harvard School of Public Health

Dennis Ross-Degnan

Associate Professor of Population Medicine, Harvard Medical School

Donald B. Rubin

John L. Loeb Professor of Statistics, Faculty of Arts and Sciences

Katherine Swartz

Professor of Health Policy and Economics, Harvard School of Public Health

## Evaluative Science and Statistics Concentration Course Descriptions

*Please Note: The following list is meant to give students the “official” course descriptions. It may not contain fully up to date semester and week times or faculty members. Courses not being offered for this academic year are labeled accordingly. Please refer to the online course catalogs to confirm faculty members and course times.*

### Course Descriptions: **Statistics**

#### **Probability Theory (1 credit)**

##### **Statistics 110. Introduction to Probability**

Catalog Number: 0147

*Joseph K. Blitzstein*

*Half course (fall term). M., W., F., at 12, and weekly sections to be arranged. EXAM GROUP: 5*

A comprehensive introduction to probability. Basics: sample spaces and events, conditional probability, and Bayes' Theorem. Univariate distributions: density functions, expectation and variance, Normal, t, Binomial, Negative Binomial, Poisson, Beta, and Gamma distributions. Multivariate distributions: joint and conditional distributions, independence, transformations, and Multivariate Normal. Limit laws: law of large numbers, central limit theorem. Markov chains: transition probabilities, stationary distributions, convergence.

*Note:* This course, when taken for a letter grade, meets the Core area requirement for Quantitative Reasoning.

*Prerequisite:* Mathematics 19a, 20, 21a, or above.

##### **Economics 2110. Introductory Probability and Statistics for Economists**

Catalog Number: 7213

*Rustam Ibragimov*

*Half course (fall term). M., W., 10–11:30. EXAM GROUP: 3, 4*

Introduction to probability and statistics. Emphasis on general methods applicable to both econometrics and economic theory. Topics include probability spaces, random variables, limit laws, estimation, hypothesis testing, and Bayesian methods.

*Prerequisite:* Statistics (Stat 100), Linear Algebra and Calculus (Math 21a and 21b), and Real Analysis (Math 112).

##### **BIO 222. Basics: Statistical Inference**

*David Wypij*

*Fall, Tu, Th, 8:30-10:20*

*5 Credits*

This course will provide a basic, yet thorough introduction to the probability theory and mathematical statistics that underlie many of the commonly used techniques in public health research. Topics to be covered include probability distributions (normal, binomial, Poisson), means, variances and expected values, finite sampling distributions, parameter estimation (method of moments, maximum likelihood), confidence intervals, hypothesis testing (likelihood ratio, Wald and score tests). All theoretical material will be motivated with problems from epidemiology, biostatistics, environmental health and other public health areas. This course is aimed towards second year doctoral students in fields other than Biostatistics. Background in algebra and calculus required.

*Prerequisite:* BIO 210, 211, or 213 Required.

##### **Statistics 210. Probability Theory**

Catalog Number: 2487

*Joseph K. Blitzstein*

*Half course (fall term). M., W., 2:30-4, and weekly sections to be arranged. EXAM GROUP: 7, 8*

Random variables, measure theory, reasoning by representation. Families of distributions: Multivariate Normal, conjugate, marginals, mixtures. Conditional distributions and expectation. Convergence, laws of large numbers, central limit theorems, and martingales.

*Prerequisite:* Statistics 110 or equivalent required; Statistics 111 or equivalent recommended.

##### **Biostatistics 230. Probability Theory and Applications I / BIO 230**

Catalog Number: 6183

*Christopher David Barr*

*Half course (fall term). M., W., 1:30–3:20, and a weekly 90-minute lab. EXAM GROUP: 6, 7, 8*

Axiomatic foundations of probability, independence, conditional probability, joint distributions, transformations, moment generating functions, characteristic functions, moment inequalities, sampling distributions, modes of convergence and their interrelationships, laws of large numbers, central limit theorem, and stochastic processes.

*Note: Offered jointly with the School of Public Health as BIO 230.*

**Statistical Inference (1 credit)**

**Statistics 111. Introduction to Theoretical Statistics**

Catalog Number: 1836

*Edoardo Maria Airoidi*

*Half course (spring term). Tu., Th., 1-2:30, and weekly sections to be arranged. EXAM GROUP: 15, 16*

Basic concepts of statistical inference from frequentist and Bayesian perspectives. Topics include maximum likelihood methods, confidence and Bayesian interval estimation, hypothesis testing, least squares methods and categorical data analysis.

*Prerequisite: Mathematics 19a and 19b or equivalent and Statistics 110.*

**Economics 2110. Introductory Probability and Statistics for Economists**

(Course information under Probability Theory)

**BIO 222. Basics of Statistical Inference**

(Course information under Probability Theory)

**Statistics 211. Statistical Inference**

Catalog Number: 1946

*Carl N. Morris and Joseph K. Blitzstein*

*Half course (spring term). M., W., 2:30-4, and weekly sections to be arranged. EXAM GROUP: 7, 8*

Inference: frequency, Bayes, decision analysis, foundations. Likelihood, sufficiency, and information measures. Models:

Normal, exponential families, multilevel, and non-parametric. Point, interval and set estimation; hypothesis tests.

Computational strategies, large and moderate sample approximations.

*Prerequisite: Statistics 111 and 210 or equivalent.*

**Economics 1127. Statistical Methods for Evaluating Causal Effects**

Catalog Number: 9967

*Donald B. Rubin*

*Half course (spring term). Tu., Th., 2:30-4. EXAM GROUP: 16, 17*

Statistical methods discussed for inferring causal effects from data from randomized experiments or observational studies.

Students will develop expertise to assess the credibility of causal claims and the ability to apply the relevant statistical methods for causal analyses. Examples will come from many disciplines: economics, education, other social sciences, epidemiology, and biomedical science. Evaluations of job training programs, educational voucher schemes, changes in laws such as minimum wage laws, medical treatments, smoking, military service.

