EPIDEMIOLOGY AND POPULATION HEALTH

Effective October 1, 2019, Epidemiology moved from the Department of Health Research and Policy to become an independent department in the School of Medicine, the new Department of Epidemiology and Population Health.

Epidemiology is the study of factors that cause illness and impairment in human populations. It is the cornerstone of population health and clinical research, informing policy, prevention, disease treatment, and understanding of disease mechanisms. A central focus of epidemiology is to go beyond simple prediction to identifying risk factors likely to be causal, upon which interventions and mechanistic understanding can be reliably based.

The Department of Epidemiology and Population Health (E&PH) is Stanford's academic and organizational home for such activities, offering expertise, research, and training on study design, data collection, analysis and proper interpretation of scientific evidence to improve human health in the clinic and in the field.

Master of Science in Epidemiology and Clinical Research

University requirements for the M.S. degree are described in the 'Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/)' section of this bulletin.

The Graduate Program in Epidemiology offers instruction and interdisciplinary research opportunities leading to the M.S. degree in Epidemiology and Clinical Research. Epidemiology is the study of the distribution and determinants of illness and impairment in human populations. Epidemiologic methods are used by clinical investigators and by other scientists who conduct observational and experimental research on the identification, prevention, and treatment of human disorders.

Core and affiliated faculty come from the Department of Epidemiology & Population Health and from other Stanford University departments. The program has particular strengths in cancer epidemiology, cardiovascular disease epidemiology, epidemiologic methods, genetic epidemiology, global health, infectious disease epidemiology, musculoskeletal disease epidemiology, neuroepidemiology, and reproductive epidemiology and women's health. Students can select an optional concentration in global health or infectious diseases.

The mission of the Stanford University School of Medicine is to be a premier research-intensive medical school that improves health through leadership, diversity, and collaborative discoveries and innovation in patient care, education and research. The Graduate Program in Epidemiology fosters this mission through the training of physician investigators in techniques of clinical research. The department also welcomes students from other disciplines who would benefit from formal training in epidemiologic methods. The master's degree in Epidemiology and Clinical Research provides students with the skills essential to patient-oriented clinical research, including epidemiologic methods and statistical analysis.

Address inquiries to the Education Program Manager at epiadmissions@stanford.edu.

Admissions

See the Department of Epidemiology & Population Health web (http://med.stanford.edu/epidemiology-dept/education.html)site (http://med.stanford.edu/epidemiology-dept/education.html) for additional information regarding the program and admissions process. GRE is required (optional in 20-21 application cycle, yet still encouraged).

Submit your application through the Stanford Graduate Admissions website (https://gradadmissions.stanford.edu/applying/) by clicking on "Apply Now.'

Successful applicants for admission are expected to have a strong academic record, high Graduate Record Examination (GRE) scores obtained within the past five years, strong letters of recommendation, and an appropriate personal statement of purpose. Preference is accorded to applicants with research interests aligned with those of faculty available to serve as research mentors.

Required supporting documents (to be submitted in the Stanford Graduate Admissions Application):

- Statement of Purpose that includes area(s) of interest
- Three letters of recommendation
- Official GRE General Test scores
- Official TOEFL scores (if applicable)
- Unofficial transcripts for all college/university degrees
- CV with relevant work and research experience

Application deadline: Tuesday, March 30, 2021.

Mentors

Students are assigned a methodology mentor from the Department of Epidemiology & Population Health and they also select a research mentor, who may be from another department. For physicians, the research mentor is often a faculty member from the department of the student's clinical specialty.

Coterminal Master's Program

For undergraduates at Stanford University, the program offers a coterminal M.S. in Epidemiology and Clinical Research. Coterminal students have the opportunity to pursue epidemiological research at the intersection of public health, disease treatment, and disease prevention. See the 'Coterminal Master's' (p. 2) tab in this section of this bulletin for admission and program details.

Degree Requirements

To receive the M.S. degree, students are expected to obtain a grounding in epidemiologic methods and applied biostatistics and to demonstrate research skills through the completion of a thesis. The master's degree program is typically completed in two years (four to six quarters).

Students must complete at least 45 units of approved course work as well as a master's thesis, which is usually based on original research related to clinical epidemiology.

Required Courses

		Units
Epidemiologic Methods		
EPI 225	Introduction to Epidemiologic and Clinical Research Methods	3
EPI 226	Intermediate Epidemiologic and Clinical Research Methods	3
EPI 251	Design and Conduct of Clinical Trials	3
Biostatistics		
EPI 259	Introduction to Probability and Statistics for Epidemiology	3
EPI 261	Intermediate Biostatistics: Analysis of Discrete Data	3

EPI 262	Intermediate Biostatistics: Regression, Prediction, Survival Analysis	3
Research Seminar (3 quarters)		
EPI 236	Epidemiology Research Seminar	1
Research (12 units, over at least 2 quarters)		
EPI 399	Graduate Research	1-18
Research Conduct		
MED 255	The Responsible Conduct of Research	1
or MED 255C	The Responsible Conduct of Research for Clinical and Community Researchers	
Electives		
Other approved selective and elective courses to complete the program total of at least 45 units		
Total Units		**45**

Pre-approved Electives

Any graduate level HRP course with primary focus on epidemiology or health services content or methods can be taken as an elective if approved by the student's epidemiology adviser.

EPI 251 is recommended but not required for coterminal students and students in designated tracks.