*Prerequisite: Statistics 100 or preferably Statistics 111; Mathematics 20.*

**Statistics 220. Bayesian Data Analysis**

Catalog Number: 6270

*Jun S. Liu*

*Half course (fall term). Tu., Th., 10-11:30. EXAM GROUP: 12, 13*

Basic Bayesian models, followed by more complicated hierarchical and mixture models with nonstandard solutions. Includes methods for monitoring adequacy of models and examining sensitivity of models.

*Note: Emphasis throughout term on drawing inferences via computer simulation rather than mathematical analysis.*

*Prerequisite: Statistics 110 and 111.*

**Biostatistics 231. Statistical Inference I / BIO 231**

Catalog Number: 8773

*Rebecca A. Betensky (Public Health)*

*Half course (spring term). M., W., 10:30-12:20, and a weekly 90-minute lab. EXAM GROUP: 3, 4, 5*

Exponential families, sufficiency, ancillarity, completeness, method of moments, maximum likelihood, unbiased estimation, Rao-Blackwell and Lehmann-Scheffe theorems, information inequality, Neyman-Pearson theory, likelihood ratio, score and Wald tests, uniformly and locally most powerful tests, asymptotic relative efficiency.

*Note: Offered jointly with the School of Public Health as BIO231.*

*Prerequisite: Biostatistics 230 or signature of instructor required.*

**API-209. Advanced Quantitative Methods I: Statistics**

*Dan Levy*

*Fall: Tu, Th, 10:10-11:30; F Section 1:10-2:30 and 2:40-4*

The goal of this course is to prepare students to analyze public policy issues using statistics. Topics included fall in the areas of

probability theory, sampling, estimation, hypothesis testing, and regression analysis. While many students taking this class will have already taken courses in statistics and regression analysis, this course will probably place a much stronger emphasis than typical courses on conceptually understanding the statistical methods. Since the course is targeted to first-year students in the MPA/ID program, we will not shy away from using the mathematical tools needed to develop the conceptual understanding. But the emphasis of the course will be on the conceptual understanding and application of the tools rather than on the math or the mechanics behind the tools. Prerequisites: Multivariate calculus or linear algebra.

*Note: This course is open to non-MPA/ID students only by permission of the instructor. May not be taken for credit with API-201.*

## **Regression (1 credit)**

### **Statistics 139. Statistical Sleuthing Through Linear Models**

Catalog Number: 1450

*Cassandra Wolos Pattanayak*

*Half course (fall term). Tu., Th., 11:30-1, and weekly sections to be arranged. EXAM GROUP: 13, 14*

A serious introduction to statistical inference with linear models and related methods. Topics include t-tools and permutation-based alternatives, multiple-group comparisons, analysis of variance, linear regression, model checking and refinement, and causation versus correlation. Emphasis on thinking statistically, evaluating assumptions, and developing tools for real-life applications.

*Prerequisite:* Statistics 100 or equivalent and Mathematics 19a and 19b or equivalent.

### **BIO 211. Regression and Analysis of Variance**

*Paul J. Catalano*

*Fall, Tu, Th, 3:30-5:20*

*5 credits*

Covers analysis of variance and regression, including details of data-analytic techniques and implications for study design. Also included are probability models and computing. Students learn to formulate a scientific question in terms of a statistical model, leading to objective and quantitative answers.

*Course Note:* Basic BIO courses required.

### **BIO 213. Applied Regression for Clinical Research**

*E. J. Orav*

*Fall, M, W, 8:30-10:20*

*5 credits*

This course will introduce students involved with clinical research to the practical application of multiple regression analysis. Linear regression, logistic regression and proportional hazards survival models will be covered, as well as general concepts in model selection, goodness-of-fit, and testing procedures. Each lecture will be accompanied by a data analysis using SAS and a classroom discussion of the results. The course will introduce, but will not attempt to develop the underlying likelihood theory. Background in SAS programming ability required.

*Course Note:* Basic BIO courses required.

### **GHP 525. Econometrics for Health Policy**

*G. Fink*

*Spring, Tu, Th, 8:30-10:20*

*5 credits*

This is a course in applied econometrics for doctoral and advanced master level students. The course has two primary objectives: (1) to develop skills in linking economic behavioral models and quantitative analysis, in a way that students can use in their own research; (2) to develop students' abilities to understand and evaluate critically other peoples' econometric studies. The course focuses on developing the theoretical basis and practical application of the most common empirical models used in health policy research. In particular, it pays special attention to a class of models identifying causal effects in observational data, including instrumental variable estimation, simultaneous equations and two-stage-least-squares, quasi-experiments and difference-in-difference method, sample selection, treatment effect models and propensity score methods.

Lectures will be complemented with computer exercises building on public domain data sets commonly used in health research. The statistical package recommended for the exercises is Stata.

*Course Note:* Students are expected to be familiar with probability theory (density and distribution functions) as well as the concepts underlying basic ordinary least square (OLS) estimation.

*Course Activities:* Optional review and computer lab sessions will be held.

### **Economics 1123. Introduction to Econometrics**

Catalog Number: 0813

*James H. Stock (fall term) and Eric Chaney (spring term)*

*Half course (fall term; repeated spring term). Fall: Tu., Th., 11:30-1; Spring: Tu., Th., 1-2:30, and a weekly section to be arranged. EXAM GROUP: Fall: 13, 14; Spring: 15, 16*

An introduction to multiple regression techniques with focus on economic applications. Discusses extensions to discrete response, panel data, and time series models, as well as issues such as omitted variables, missing data,

*Note:* Students may take either Economics 1123 or Statistics 139 for credit. Statistics 139 will not count as econometrics requirement. Also, Economics 1123 may not be taken for credit if taken after Economics 1126, but credit will be given for both courses if Economics 1123 is taken first. This course, when taken for a letter grade, meets the General Education requirement for Empirical and Mathematical Reasoning or Core requirement for Quantitative Reasoning.