		Units
EPI 206	Meta-research: Appraising Research Findings, Bias, and Meta-analysis	3
EPI 214	Scientific Writing	2-3
EPI 216	Analytical and Practical Issues in the Conduct of Clinical and Epidemiologic Research	2-3
HRP 218	Methods for Health Care Delivery Innovation, Implementation and Evaluation	2
EPI 219	Evaluating Technologies for Diagnosis, Prediction and Screening	3
EPI 223	Introduction to Data Management and Analysis in SAS	2
EPI 224	Genetic Epidemiology	3
EPI 227	Advanced Epidemiologic Methods	3
EPI 231	Epidemiology of Infectious Diseases	3
EPI 235	Designing Research-Based Interventions to Solve Global Health Problems	3-4
EPI 237	Practical Approaches to Global Health Research	1-3
EPI 238	Genes and Environment in Disease Causation: Implications for Medicine and Public Health	2-3
EPI 239	Applications of Causal Inference Methods	2
EPI 244	Developing Measurement Tools for Health Research	2
EPI 247	Epidemic Intelligence: How to Identify, Investigate and Interrupt Outbreaks of Disease	4
HRP 249	Topics in Health Economics I	3-5
HRP 252	Outcomes Analysis	4
EPI 253	Cancer Epidemiology and Prevention	3
HRP 256	Economics of Health and Medical Care	5
HRP 263	Advanced Decision Science Methods and Modeling in Health	3
EPI 264	Foundations of Statistical and Scientific Inference	1
EPI 265	Advanced Methods for Meta-Analysis	2
EPI 267	Life Course Epidemiology	2
EPI 272	The Science of Community Engagement in Health Research	3
EPI 292	Advanced Statistical Methods for Observational Studies	2-3
EPI 263	Social Epidemiology	2
HRP 391	Health Law: Finance and Insurance	3
HRP 392	Analysis of Costs, Risks, and Benefits of Health Care	4

Coterminal Master of Science in Epidemiology and Clinical Research

The coterminal master's degree is available only to current Stanford undergraduates. The M.S. entails a minimum of 45 units of course work but can require more depending upon the courses chosen and the previous training of the student; a minimum of 12 units must be applied towards the master's thesis.

Coterminal students are enrolled full-time and courses are taken on campus. Graduates of this program are prepared to contribute creatively to basic or applied projects in epidemiology and clinical research. The department anticipates that many go on to Ph.D. programs, M.D. degrees, or to pursue careers in public health, pharma or biotech.

Coterms may choose to obtain their bachelor's degree early after completion of requirements. However, all classes after conferral of the degree may only be counted towards the graduate degree. Part of the strategy that allows coterms maximal flexibility in their course of study is their dual status as both undergraduate and graduate student.

Coterminal students must have at least one quarter of overlap in the undergraduate and graduate career prior to conferring their undergraduate degree. See the 'Coterminal Degrees (http://exploredegrees.stanford.edu/cotermdegrees/)' section of this bulletin for additional details. See also the Registrar's coterminal degrees (https://registrar.stanford.edu/students/coterminal-degree-programs/) pages.

Admission

For additional information on the application process, see the department's coterminal page (http://med.stanford.edu/epidemiology/co-term.html). Address inquiries to the Education Program Manager at epiadmissions@stanford.edu. GRE scores are recommended but not required for coterm applications.

Before applying to the M.S. Epidemiology and Clinical Research coterm program, students should discuss with their advisor and review the Stanford coterm information at the following links:

- Stanford bulletin coterm page (http://exploredegrees.stanford.edu/cotermdegrees/)
- Stanford Registrar coterm page (https://studentaffairs.stanford.edu/registrar/students/coterm/)
- Stanford Undergraduate Advising page for coterms (https://undergrad.stanford.edu/advising/coterm/). There is an option of scheduling a meeting with the Stanford Coterminal Student Advisor from this page.

The application process for coterms is online through Stanford Graduate Admissions (https://www.applyweb.com/stanterm/).

The application must include the following items:

- *Statement of Purpose.* In a maximum two pages, describe the reasons for applying to the M.S. Epidemiology and Clinical Research program and include your areas of interest.

- *Transcript.* Official Stanford transcript is requested and submitted through the online application.
- *Letters of Recommendation:* Three letters of recommendation are required in the application. Two letters should be from your current department faculty or E&PH faculty and one from your academic advisor.
- *CV/Resume:* Include a copy of your resume in your application.
- *GRE Scores:* GRE scores are recommended but not required for coterm applications (but may be requested by the admissions committee for students who have relatively little prior coursework in quantitative courses). For those reporting GRE scores, official test scores must be reported directly to Stanford from Educational Testing Service (ETS). Stanford's ETS institutional code is 4704; an individual department code number is not necessary. Be sure to list Stanford University as a Score Recipient in addition to listing it as your Graduate Institution (GI).

Application Deadline

The M.S. Epidemiology and Clinical Research program only matriculates students into Autumn Quarter. **The deadline to apply for the coterm program is February 2, 2021.**

University Coterminal Requirements

Coterminal master's degree candidates are expected to complete all master's degree requirements as described in this bulletin. University requirements for the coterminal master's degree are described in the "Coterminal Master's Program (http://exploredegrees.stanford.edu/cotermdegrees/)" section. University requirements for the master's degree are described in the 'Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/#masterstext)' section of this bulletin.

After accepting admission to this coterminal master's degree program, students may request transfer of courses from the undergraduate to the graduate career to satisfy requirements for the master's degree. Transfer of courses to the graduate career requires review and approval of both the undergraduate and graduate programs on a case by case basis.

In this master's program, courses taken during or after the first quarter of the sophomore year are eligible for consideration for transfer to the graduate career; the timing of the first graduate quarter is not a factor. No courses taken prior to the first quarter of the sophomore year may be used to meet master's degree requirements.

Course transfers are not possible after the bachelor's degree has been conferred.

The University requires that the graduate advisor be assigned in the student's first graduate quarter even though the undergraduate career may still be open. The University also requires that the Master's Degree Program Proposal be completed by the student and approved by the department by the end of the student's first graduate quarter.