*Prerequisite:* Statistics 100.

### **\*Biostatistics 235. Regression and Analysis of Variance / BIO 235**

Catalog Number: 7549

*Tianxi Cai (Public Health)*

*Half course (fall term). M., W., 10:30-12:20, and a weekly 90-minute lab. EXAM GROUP: 3, 4, 5*

An advanced course in linear models - regression and analysis of variance. Estimation (maximum likelihood and least squares) and inference (confidence intervals, hypothesis testing, analysis of residuals) are presented from a theoretical and data analysis perspective.

*Note:* Offered jointly with the School of Public Health as BIO 235.

*Prerequisite:* Biostatistics 230 and Biostatistics 232. Background in matrix algebra and linear regression required.

### **Economics 2120. Introduction to Applied Econometrics**

Catalog Number: 2352

*Gary Chamberlain*

*Half course (spring term). Tu., Th., 2:30-4. EXAM GROUP: 16, 17*

Introduction to methods employed in applied econometrics, including linear regression, instrumental variables, panel data techniques, generalized method of moments, and maximum likelihood.

*Note:* Enrollment limited to PhD candidates in economics, business economics, health policy, public policy, and political economy and government (PEG). Offered jointly with the Kennedy School as API-217.

*Prerequisite:* Economics 2110 or API-209 or the equivalent.

### **API-210. Advanced Quantitative Methods II: Econometric Methods**

*Alberto Abadie*

*Spring: Tu, Th, 10:10-11:30; Section F 10:10-11:30*

Intended as a continuation of API-209, Advanced Quantitative Methods I, this course focuses on developing the theoretical basis and practical application of the most common tools of empirical analysis including non-linear models, instrumental variables, and panel data. Foundations of analysis will be coupled with hands-on examples and assignments involving the analysis of data sets. Prerequisite: API-209 or permission of instructor.

*Prerequisite:* API-209 or permission of instructor.

*Note:* This course is open to non-MPA/ID students only by permission of the instructor. May not be taken for credit with API-202.

### **Other Data Analysis (2 credits)**

#### **BIO 210. Analysis of Rates and Proportions**

*Bernard A. Rosner (Fall) /Robert J. Glynn (Spring)*

*Fall/Spring, (F) M, W, 8:30-10:20; (S) Tu, Th, 8:30-10:20*

*5 credits*

Emphasizes concepts and methods for analysis of data which are categorical, rate-of-occurrence (e.g., incidence rate), and time-to-event (survival duration). Stresses applications in epidemiology, clinical trials, and other public health research. Topics include measures of association, 2x2 tables, stratification, matched pairs, logistic regression, model building, analysis of rates, and survival data analysis using proportional hazards models.

*Course Note:* Basic BIO courses required.

#### **Biostatistics 233. Methods II / BIO 233**

Catalog Number: 7804

*Sebastien Haneuse*

*Half course (spring term). M., W., 8:30-10:20, and a weekly 90-minute lab. EXAM GROUP: 1, 2, 3*

Intermediate course in the analysis of Gaussian, categorical, and survival data. The generalized linear model, Poisson regression, random effects and mixed models, comparing survival distributions, proportional hazards regression, splines and smoothing, the generalized additive model.

**Note:** Offered jointly with the School of Public Health as BIO 233.

**Prerequisite:** Biostatistics 232 or signature of instructor required.

### **EDU S-052. Applied Data Analysis**

*John B. Willett*

*Spring, Tu, Th, 10 – 11:30*

This course is designed for those who want to extend their data analytic skills beyond a basic knowledge of multiple regression analysis, and who want to communicate their findings clearly to audiences of researchers, scholars, and policymakers. The course contributes directly to the diverse data analytic toolkit that the well-equipped empirical researcher must possess in order to perform sensible analyses of complex educational, psychological, and social data. Topics in the course include more extensive use of transformations in regression analysis, influence statistics, building and comparing taxonomies of regression models, general linear hypothesis testing, an introduction to multilevel modeling, nonlinear regression analysis, binomial logistic regression analysis, principal components analysis, cluster analysis, introduction to discrete-time survival analysis, and others. S-052 is an applied course that offers conceptual explanations of statistical techniques, along with opportunities to examine, implement, and practice them in real data. Because the course will feature the intensive use of Stata statistical software in all data analyses, learning the computer skills necessary to conduct these kinds of analyses, and the communication skills to discuss them, is an integral part of the course.

**Prerequisite:** Successful completion of S-040 or equivalent. All cross-registrants, and those claiming equivalent knowledge in lieu of taking S-040, must complete the poll on the course web site before the start of the course and obtain the written permission of the instructor.

### **Biostatistics 232. Methods I / BIO 232**

Catalog Number: 0131

*Xihong Lin (Public Health)*

*Half course (fall term). M., W., 10:30-12:20, and a weekly 90-minute lab. EXAM GROUP: 3, 4, 5*

Introductory course in the analysis of Gaussian and categorical data. The general linear regression model, ANOVA, robust alternatives based on permutations, model building, resampling methods (bootstrap and jackknife), contingency tables, exact methods, logistic regression.

**Note:** Offered jointly with the School of Public Health as BIO 232.

**Prerequisite:** Signature of instructor required.

### **BIO 223. Applied Survival Analysis**

*Lee-Jen Wei*

*Spring, Tu, Th, 10:30-12:20*

*5 credits*

This course will cover topics in both discrete data analysis (25% of class) and applied survival analysis (75% of class). The course will begin with a review of sampling plans and contingency table for discrete data. Further topics in discrete data analysis will include logistic regression, exact inference, and conditional logistic regression. This short survey of discrete data topics will provide a natural transition to analysis of survival data. Survival topics include: hazard, survivor, and cumulative hazard functions, Kaplan-Meier and actuarial estimation of the survival distribution, comparison of survival using log rank and other tests, regression models including the Cox proportional hazards model and accelerated failure time model, adjustment for time-varying covariates, and use of parametric distributions (exponential, Weibull) in survival analysis. Class material will include presentation of statistical methods for estimation and testing, along with current software (SAS, Stata, Splus) for implementing analyses of discrete data and survival data. Applications to real data will be emphasized.

**Course Note:** BIO 210 and BIO 213, or BIO 230 required, or signature of instructor.

### **BIO 226. Applied Longitudinal Analysis**

*Michael Hughes*

*Spring, Tu, Th, 1:30-3:20*

*5 credits*

This course covers modern methods for the analysis of repeated measures, correlated outcomes and longitudinal data, including the unbalanced and incomplete data sets characteristic of biomedical research. Topics include an introduction to the analysis of correlated data, analysis of response profiles, fitting parametric curves, covariance pattern models, random effects and growth curve models, and generalized linear models for longitudinal data, including generalized estimating equations (GEE) and generalized linear mixed effects models (GLMMs).

**Course Activities:** Homework assignments will focus on data analysis in SAS using PROC GLM, PROC MIXED, and PROC GENMOD.

**Course Note:** BIO 211, BIO 213, or BIO 232, or signature of instructor required; lab or section times will be announced at first

meeting.

**EDU S-077. Applied Longitudinal Data Analysis (Not offered in 2011 – 2012; will likely be offered for the last time in 2012-2013)**

*Spring*

*John B. Willett*

Researchers in education and the social sciences often pose research questions about change and event occurrence over time. For instance, a researcher investigating the development of reading skills in young children might ask: How rapidly do children's reading skills develop as they age, and do the skills of boys and girls develop at different rates? Alternatively, her questions could be framed in terms of whether and when children achieve particular developmental milestones. Then, she would ask: When does a child make the transition from "learning to read" to "reading to learn," and do children exposed to innovative reading programs make the transition at different ages? Answering these kinds of questions requires longitudinal (panel) data and the application of innovative statistical methods. The goal of S-077 is to introduce two of these methods: individual growth modeling and survival analysis. The course is a seminar in which class members must take individual responsibility for reading new material, preparing written answers to discussion questions, and providing feedback to peers. Class members will also conduct an original research project of their own devising, using the new methods; make a public presentation of their findings; and submit a final paper of their original research. The nature of the research projects is negotiable, but must directly advance class members' professional and scholarly agenda. Enrollment is limited to advanced students who have completed the S-052 course, have arranged access to appropriate longitudinal data, and have proposed a suitable research project.

**Statistics 131. Time Series Analysis and Forecasting**

Catalog Number: 8291

*Tirthankar Dasgupta*

*Half course (fall term). Tu., Th., 1–2:30. EXAM GROUP: 15, 16*

An introduction to time series models and associated methods of data analysis and inference. Auto regressive (AR), moving average (MA), ARMA, and ARIMA processes, stationary and non-stationary processes, seasonal processes, auto-correlation and partial auto-correlation functions, identification of models, estimation of parameters, diagnostic checking of fitted models, forecasting, spectral analysis, and transfer function models.

*Prerequisite:* Statistics 111 and 139 or equivalent.

**Economics 2130. Applied Econometrics (Not offered 2011-2012)**

*Half course (spring term). Hours to be arranged.*

Advanced methods in applied econometrics, including nonlinear regression, discrete and limited dependent variables, models of selection, and stationary and non-stationary time series. Includes detailed discussion of empirical applications.

*Note:* This course may no longer exist as it is not in the course directory for 2010-11 or 2011-12.

*Prerequisite:* Economics 2120 or equivalent.

**Economics 2140. Econometric Methods**

Catalog Number: 7210

*Guido W. Imbens*

*Half course (spring term). Tu., Th., 11:30–1. EXAM GROUP: 13, 14*

Econometric methods for cross-section and panel data. Topics include generalized method of moments, empirical likelihood, instrumental variables, bootstrapping, clustering, treatment effects, selection bias, difference-in-differences, qualitative choice, quantile regression, nonparametric methods, and semiparametric methods.

*Prerequisite:* Economics 2120 or equivalent.

**Statistics 149. Statistical Sleuthing through Generalized Linear Models**

Catalog Number: 6617

*Natesh S. Pillai*

*Half course (spring term). M., W., 1–2:30. EXAM GROUP: 6, 7*

A sequel to Statistics 139, emphasizing common methods for analyzing categorical data. Topics include mixed effects model, contingency tables, log-linear models, logistic, Probit and Poisson regression, model selection, and model checking. Examples will be drawn from several fields, particularly from biology and social sciences.

*Prerequisite:* Statistics 139 or with permission of instructor.

**Government 2001. Advanced Quantitative Research Methodology**

Catalog Number: 8941

*Gary King*

*Half course (spring term). M., 2–4. EXAM GROUP: 7, 8*

Graduate-level version of Gov. 1002. Meets with Gov. 1002, introduces theories of inference underlying most statistical

methods and how new approaches are developed. Examples include discrete choice, event counts, durations, missing data, ecological inference, time-series cross sectional analysis, compositional data, causal inference, and others. Will require extra homework and examination problems in addition to those for Gov. 1002.

*Prerequisite:* Government 2000 or the equivalent.

### **Statistics 160. Design and Analysis of Sample Surveys**

Catalog Number: 2993

*Alan M. Zaslavsky (Medical School)*

*Half course (fall term). M., W., 2:30–4. EXAM GROUP: 7, 8, 9*

Methods for design and analysis of sample surveys. The toolkit of sample design features and their use in optimal design strategies. Sampling weights and variance estimation methods, including resampling methods. Brief overview of nonstatistical aspects of survey methodology such as survey administration and questionnaire design and validation (quantitative and qualitative). Additional topics: calibration estimators, variance estimation for complex surveys and estimators, nonresponse, missing data, hierarchical models, and small-area estimation.

*Prerequisite:* Statistics 111 or 139 or with permission of instructor.