Funding Sources

Access to financial aid and other options for coterminal students depends on the number of units and quarters as a registered student at Stanford. Coterminal students have full access to undergraduate sources of financial aid until their twelfth quarter or four years of study. Coterminal students who have completed 180 units are eligible for University fellowships and assistantships. However, many federal and private fellowships and assistantships are awarded only to students who have received the bachelor's degree. Even after the conferral of the bachelor's degree, there is no guarantee that a coterminal student be awarded financial support via a RA-ship, TA-ship, or fellowship.

Degree Requirements

The coterminal Master of Science program follows the same program requirements as the Master of Science (academic), except that the student is not required to take the course in Clinical Trials. Students who desire to concentrate in a specific area can participate in one of the track areas (Infectious Diseases or Global Health), although this is not required. To pursue a research project, the student must make arrangements with program faculty.

See the 'Master's (p. 1)' tab in this section of this bulletin for degree requirements.

Ph.D. in Epidemiology and Clinical Research

University requirements for the Ph.D. are described in the 'Graduate Degrees (http://exploredegrees.stanford.edu/graduatedegrees/)' section of this bulletin.

The field of epidemiology is poised to undergo major changes, and this Ph.D. program offers a cutting-edge curriculum that reflects this shift. Driven by technological advancements, the availability of very large datasets, and the omics revolution, epidemiology is moving toward what some have called Big Epidemiology, where epidemiologists partner with other scientists to study vast amounts of data. Thus, this program will train epidemiologists and clinical researchers to be savvy in technology, computing, data mining, bioinformatics, and genomics. The curriculum capitalizes on Stanford's unique strengths in these disciplines.

Admission

See the department's website (http://med.stanford.edu/epidemiology-dept/education.html) for additional information on the admissions process. Address inquiries to the Education Program Manager at epiadmissions@stanford.edu.

Application deadline: Tuesday, December 8, 2020. This is the final deadline. All applications must be submitted and all reference letters must be received by 11:59 pm on December 8, 2020.

Submit your application through the Stanford Graduate Admissions website (https://gradadmissions.stanford.edu) by clicking on "Apply Now."

Applications are evaluated based on the applicant's commitment to and aptitude for a career in epidemiology as demonstrated via transcripts, statement of purpose, relevant work and research experience, and letters of recommendation. The Graduate Record Examination (GRE) is required (optional in the 2020-2021 application cycle). Applicants from non-English speaking countries should provide evidence of competence in English on the Test of English as a Foreign Language (TOEFL). (For additional information on Stanford University requirements regarding TOEFL, visit the Stanford Graduate Admissions website page related to tests (https://gradadmissions.stanford.edu/applying/starting-your-application/required-exams/).

Required Supporting Documents (to be submitted in the Stanford Graduate Admissions Application)

- Statement of Purpose that includes area(s) of interest
- Three letters of recommendation
- Official GRE General Test scores
- Official TOEFL scores (if applicable)
- Unofficial transcripts for all college/university degrees
- CV with relevant work and research experience

The GRE is required, yet optional for the 20-21 admissions cycle.

Advising

Academic advising by department faculty is a critical component of graduate students' education.

All matriculating students are assigned a faculty adviser from the group of core faculty to help them design their academic program.

The program adheres to the advising guidelines and responsibilities listed by the Office of the Vice Provost for Graduate Education (https://vpge.stanford.edu/academic-guidance/advising-mentoring/) and in the Graduate Academic Policies and Procedures (https://gap.stanford.edu/handbooks/gap-handbook/chapter-3/subchapter-3/page-3-3-1/) manual.

See the 'Graduate Advising (p. 5)' tab of this section of this bulletin for additional information on advising expectations for student and faculty.

After matriculating, students meet with their academic advisers to plan out an individually tailored curriculum. Students who matriculate with prior training in epidemiology and statistics may replace introductory core courses with more advanced courses, subject to approval. Beyond core course requirements, students select electives that delve deeper into a particular area of specialization of their choosing. Innovative online learning approaches will help meet the needs of physician-students, who will also be busy with clinical duties.

Degree Requirements

Students take core courses in epidemiology and biostatistics. Ph.D. students must complete a minimum of 135 units (as per University requirements), including 45 course units exclusive of EPI 236 Epidemiology Research Seminar, EPI 299 Directed Reading in Epidemiology, and EPI 399 Graduate Research.