## **Calculus**

### **Mathematics 1b. Calculus, Series, and Differential Equations**

Catalog Number: 1804

Enrollment: Normally limited to 30 students per section.

*Clifford Taubes, John Hall, Meghan Anderson, David Ayala, and Keerthi Madapusi (fall term); Robin Gottlieb, Meghan Anderson, Juliana Belding and Janet Chen (spring term)*

*Half course (fall term; repeated spring term). Section I, M., W., F., at 9 (with sufficient enrollment); Section II, M., W., F., at 10; Section III, M., W., F., at 11; Section IV, M., W., F., at 12 (with sufficient enrollment); Section V: Tu., Th., 10-11:30; Section VI, Tu., Th., 11:30-1. Spring: Section I, M., W., F., at 10; Section II, M., W., F., 11; Section III, M., W., F., 12; Section IV, Tu., Th., 10-11:30 (with sufficient enrollment); Section V, Tu., Th., 11:30-1 (with sufficient enrollment), and a weekly problem section to be arranged. Required exams. EXAM GROUP: 1*

Speaking the language of modern mathematics requires fluency with the topics of this course: infinite series, integration, and differential equations. Model practical situations using integrals and differential equations. Learn how to represent interesting functions using series and find qualitative, numerical, and analytic ways of studying differential equations. Develop both conceptual understanding and the ability to apply it. *Note:* Required first meeting in fall: Wednesday, August 31, 8:30 am, Science Center C. Required first meeting in spring: Monday, January 23, 8:30 am, Science Center C. This course, when taken for a letter grade, meets the General Education requirement for Empirical and Mathematical Reasoning or the Core area requirement for Quantitative Reasoning.

*Prerequisite:* Mathematics 1a, or Ma and Mb, or equivalent.

### **Mathematics 20. Algebra and Multivariable Mathematics for Social Sciences**

Catalog Number: 0906

*Rachel Louise Epstein*

*Half course (fall term). M., W., F., at 9. EXAM GROUP: 2*

Introduction to linear algebra, including vectors, matrices, and applications. Calculus of functions of several variables, including partial derivatives, constrained and unconstrained optimization, and applications. Covers the topics from Mathematics 21a,b which are most important in applications to economics, the social sciences, and some other fields. *Note:* Should not ordinarily be taken in addition to Mathematics 21a,b. Examples drawn primarily from economics and the social sciences though Mathematics 20 may be useful to students in certain natural sciences. This course, when taken for a letter grade, meets the General Education requirement for Empirical and Mathematical Reasoning or the Core area requirement for Quantitative Reasoning.

*Prerequisite:* Mathematics 1b or equivalent, or an A or A- in Mathematics 1a, or a 5 on the AB or a 3 or higher on the BC Advanced Placement Examinations in Mathematics.

**Research Design and Methodology (2 credits)**

**GHP 228. Quantitative Methods in Impact Evaluation**

*Jessica Cohen*

*Spring, Tu, 3:30-6:30*

*5 Credits*

The objective of this course is to provide students with a set of theoretical, econometric and reasoning skills to estimate the causal impact of one variable on another. Examples from the readings explore the causal effect of policies, laws, programs and natural experiments derived from pension programs to television shows to natural disasters. We will go beyond estimating causal effects to analyze the channels through which the causal impact was likely achieved. This will require that the students are familiar with microeconomic theories of incentives, institutions, social networks, etc.

The course will introduce students to a variety of econometric techniques in impact evaluation and a set of reasoning skills intended to help them become both a consumer and producer of applied empirical research. Students will learn to critically analyze evaluation research and to gauge how convincing the research is in identifying a causal impact. They will use these skills to develop an evaluation plan for a topic of their own, with the aim of stimulating ideas for dissertation research. This is a methods class that relies heavily on familiarity with econometrics and microeconomics. These are pre-requisites for the course without exception. The course is intended for doctoral students who are finishing their course work and aims to help them transition into independent research.

The aim of this course is to prepare doctoral students in the health systems track of the Global Health and Population department for the dissertation phase of their research and thus they will be given priority in enrollment. The course is also open to other GHP doctoral students, other GHP masters students and students from other departments, conditional on having adequate training in economics and the course having enough space.

**Pre-Requisites:** Econometrics and intermediate micro-economics (GHP 525 and GHP 291 or equivalent) are required for this course. While students can get by with just these two subjects, some previous experience with regression analysis and applied economic research will be a huge advantage. Students seeing applied regression analysis for the first time in this course will most likely struggle with the reading.

**\*Health Policy 3080hf. Graduate Reading Course: Evaluative Science and Statistics**

Catalog Number: 9516

*John Michael McWilliams (Medical School) 1447, Stephen B. Soumerai (Medical School) 1906, and Alan M. Zaslavsky (Medical School) 1927*

*Half course (throughout the year). Hours to be arranged.*

This course will include readings on study designs that help develop critical analysis skills. It will also include a close reading of the Shadish, Cook, and Campbell book. During the second semester, the course will prepare students for the ESS qualifying exam.

**Specific Methodological Approaches (2.5 credits chosen from Decision Sciences, Epidemiology, Program Evaluation, Qualitative Research, Survey Research Methods, and Other)**

**Decision Sciences**

**API-302. Analytic Frameworks for Policy**

*Richard Zeckhauser*

*Fall, Tu, Th, 10:10-11:30; Review section on F, 1:10-2:30*

This course develops abilities in using analytic frameworks in the formulation and assessment of public policies. It considers a variety of analytic techniques, particularly those directed toward uncertainty and interactive decision problems. It emphasizes the application of techniques to policy analysis, not formal derivations. Students encounter case studies, methodological readings, modeling of current events, the computer, a final exam, and challenging problem sets.

**Prerequisites:** An understanding of intermediate-level microeconomic theory and introductory techniques of optimization and decision analysis; API-101, API-102, or equivalent.

**RDS 280. Decision Analysis for Health and Medical Practices**

*S. Goldie*

*Fall 2, Tu, Th, 1:30-3:20*

*2.5 credits*

This course is designed to introduce the student to the methods and growing range of applications of decision analysis and cost-effectiveness analysis in health technology assessment, medical and public health decision making, and health resource allocation. The objectives of the course are: (1) to provide a basic technical understanding of the methods used, (2) to give the student an appreciation of the practical problems in applying these methods to the evaluation of clinical interventions and public health policies, and (3) to give the student an appreciation of the uses and limitations of these methods in decision making at the individual, organizational, and policy level both in developed and developing countries.

*Course Note:* Introductory economics is recommended but not required.

## **RDS 282. Economic Evaluation of Health Policy and Program Management**

*S. Resch*

*Spring 2, M, W, 1:30-3:20*

*2.5 credits*

This course features case studies in the application of health decision science to policymaking and program management at various levels of the health system. Both developed and developing country contexts will be covered. Topics include: [1] theoretical foundations of cost-effectiveness analysis (CEA); [2] controversies and limitations of CEA in practice; [3] design and implementation of tools and protocols for measurement and valuation of cost and benefit of health programs; [4] integration of evidence of economic value into strategic planning and resource allocation decisions, performance monitoring and program evaluation; [5] the role of evidence of economic value in the context of other stakeholder criteria and political motivations.

## **Epidemiology**

### **EPI 500. Fundamentals of Epidemiology**

*J. Buring, E. Cook*

*Fall 1, Tu, Th, 1:30-3:20*

*2.5 credits*

This course will provide an orientation to epidemiology as a basic science for public health and clinical medicine. It will address the principles of the quantitative approach to clinical and public health problems. The course will discuss measure of frequency and association, introduce the design and validity of epidemiologic research, and give an overview of data analysis. This course is an introduction to the skills needed by public health professionals and clinicians to interpret critically the epidemiologic literature. It will provide students with the principles and practical experience needed to initiate the development of these skills. Lectures are complemented by seminars devoted to case studies, exercises, or critique of current examples of epidemiologic studies.

### **EPI 202. Elements of Epidemiologic Research**

*M. Mittleman*

*Fall 2, Tu, Th, 10:30-12:20*

*2.5 credits*

Introduces elements of study design, data analysis and inference in epidemiologic research. Principles and methods are illustrated with examples, and reviewed through homework and in-class exercises. May serve as an introduction to more advanced study or as a concluding course for those desiring a working knowledge of epidemiologic methods.

*Course Note:* EPI 201 or EPI208 required - concurrent enrollment permitted; BIO 200; or BIO 200s and BIO 200t; or BIO 201 or BIO 202 and 203; or BIO 205; or BIO 219; or BIO 206 and BIO 207, BIO 208 or BIO 209 required - concurrent enrollment permitted. Thursday or Friday lab required; sign up for appropriate section at first class meeting.

### **EPI 207. Advanced Epidemiologic Methods**

*E. Tchetge*

*Fall 1, M, W, 3:30-5:20*

*2.5 credits*

Provides an in-depth investigation of statistical methods for drawing causal inferences from observational studies. Informal epidemiologic concepts such as confounding, selection bias, overall effects, direct effects, and intermediate variables will be formally defined within the context of a counterfactual causal model and with the help of causal diagrams. Methods for the analysis of the causal effects of time-varying exposures in the presence of time dependent covariates that are simultaneously confounders and intermediate variables will be emphasized. These methods include g-computation algorithm estimators, inverse probability weighted estimators of marginal structural models, g-estimation of structural nested models. As a practicum, students will reanalyze data sets using the above methods.

*Course Activities:* Class discussion, homework, practicum and final examination.

*Course Note:* Familiarity with logistic regression and survival analysis is expected; lab time will be announced at first meeting.

### **EPI 241. Measuring Health Status (Not offered 2011-12)**

*J. Page, E. F. Cook*

*2.5 credits*

*Lectures. One 2-hour session each week.*

Examines methodologic issues related to measures of health and disease status encountered in clinical research. Topics to be covered include instrument development, scaling, space assessment of reliability, validity and responsiveness to change; principal component analysis and factor analysis; diagnostic test evaluation. Course Activities: Class discussion, examination, paper. Course Note: Minimum enrollment of 10 students required.

## **Program Evaluation**

### **GHP 228. Quantitative Methods in Impact Evaluation**

(Course information under Research Design and Methodology)

### **API-208. Program Evaluation: Estimating Program Effectiveness with Empirical Analysis**

*Alberto Abadie*

*Spring, Tu, Th, 1:10-2:30; Section F, 11:40-1*

Program evaluation comprises a set of statistical tools for assessing the impact of public interventions. This methodological course will develop students' skills in quantitative program evaluation. Students will study a variety of evaluation designs (from random assignment to quasi-experimental evaluation methods) and analyze data from actual evaluations, such as the national Job Training Partnership Act Study. The course evaluates the strengths and weaknesses of alternative evaluation methods. This course meets the PhD requirement for empirical methods.

*Prerequisite:* Familiarity with the basic concepts of statistical inference and regression analysis (such as API-202 or API-210).

## **Qualitative Research**

### **EDU S-504. Introduction to Qualitative Research**

*Vanessa L. Fong*

*Fall, F, 9-12*

How does one collect, analyze, and write about data collected from a small number of people who were neither randomly sampled nor numerous enough to serve as the basis for statistically significant generalizations? What kinds of claims can one make based on this kind of data, and what kinds of claims can one not make? How does one handle research design when one is not sure of what might be discovered in the research? What kinds of questions are best answered with qualitative research? Which specific qualitative research methods are best for answering which questions? This course will teach students to answer these questions by providing a survey of various qualitative research methods and walking students through the process of formulating a research question; selecting the kinds of research participants and qualitative research methods that can answer the research question; collecting qualitative data to answer the question; analyzing the data; finding the proper fit between theories, data, and practice; writing an academic paper based on the data; and presenting the findings to the class. Students will also read and discuss books and articles about the practice and epistemology of qualitative research, do close readings of published work based on qualitative research, and discuss their own and others' projects in small workshops. Each student will write a paper based on a small research project (on a topic of the student's own choosing) and develop the skills to understand and evaluate qualitative research.