		Units
Epidemiologic methods sequence (required)		
EPI 225	Introduction to Epidemiologic and Clinical Research Methods	3
EPI 226	Intermediate Epidemiologic and Clinical Research Methods	3
EPI 227	Advanced Epidemiologic Methods	3
EPI 264	Foundations of Statistical and Scientific Inference	1
Biostatistics sequence (required)		
EPI 259	Introduction to Probability and Statistics for Epidemiology	3
EPI 261	Intermediate Biostatistics: Analysis of Discrete Data	3
EPI 262	Intermediate Biostatistics: Regression, Prediction, Survival Analysis	3
Additional Methodologic coursework (must take at least 3 courses totaling at least 9 units)		
Any 200-level STATS course (other than STATS 260)		
STATS 116	Theory of Probability	
EPI 216	Analytical and Practical Issues in the Conduct of Clinical and Epidemiologic Research	2-3
HRP 252	Outcomes Analysis	
HRP 392	Analysis of Costs, Risks, and Benefits of Health Care	
EPI 206	Meta-research: Appraising Research Findings, Bias, and Meta-analysis	3
CS 229	Machine Learning	3-4
COMM 382	Big Data and Causal Inference	
BIOMEDIN 215	Data Science for Medicine	
CS 246	Mining Massive Data Sets	
STATS 202	Data Mining and Analysis	
CS 106A	Programming Methodology	3-5
BIOMEDIN 217/ CS 275	Translational Bioinformatics	
GENE 224	Principles of Pharmacogenomics	
BIOMEDIN/DBIO/ CS 273A	The Human Genome Source Code	
GENE 210/ DBIO 220	Genomics and Personalized Medicine	
Electives coursework: Infectious Disease Epidemiology/ Global Health/Genetics/Social and Behavioral Epidemiology/ Community-based Research/Cancer Epidemiology/Clinical Trials		
Take at least one course in 3 distinct areas, for a total of at least 9 units.		3-4
EPI 206	Meta-research: Appraising Research Findings, Bias, and Meta-analysis	3
EPI 219	Evaluating Technologies for Diagnosis, Prediction and Screening	3
EPI 224	Genetic Epidemiology	3
EPI 231	Epidemiology of Infectious Diseases	3
EPI 235	Designing Research-Based Interventions to Solve Global Health Problems	3-4
EPI 237	Practical Approaches to Global Health Research	1-3
EPI 247	Epidemic Intelligence: How to Identify, Investigate and Interrupt Outbreaks of Disease	4
EPI 251	Design and Conduct of Clinical Trials	3
EPI 253	Cancer Epidemiology and Prevention	3
EPI 263	Social Epidemiology	2
EPI 267	Life Course Epidemiology	2
EPI 270	Big Data Methods for Behavioral, Social, and Population Health Research	2-3
EPI 272	The Science of Community Engagement in Health Research	3
BIO 247	Genomic approaches to the study of human disease	3
CHPR 247	Methods in Community Assessment, Evaluation, and Research	3
HRP 204	Models for Understanding and Controlling Global Infectious Diseases	3-4
HRP 263	Advanced Decision Science Methods and Modeling in Health	3
Other core courses/requirements (details in PhD handbook)		
MED 255	The Responsible Conduct of Research	1
EPI 236	Epidemiology Research Seminar	1
EPI 399	Graduate Research	1-18
Electives		
Total Units Required		**135**

Students should take EPI 236 Epidemiology Research Seminar at least 3 quarters (3 units).

Additional Requirements

See the department's website (https://med.stanford.edu/epidemiology-dept/education/graduate-programs/phd-ecr2/phd-requirements.html) and PhD Epidemiology & Clinical Research Handbook for additional requirements and sample programs.

COVID-19 Policies

On July 30, the Academic Senate adopted grading policies effective for all undergraduate and graduate programs, excepting the professional Graduate School of Business, School of Law, and the School of Medicine M.D. Program. For a complete list of those and other academic policies relating to the pandemic, see the 'COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes/#tempdepttemplatetabtext)' section of this bulletin.

The Senate decided that all undergraduate and graduate courses offered for a letter grade must also offer students the option of taking the course for a "credit" or "no credit" grade and recommended that deans, departments, and programs consider adopting local policies to count courses taken for a "credit" or "satisfactory" grade toward the fulfillment of degree-program requirements and/or alter program requirements as appropriate.

Graduate Degree Requirements

Grading

The Department of Epidemiology & Population Health counts all courses taken in academic year 2020-21 with a grade of 'CR' (credit) or 'S' (satisfactory) towards satisfaction of graduate degree requirements that otherwise require a letter grade.

Graduate Advising Expectations

The Department of Epidemiology & Population Health is committed to providing academic advising in support of graduate student scholarly and professional development. When most effective, this advising relationship entails collaborative and sustained engagement by both the adviser and the advisee. As a best practice, advising expectations should be periodically discussed and reviewed to ensure mutual understanding. Both the adviser and the advisee are expected to maintain professionalism and integrity.

Faculty advisers guide students in key areas such as selecting courses, designing and conducting research, developing teaching pedagogy, navigating policies and degree requirements, and exploring academic opportunities and professional pathways.

Graduate students are active contributors to the advising relationship, proactively seeking academic and professional guidance and taking responsibility for informing themselves of policies and degree requirements for their graduate program.

E&PH programs adhere to the advising guidelines and responsibilities listed by the Office of the Vice Provost for Graduate Education (https://vpge.stanford.edu/academic-guidance/advising-mentoring/) and in the Graduate Academic Policies and Procedures (https://gap.stanford.edu/handbooks/gap-handbook/chapter-3/subchapter-3/page-3-3-1/) manual.

For a statement of University policy on graduate advising, see the 'Graduate Advising (http://exploredegrees.stanford.edu/graduatedegrees/#advisingandcredentialstext)' section of this bulletin.

Department Chair: Melissa Bondy

Director: Steven Goodman

Core Faculty and Academic Teaching Staff:

Michael Baiocchi, Melissa Bondy, Mark Cullen, Lisa Goldman Rosas, Steven Goodman, Victor Henderson, Ann Hsing, John Ioannidis, Esther John, Abby King, Allison Kurian, Yvonne Maldonado, Lorene Nelson, Michelle Odden, Lesley Park, Julie Parsonnet, Rita Popat, Patricia Rodriguez Espinosa, Kristin Sainani, Julia Simard

Affiliated Faculty by Department:

- Biomedical Data Science: Ying Lu
- Dermatology: Eleni Linos
- Medicine: Jason Andrews, Themistocles Assimes, Glenn Chertow, Jennifer Lee, Stephen Luby, Latha Palaniappan, David Rehkopf, Thomas Robinson, Marcia Stefanick, Holly Tabor
- Pediatrics: Suzan Carmichael, Bonnie Halpern-Felsher, Paul Fisher, Angelle (Desiree) LaBeaud, Mary Leonard, David Maahs, Lee Sanders, Gary Shaw

Courses

EPI 199. Undergraduate Research. 1-18 Unit.
Students undertake investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

EPI 202. R Fundamentals for Health Research. 1-2 Unit.
This introductory course is a practicum in which students will learn the basics of R and use the programming language to analyze health datasets by application of classical statistical methods. A familiarity with basic descriptive and inferential statistics is required. It is assumed that students will have no (or very little) prior experience with R. Class sessions will include some lecture content and hands-on coding by each student on their own computers. Students will practice using R with open-source and simulated datasets. The primary goal of the course is to equip students with a basic and fundamental understanding of R's capabilities, experience using R with practice datasets, and the ability to extend their facility with R as their needs dictate. Students enrolled for 2 units will have additional weekly practice problems assigned. Priority for enrollment given to CHPR masters students, who must take the course for a letter grade.
Same as: CHPR 202

EPI 206. Meta-research: Appraising Research Findings, Bias, and Meta-analysis. 3 Units.
Open to graduate, medical, and undergraduate students. Appraisal of the quality and credibility of research findings; evaluation of sources of bias. Meta-analysis as a quantitative (statistical) method for combining results of independent studies. Examples from medicine, epidemiology, genomics, ecology, social/behavioral sciences, education. Collaborative analyses. Project involving generation of a meta-research project or reworking and evaluation of an existing published meta-analysis. Prerequisite: knowledge of basic statistics.
Same as: CHPR 206, MED 206, STATS 211

EPI 214. Scientific Writing. 2-3 Units.
(Formerly HRP 214) Step-by-step through the process of writing and publishing a scientific manuscript. How to write effectively, concisely, and clearly in preparation of an actual scientific manuscript. Students are encouraged to bring a manuscript on which they are currently working to develop and polish throughout the course. Please note 3-units students will additionally write and revise a manuscript.

EPI 216. Analytical and Practical Issues in the Conduct of Clinical and Epidemiologic Research. 2-3 Units.
(Formerly HRP 216) Topics include: advanced aspects of study design and data analyses; evaluating confounding and interaction; modeling continuous characteristics of exposure; building prediction models; methods of summarizing literature and quantifying effect sizes (meta-analysis); handling missing data; and propensity score methods. 3 units requires a data analysis project. Prerequisites: 258 or 261, or consent of instructor.

EPI 219. Evaluating Technologies for Diagnosis, Prediction and Screening. 3 Units.
(Formerly HRP 219) New technologies designed to monitor and improve health outcomes are constantly emerging, but most fail in the clinic and in the marketplace because relatively few are supported by reliable, reproducible evidence that they produce a health benefit. This course covers the designs and methods that should be used to evaluate technologies to diagnose patients, predict prognosis or other health events, or screen for disease. These technologies can include devices, statistical prediction rules, biomarkers, gene panels, algorithms, imaging, or any information used to predict a future or a previously unknown health state. Specific topics to be covered include the phases of test development, how to frame a proper evaluation question, measures of test accuracy, Bayes theorem, internal and external validation, prediction evaluation criteria, decision analysis, net-utility, ROC curves, c-statistics, net reclassification index, decision curves and reporting standards. Examples of technology assessments and original methods papers are used. Knowledge of statistical software is not required, although facility with at least Excel for basic calculations is needed. Open to students with an understanding of introductory biostatistics, epidemiologic and clinical research study design. Undergraduates may enroll with consent of instructor.

EPI 223. Introduction to Data Management and Analysis in SAS. 2 Units.
(Formerly HRP 223) Provides hands-on introduction to basic data management and analysis techniques using SAS. Data management topics include: Introduction to SAS and SAS syntax, importing data, creating and reading SAS datasets, data cleaning and validation, creating new variables, and combining data sets. Analysis techniques include: basic descriptive statistics (e.g., means, frequency) and bivariate procedures for continuous and categorical variables (e.g., t-tests, chi-squares).

EPI 224. Genetic Epidemiology. 3 Units.
This course presents fundamental concepts and methods in genetic epidemiology, with examples on genetic studies of chronic diseases, including cancer, cardiovascular disease, metabolic conditions, and autoimmune diseases. It will provide an overview of various study designs, including family studies, and it covers fundamental analyses, inferences, and their strengths and limitations. It will include topics such as assessing genetic influences on disease; advances in genomics technology; family based study designs for linkage, exome sequencing and case-parent trios; candidate gene and genome-wide association studies of both common and rare genetic variants; gene-environment interactions, epistasis and non-Mendelian genetics; software and web-based data resources; ethical issues in genetic epidemiology; and applications of genetic epidemiology to clinical practice and public health. Guest speakers will discuss these concepts through the lens of various chronic diseases. Prerequisite: introductory biostatistics or epidemiology, biology, and genetics. Biostatistics (intro) or epidemiology (intro), biology, genetics (intro).

EPI 225. Introduction to Epidemiologic and Clinical Research Methods. 3 Units.
(Formerly HRP 225) The skills to design, carry out, and interpret epidemiologic studies, particularly of chronic diseases. Topics: epidemiologic concepts, sources of data, cohort studies, case-control studies, cross-sectional studies, sampling, measures of association, estimating sample size, and sources of bias. Prerequisite: A basic/introductory course in statistics or consent of instructor.

EPI 226. Intermediate Epidemiologic and Clinical Research Methods. 3 Units.
(Formerly HRP 226) The principles of study design, measurement, confounding, effect modification, and strategies for minimizing bias in clinical and epidemiologic studies. Prerequisite: 225 or consent of instructor.

EPI 227. Advanced Epidemiologic Methods. 3 Units.
(Formerly HRP 227) Theory and applied methods for causal inference in epidemiology. Focus on the potential outcomes model and related methods including inverse probability weights, G-computation, and targeted maximum likelihood estimation. Other contemporary topics may be included. Learning is facilitated through in-class discussion, critical review of peer-reviewed literature, and applied laboratories in R. Prerequisites: EPI 225, EPI 226, and EPI 261 or equivalent (or permission of instructor).