*Note:* No prerequisites or previous course work necessary. First-year Ed.D. Students must take either S-504, or S-710B in combination with S-710C, in order to meet the qualitative methods requirement. Master's students are also welcome.

### **GHP 504. Applied Qualitative Methods for Global Health**

*T. Betancourt*

*Spring I, F, 10:30-1:20*

*2.5 credits*

The aim of this course is to provide students with an introduction to qualitative methods for global health research. The module is designed to expose students to a wide range of topics including: developing research questions, sampling and site selection, frequently used qualitative methods (such as interviews, observations, focus groups), design of qualitative research protocols, as well as data management and analysis. Students will engage in a variety of active learning exercises (such as constructing and conducting a short informal interview) and will work in small groups on the preparation of a qualitative research project on a defined topic area of international or multicultural health. Class activities and discussions will aim at building a research community in the class, where students support each other's development as researchers recognizing the complexity, benefits and limitations of conducting cross-cultural qualitative research.

*Course prerequisite:* Prospective students wishing to enroll in GHP 504 must email an essay (maxim half-page) to course TAs, by December 2, 2011. All admitted students will be notified by December 16, 2011.

*The essay should describe:* - Current departmental affiliation, degree program and remaining time to graduation - Rationale for

and interest in pursuing training in qualitative methods - Upcoming plans to use qualitative methods in research -Any prior training in or experience with using qualitative methods in field research (and lessons learned if relevant) - Research topics and populations in which the student plans to use qualitative methods

### **SHDH 235. Qualitative Research Methods for Public Health (Not offered 2011-12)**

*E. Barbeau*

*Spring 2, 2.5 credits*

*Lectures, seminars. One 3-hour session each week.*

Qualitative research can be used alone or in combination with quantitative research to investigate public health questions. This introductory-level course begins by examining when it is appropriate to use qualitative methods in public health research. The course then explores specific topics, including: developing research questions, sampling, data collection methods (focusing on interviews, focus groups, observation and document review), data management and analysis, and combining qualitative and quantitative research methods. Students will be required to apply concepts covered in class through an assignment to collect and analyze qualitative data.

Course Activities: Class discussion, primary data collection and analysis using qualitative research methods.

Course Note: Enrollment limited to 30 students; ordinal grading option only.

### **SHDH 288. Qualitative Research Methods in Public Health**

*R. Goldman*

*Fall 1, 9:30-12:20*

*2.5 credits*

Qualitative research can be used alone or in combination with quantitative research to investigate public health questions. This introductory-level course begins by examining the variety of potential uses of qualitative methods in public health research and diverse qualitative research approaches. The course then explores specific topics, including: "entering" the community to conduct qualitative research; applying theory to study design and open-ended questions; ensuring study rigor; developing theory-based research questions, specific data collection methods (including, but not limited to, semi-structured interviews, focus groups, participant observation); sampling for qualitative studies; data management; data analysis; writing results and research proposals; and considerations for choosing qualitative methods at each stage of a mixed-methods qualitative or mixed-methods qualitative/quantitative study. Students will be required to participate in class discussions, apply concepts covered in class through assignments to collect and analyze qualitative data, critique qualitative works, and propose a qualitative study.

### **EDU S-710C1/C2. Interviewing in Qualitative Research**

*Mark R. Warren*

*Fall 1, M, W, 10-11:30 or 12-1:30*

*2 credits*

This module provides an introduction to qualitative interviewing as a research strategy and practice. We will briefly introduce some of the theoretical and methodological issues surrounding interviewing as a research method. But the focus of the module will be on students learning the craft of interviewing. This will be accomplished primarily through practicing qualitative interviewing as a research method and reflecting on that experience. Interviewing can be thought of as a conversation in relationship and is therefore inherently an interpersonal and social enterprise. Students will have the opportunity to develop their own personal approach to interviewing and consider their own interest and commitment to qualitative interviewing. We will work toward building a research community in the class, where students support each other's development as researchers committed to advancing the public's interest in education and social change. The module will discuss ethical issues in qualitative research and consider how researcher positionality and power differentials between researcher and subject affect the research process.

*Course notes:* Permission of instructor required. First-year Ed.D. students must either take S-710C in combination with S-710B or take S-504 to meet the qualitative methods requirement. Master's students are welcome.

### **HBS 4852. Seminar on the Craft of Inductive Qualitative Research**

Michel Anteby and Leslie Perlow

Full Year? Fridays: Sept 16, 2-5; Oct 14, 9-5; Nov 18, 2-5; Dec 9, 9-5; Spring semester schedule TBD

This seminar provides a forum to demystify the craft of qualitative inductive research. How do field notes get transformed into published books and articles? How does theory get built and substantiated? What is the behind the scenes process successful scholars are using? Our goal is to look behind the curtain and understand the art and science of writing up this work. It is also to gain an appreciation for the variety of ways in which people work.

Towards this end, the seminar will be composed of two parts: 1) learning from others and 2) learning by doing. The first part of each class will involve uncovering the story behind a published piece of work, written by a leading scholar. The second part of each class will involve class participants sharing their own writing based on on-going research projects. This writing can take the form of full paper or much earlier stage memos, outlines or other writing sample.

The seminar is offered as a Pass/Fail course and has three requirements:

In preparation for each class, participants will read the piece of work by the leading scholar, and possibly some earlier drafts, memos, or reviews.

For each class, participants will also be provided a writing sample distributed by one of the class participant, whose week it is to share their work.