EPI 229. Stanford CTSA Scholars Seminar. 1 Unit.
Preference to trainees awarded Stanford internal KL2, TL1 grants. Focus is on students and junior faculty who have received a CTSA KL2 or TL1 Award. Discussions include progress and challenges involved in starting and conducting clinical research, current courses, time management and resources; support from peers; education and professional development. All scholars are required to attend a weekly seminar series meeting throughout the year that will cover an array of cross-cutting methodological topics with published examples of implementation. Prerequisite: Awarded a CTSA KL2, TL1 Grant or Spectrum UL1.

EPI 231. Epidemiology of Infectious Diseases. 3 Units.
(Formerly HRP 231) Principles of the transmission of the infectious agents (viruses, bacteria, rickettsiae, mycoplasma, fungi, and protozoan and helminth parasites). The role of vectors, reservoirs, and environmental factors. Pathogen and host characteristics that determine the spectrum of infection and disease. Endemicity, outbreaks, and epidemics of selected infectious diseases. Principles of control and surveillance.

EPI 235. Designing Research-Based Interventions to Solve Global Health Problems. 3-4 Units.
The excitement around social innovation and entrepreneurship has spawned numerous startups focused on tackling world problems, particularly in the fields of education and health. The best social ventures are launched with careful consideration paid to research, design, and efficacy. This course offers students insights into understanding how to effectively develop, evaluate, and scale social ventures. Using TeachAids (an award-winning nonprofit educational technology social venture used in 82 countries) as a primary case study, students will be given an in-depth look into how the entity was founded and scaled globally. Guest speakers will include world-class experts and entrepreneurs in Philanthropy, Medicine, Communications, Education, and Technology. Open to both undergraduate and graduate students.
Same as: AFRICAST 135, AFRICAST 235, EDUC 135, EDUC 335, HUMBIO 26, MED 235

EPI 236. Epidemiology Research Seminar. 1 Unit.
(Formerly HRP 236) Weekly forum for ongoing epidemiologic research by faculty, staff, guests, and students, emphasizing research issues relevant to disease causation, prevention, and treatment. May be repeated for credit.

EPI 237. Practical Approaches to Global Health Research. 1-3 Unit.
(Formerly IPS 290 and HRP 237) How do you come up with an idea for a useful research project in a low resource setting? How do you develop a research question, prepare a concept note, and get your project funded? How do you manage personnel in the field, complex cultural situations, and unexpected problems? How do you create a sampling strategy, select a study design, and ensure ethical conduct with human subjects? This course takes students through the process of health research in under-resourced countries from the development of the initial research question and literature review to securing support and detailed planning for field work. Students progressively develop and receive weekly feedback on a concept note to support a funding proposal addressing a research question of their choosing. Aimed at graduate students interested in global health research, though students of all disciplines interested in practical methods for research are welcome. Undergraduates who have completed 85 units or more may enroll with instructor consent. Sign up for 1 unit credit to audit class sessions or 3 units to both participate in classes and develop a concept note.
Same as: INTLPOL 290, MED 226

EPI 238. Genes and Environment in Disease Causation: Implications for Medicine and Public Health. 2-3 Units.
(Formerly HRP 238) The historical, contemporary, and future research and practice among genetics, epidemiology, clinical medicine, and public health as a source of insight for medicine and public health. Genetic and environmental contributions to multifactorial diseases; multidisciplinary approach to enhancing detection and diagnosis. The impact of the Human Genome Project on analysis of cardiovascular and neurological diseases, and cancer. Ethical and social issues in the use of genetic information. This course must be taken for a minimum of 3 units and a letter grade to be eligible for Ways credit. Prerequisites:Human Biology core or Biology Foundations or consent of instructor.
Same as: HUMBIO 159

EPI 239. Applications of Causal Inference Methods. 2 Units.
See http://rogosateaching.com/stat209/. Application of potential outcomes formulation for causal inference to research settings including: mediation, compliance adjustments, time-1 time-2 designs, encouragement designs, heterogeneous treatment effects, aggregated data, instrumental variables, analysis of covariance regression adjustments, and implementations of matching methods. Prerequisite: STATS 209A/MSE 327 or other introduction to causal inference methods. (Formerly HRP 239).
Same as: EDUC 260A, STATS 209B

EPI 244. Developing Measurement Tools for Health Research. 2 Units.
(Formerly HRP 244) The focus of this course is on providing the skills necessary to develop, validate and administer both qualitative and quantitative measures and instruments. Topics will include creating valid measures, ensuring the measures used address and apply to the research questions, design and samples; determining when to use standardized measures or develop new ones; instrument validation techniques; factor analysis; and survey administration, including determining the most effective way of administering measures (e.g., online, paper-and-pencil, ACASI) and the best way to design the survey.

EPI 245. Intensive Course in Clinical Research. 2 Units.
The Intensive Course in Clinical Research (ICCR) is a one-week immersion course designed for new or aspiring clinical investigators, medical students, residents, graduate students, fellows and junior faculty interested in pursuing careers in clinical and transnational research. Students spend five days and four evenings immersed in all aspects of research study design and performance. The format combined didactic with intense group/team activities focused on practical issues in clinical research design - from selection of a researchable study question through actual writing of a research proposal. Lectures and panel discussions are presented by an accomplished faculty of Stanford clinical researchers and key leaders from the Stanford community. Every presentation includes a discussion of relevant issues. The course is supported by over 40 faculty and fellows from across the School of Medicine.

EPI 247. Epidemic Intelligence: How to Identify, Investigate and Interrupt Outbreaks of Disease. 4 Units.
(HUMBIO students must enroll in HUMBIO 57. Med/Graduate students must enroll in EPI 247.) We will cover: the components of public health systems in the US; principles of outbreak investigation and disease surveillance; different types of study design for field investigation; visualization and interpretation of public health data, including identification and prevention of biases; and implementation of disease control by public health authorities. Students will meet with leaders of health departments of the state and the county and will be responsible for devising, testing and evaluating a field questionnaire to better understand the complexities of field research. (Formerly HRP 247).
Same as: HUMBIO 57

EPI 250. Understanding Evidence-Based Medicine: Hands-on experience. 3-4 Units.
How can one practice evidence-based medicine and make evidence-based decisions for clinical practice and policy making? Using pivotal papers published in the recent scientific literature addressing important clinical questions on diverse medical topics, we will probe a wide range of types of studies, types of targeted therapeutic or preventive interventions, and types of studied outcomes (effectiveness and/or safety), including RCTs, observational studies, epidemiologic surveillance studies, systematic reviews-umbrella reviews-meta-analyses-meta-analyses of individual patient data, studies on the evaluation of diagnostic tests and prognostic models, economic analyses studies, and guidelines. Students enrolled for 4 units will complete an additional project or other engagement approved by the instructor. MD studies enroll for +/-. GR students enroll for Letter grade.
Same as: CHPR 205, MED 250

EPI 251. Design and Conduct of Clinical Trials. 3 Units.
(Formerly HRP 251) The rationale for phases 1-3 clinical trials, the recruitment of subjects, techniques for randomization, data collection and endpoints, interim monitoring, and reporting of results. Emphasis is on the theoretical underpinnings of clinical research and the practical aspects of conducting clinical trials.

EPI 253. Cancer Epidemiology and Prevention. 3 Units.
(Formerly HRP 253) This course focuses on the role of epidemiology in cancer etiology, prevention, and control. We will discuss descriptive epidemiology, including cancer trends and patterns, natural history, and biologic characteristics as well as etiology of selected cancers. the influence of environmental and genetic factors and their interplay on the development of cancer are discussed as well as methodologic issues related to investigations of these studies. Principles and problems involved in cancer prevention and screening are covered. Student evaluation is based on a brief presentation and a paper on the descriptive epidemiology of a selected cancer, and participation in class discussions.

EPI 258. Introduction to Probability and Statistics for Clinical Research. 3 Units.
(Formerly HRP 258) Open to medical and graduate students; required of medical students in the Clinical Research Scholarly Concentration. Tools to evaluate medical literature. Topics include random variables, expectation, variance, probability distributions, the central limit theorem, sampling theory, hypothesis testing, confidence intervals, correlation, regression, analysis of variance, and survival analysis.

EPI 259. Introduction to Probability and Statistics for Epidemiology. 3 Units.
(HUMBIO students must enroll in HUMBIO 89X. Med/Graduate students must enroll in EPI 259.) Topics: random variables, expectation, variance, probability distributions, the central limit theorem, sampling theory, hypothesis testing, confidence intervals. Correlation, regression, analysis of variance, and nonparametric tests. Introduction to least squares and maximum likelihood estimation. Emphasis is on medical applications. (Formerly HRP 259).
Same as: HUMBIO 89X

EPI 261. Intermediate Biostatistics: Analysis of Discrete Data. 3 Units.
(Formerly HRP 261) Methods for analyzing data from case-control and cross-sectional studies: the 2x2 table, chi-square test, Fisher's exact test, odds ratios, Mantel-Haenzel methods, stratification, tests for matched data, logistic regression, conditional logistic regression. Emphasis is on data analysis in SAS or R. Special topics: cross-fold validation and bootstrap inference.
Same as: BIOMEDIN 233, STATS 261

EPI 262. Intermediate Biostatistics: Regression, Prediction, Survival Analysis. 3 Units.
(Formerly HRP 262) Methods for analyzing longitudinal data. Topics include Kaplan-Meier methods, Cox regression, hazard ratios, time-dependent variables, longitudinal data structures, profile plots, missing data, modeling change, MANOVA, repeated-measures ANOVA, GEE, and mixed models. Emphasis is on practical applications. Prerequisites: basic ANOVA and linear regression.
Same as: STATS 262

EPI 263. Social Epidemiology. 2 Units.
Preference to graduate students with prior coursework in Epidemiology. Focuses on understanding the theory and empirical evidence that shows support for the relationships between social environments and health. Covers four main topics: the historical development of social epidemiology, and a survey of the major theories in social epidemiology; the three main empirical approaches used to generate new knowledge in social epidemiology: traditional observational studies, quasi-experimental studies and experimental approaches; how the constructs of social class, race/ethnicity and gender are used in social epidemiology; new emerging empirical approaches within the field including the application of causal, machine learning and complex systems methods.

EPI 264. Foundations of Statistical and Scientific Inference. 1 Unit.
(Formerly HRP 264) The course will consist of readings and discussion of foundational papers and book sections in the domains of statistical and scientific inference. Topics to be covered include philosophy of science, interpretations of probability, Bayesian and frequentist approaches to statistical inference and current controversies about the proper use of p-values and research reproducibility. Recommended preparation: At least 2 quarters of biostatistics and one of epidemiology. Intended for second year Masters students or PhD students with at least 1 year of preceding graduate training.
Same as: STATS 264

EPI 265. Advanced Methods for Meta-Analysis. 2 Units.
(Formerly HRP 265) Meta-analysis is a method to quantitatively combine information from multiple studies; this combination is also called 'research synthesis.' Historically, it has been used to combine studies with a similar design, such as randomized controlled trials or observational studies examining similar interventions or exposures. However, evidence about a given relationship is often provided by many studies with different designs, or studies that can be 'fit together' to create an evidence base. This can only be done with advanced meta-analytic methods. The course will cover advanced methods for research synthesis, including multivariate meta-analysis for multiple outcomes, generalized evidence synthesis of multiple study designs, and network meta-analysis for multiple interventions. These techniques are being increasingly used in evidence-based medicine, health technology assessments and policy making. Recommended preparation: EPI 206, and at least 2 quarters of biostatistics and one of epidemiology, including clinical research design. Familiarity with logistic and linear regression modeling required.