Participants will be responsible for sharing their work during at least one class session. This course is open to doctoral students who have successfully completed their first-year of graduate work and are engaged in inductive qualitative research projects ideally with data. **\*\*Permission of the instructors is required for all enrollees.\*\***

## Survey Research Methods and Sampling

### **BIO 212. Survey Research Methods In Community Health**

*T. Mangione*

*Spring, W, 3:30-5:20*

*2.5 credits*

Covers research design, sample selection, questionnaire construction, interviewing techniques, the reduction and interpretation of data, and related facets of population survey investigations. Focuses primarily on the application of survey methods to problems of health program planning and evaluation. Treatment of methodology is sufficiently broad to be suitable for students who are concerned with epidemiological, nutritional, or other types of survey research.

### **Statistics 160. Design and Analysis of Sample Surveys**

(Course information under Other Data Analyses)

## Other

### **EPI 203. Study Design in Epidemiologic Research**

*Alexander Walker*

*Spring 2, Tu, Th, 3:30-5:20*

*2.5 credits*

Beginning with the randomized clinical trial as a paradigm, this course examines common problems in the design, analysis, and interpretation of observational studies. Cohort and case-control studies are the focus of the discussion, but not to the exclusion of other designs. Problems of exposure and disease definitions, time-dependent effects, confounding, and misclassification are considered in the light of data sources typically available. Relevant statistical methods are introduced but not developed in detail.

*Course Activities:* Review of published studies, class discussion.

### **EPI 204. Analysis of Case-Control and Cohort Epidemiologic Data**

*Joel D. Schwartz*

*Spring 2, Tu, Th, 10:30-12:20*

*2.5 credits*

This course will examine, through practical examples, the use of regression methods for analyses of epidemiologic data, primarily case-control and cohort studies. Methods used will include linear, logistic, Poisson, conditional logistic and Cox regression models. The lectures will focus on the principle ideas and issues underlying the regression analyses, and the computer labs will provide practical experience applying those methods, using SAS software. Issues to be dealt with include dose-response, confounding, influence, and interaction. It will emphasize analysis and interpretation of results in the context of the study design. Familiarity with basic SAS is required, as this will be used in the labs. This can be met through BIO 113 (Introduction to Data Management and Programming in SAS) or other significant SAS experience.

*Course Activities:* Written group projects, class discussion, quizzes, homework.

*Course Note:* Computer lab is required, please sign up for one lab session when registering.

### **SHDH 263. Multilevel Statistical Methods: Concept and Application**

*S V Subramanian*

*Spring, M, W, 10:30-12:20*

*5 credits*

This course is designed to provide doctoral students with a training experience in the concept and application of multilevel statistical modeling. Students will be motivated to think about correlated and dependent data structures that arise due to sampling design and/or are inherent in the population (such as pupils nested within schools; patients nested within clinics; individuals nested within neighborhoods and so on). The substantive motivation for analyzing such complex data structures would be to make quantitative assessments about the role of contexts (e.g., schools, clinics, neighborhoods) in predicting

individual outcomes. In particular, the principles of recognizing and modeling the underlying heterogeneity in average relationships would be emphasized. Linear, non-linear, and multivariate multilevel models will be covered. Upon completion, students should be able to conceptualize multilevel modeling strategies and to undertake empirical, quantitative multilevel research. The course will be lecture-based with substantial hands-on component.

*Course Activities:* Data management, modeling and analysis; individual assignments; project submission and class participation.

*Course Notes:* This course is a requirement for all SHDH doctoral students.

### **HBS 4070. Design of Field Research Methods**

*Spring, W, 11-2*

*Michel Anteby*

Field research involves collecting original data (qualitative or quantitative) in field sites. The course will combine informal lecture and discussion with practical sessions designed to build specific skills for conducting field research in organizations. Readings include books and papers about research methodology, as well as articles that provide exemplars of field research, including both theory driven and phenomenon driven work. Specific topics covered include variance versus process models, blending qualitative and quantitative data (in one paper, one study, or one career), collecting and analyzing different kinds of data (observation interview, survey, archival), levels of analysis, construct development, and writing up field research for publication. A core aim of the course is to help students understand the contingent relationship between the nature of the research question and the field research methods used to answer it, and to use this understanding to design and carry out original field research. Course requirements include several short assignments assessing readings and a final paper designed to help students' further their own field research goals.

*Prerequisite:* This seminar is primarily for graduate students, who are in or beyond their second year of study.

### **Statistics 140. Design of Experiments (Not offered 2011-2012; Expected to be given 2012-2013)**

Catalog Number: 7112

*Tirthankar Dasgupta and Donald B. Rubin*

*Half course (spring term) M., W., 2:30-4 EXAM GROUP: 7, 8*

Statistical designs for estimation of treatment effects in randomized experiments. Topics include analysis of variance, randomized block and Latin square designs, balanced incomplete block designs, factorial designs, nested factorial designs, confounding in blocks, fractional replications, orthogonal arrays, response surface designs, applications in engineering, biological, and social and management sciences.

*Prerequisite:* Statistics 100 or equivalent and Mathematics 19a and 19b.

### **Government 2010. Strategies for Political Inquiry**

Catalog Number: 7421

*Michael J. Hiscox and Nahomi Ichino*

*Half course (fall term). M., 10-12. EXAM GROUP: 3, 4*

Research design for causal inference in qualitative and quantitative studies. Topics covered include measurement, conceptualization, case studies, the relationship between large-n and small-n studies, process-tracing, surveys, field experiments, and natural experiments, with examples of their use in political science.

*Note:* Primarily for graduate students; may also be taken by undergraduates preparing for senior thesis research.

### **Statistics 240 (formerly Statistics 233). Matched Sampling and Study Design**

Catalog Number: 4036

*Donald B. Rubin and Tirthankar Dasgupta*

*Half course (fall term). W., 5-7 pm. EXAM GROUP: 9*

This course provides an accessible introduction to the study of matched sampling and other design techniques in any field (e.g., economics, education, epidemiology, medicine, political science, etc.) conducting empirical research to evaluate the causal effects of interventions.

*Prerequisite:* Statistics 110, Statistics 111, and Statistics 139.