EPI 267. Life Course Epidemiology. 2 Units.
(Formerly HRP 267) The focus of this course is on understanding the evidence for how exposure at multiple levels and at multiple ages influences an individual's health at any given time. The course emphasizes the primary theories used to examine life course determinants of health and how these theories both facilitate and impede research. A secondary focus is on understanding the methodological challenges to studying health from a life course perspective, as well as how knowledge of life course determinants of health can inform interventions to improve health from a population perspective.

EPI 270. Big Data Methods for Behavioral, Social, and Population Health Research. 2-3 Units.
This course will expose students from a variety of quantitative backgrounds to study design and analysis strategies for addressing specific hypotheses using the varied sources of behavioral, social, and population health sciences research data, and the analytic tools available for analyzing these data. The purpose of this foundational course is to lay the groundwork to have a framework for conceptualizing experiments and observational studies that rely on big data in behavioral science and population health. Weekly course meetings will be organized into three section: (1) Core lecture/discussion: weekly lecture and/or discussion of general principles; (2) Module A (Tuesday): large and complex data from internet, commercial, administrative health record, population database sources; and (3) Module B (Thursday): intensive or voluminous longitudinal data from mHealth, smartphone, and sensor technologies. All students are required to enroll in the core course and at least 1 data type module (option to enroll in both). Lecture and core modules are one unit each so students should register appropriately for the units that match their schedule. Register for 2 units if core lecture and one discussion section module, register for 3 units if core lecture and both discussion section modules. Prerequisites: EPI 258/259 (or equivalent statistics course, please contact instructors for approval). Students must have some experience in statistical programming in SAS or R.

EPI 272. The Science of Community Engagement in Health Research. 3 Units.
The Science of Community Engagement in Health Research course will focus on how the science of community engagement can be applied to diverse health-related research topics across the translational spectrum with the ultimate goal of high quality research that transforms human health and addresses health disparities. The course will provide historical context, theoretical frameworks, foundational skills in diverse community engagement methodologies, and tools for examining the effectiveness of various engagement strategies aimed. Specifically, the course will cover: 1) Historical context for community engagement in health-related research; 2) Evolution of community engagement as a science; 3) Theoretical frameworks for various community engagement approaches; 4) Community-Based Participatory Research (CBPR); 5) Community engagement strategies for different stages of translational research; and 6) Evaluation of various engagement strategies; and 7) Ethics of community engagement. Students will gain practical experience in various community engagement tools and strategies to help guide the development of a community engagement plan responsive to community needs. Challenges and benefits of establishing community partnerships will be highlighted by real-world examples. nThe course will include lectures; interactive student-led presentations and guided exercises; class discussions among invited speakers, students and instructors; individual and group assignments; and organized small-group and experiential activities. Course readings will demonstrate the need and opportunity for interdisciplinary community engagement approaches and will illustrate how to conduct innovative community-engaged research. nThe Science of Community Engagement course is intended to reach students with diverse research interests, including clinical research, community health, health research and policy, epidemiology, prevention research, environmental health, etc.
Same as: CHPR 227

EPI 273. Essentials of Clinical Research at Stanford. 1 Unit.
The course will consist of an introduction to the fundamentals of clinical research at Stanford, including the science of clinical research (design and analysis) and logistics (GCP, data management, regulatory). Material will be covered in approximately 4-6 3 hour sessions per quarter.

EPI 275. Population Health Research. 3 Units.
This course provides hands-on experience for students wishing to undertake health-related research using registry data covering the population of Denmark. Students will be instructed in basic R-programming, which they will use to analyze anonmyized Danish data (prior experience with R not required). Students will become familiar with the Danish data and develop a detailed original research proposal on a health-related topic addressable within the Danish data. Most students should be able to complete their proposed research in independent studies after successful completion of this course. nPrerequisites: HRP 259 or comparable introductory course in statistics. Special permission from the instructor required without prerequisites.

EPI 291. Curricular Practical Training. 1-18 Unit.
Curricular Practical Training in HRP.

EPI 292. Advanced Statistical Methods for Observational Studies. 2-3 Units.
Design principles and statistical methods for observational studies. Topics include: matching methods, sensitivity analysis, and instrumental variables. 3 unit registration requires a small project and presentation. Computing is in R. Pre-requisites: EPI 261 and 262 or STATS 209 (EPI 239), or equivalent. See http://rogosateaching.com/somgen290/.
Same as: CHPR 266, EDUC 260B, STATS 266

EPI 299. Directed Reading in Epidemiology. 1-18 Unit.
Epidemiology, preventive medicine, medical genetics, public health, occupational or environmental medicine, international health, or related fields. May be repeated for credit. Prerequisite: consent of instructor.

EPI 370. Medical Scholars Research. 4-18 Units.
Provides an opportunity for student and faculty interaction, as well as academic credit and financial support, to medical students who undertake original research. Enrollment is limited to students with approved projects.

EPI 370W. Medical Scholars Research. 4-18 Units.
Provides academic credit and financial support to medical scholar students who undertake original research under the mentorship of faculty at other institutions. Pre-requisite: Approval of the Medical Student Scholarship Committee.
Same as: Away

EPI 399. Graduate Research. 1-18 Unit.
Investigations sponsored by individual faculty members. Prerequisite: consent of instructor.

EPI 801. TGR Project. 0 Units.
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EPI 802. TGR Dissertation. 0 Units.
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