

CLINICAL SCIENCE (PHD)

Overview

The Clinical Science PhD program is designed for qualified individuals who have already earned a health care graduate or professional degree (i.e., physicians, MSPH graduates, biostatisticians, epidemiologists, nurses, pharmacists, and dentists) or a graduate degree related to health sciences.

The overall goal of CLSC doctoral training program is to prepare nationally competitive clinician/clinical scientists who are able to translate across the discovery-community continuum. Students in our program are highly motivated and bright individuals who seek additional rigorous training to become leaders in their field and make significant contributions to improving the health of citizens.

Admission Requirements

All completed application materials for the PhD Program must be submitted by February 1st of each year to be considered for admission. There is only one application submission and review process per year. CLSC accepted applicants may start in the summer or fall term. Specific course offerings can be previewed at our Course Books and Schedules section of this page under Resources.

Clinical Science PhD Program (CI & HIT tracks)

Qualified clinicians who have already earned either a professional doctoral degree (e.g., MD, DO, DPT, DDS, PharmD) or a health-related master's degree (nursing, public health, epidemiology, psychology, biostatistics, etc.) are eligible to apply to the CLSC PhD Program.

Minimum Criteria for Admission

Meeting the minimum criteria does not guarantee admission.

- An undergraduate GPA of at least 3.0 (on a 4.0 scale)
- An acceptable and verifiable GRE, MCAT or PCAT score or earned MS/MPH or PhD from an accredited US School
- Health related master's or professional doctoral degree. Individuals without a health related degree but with an exceptional background and relevant experience in the health care research field are encouraged to contact one of the Executive Leadership team members to discuss their interest further.
- Your submitted CV should document your previous research experience.
- In your personal statement portion of the application, you should identify the focus for your dissertation and your research mentor. Your identified research mentor should be one of your letters of support.

You are encouraged to speak with CLSC staff and/or faculty before applying to the program.

Please note that the Clinical Science Program does not provide stipends to assist with tuition and/or room and board expenses. In addition, we currently do not have any research or teaching assistantships to support the educational costs of international students.

International Applicant Additional Admission Criteria

In addition to the general admission requirements listed above, international applicants must meet additional requirements dictated by the University.

Please note that the Clinical Science Program does not provide stipends to assist with tuition and/or room and board expenses. In addition we

currently do not have any research or teaching assistantships to support the educational costs of international students.

The application package must include the following:

- For **Upload A** please provide your CV listing Education and training, awards, publications, presentations, grants and research experience and other scholarly activity.
- Additional Non-academic and professional experiences can be detailed in **Upload B** of the electronic application.
- Identify your selected track of study, a proposed research project for your thesis, and your research mentor. In addition, include a description of how this program will enhance your career. (Provided in Upload C of the electronic application)
- **Three recommendation letters** (Once you submit your application on-line, your references will receive an e-mail explaining how to upload their letters to the on-line application system)
- **Transcripts** from **all** higher education institutions. Students are not permitted to personally issue, send or deliver transcripts to program staff: All transcripts must be officially issued/sealed by and sent from the originating college/university institution. Therefore, when requesting an official transcript from your school, **please instruct the school to send your transcript directly from their office to:**

- Clinical Science Program
ATTN: Amanda Whiting
University of Colorado Denver
12401 East 17th Avenue, Campus Box B141
Leprino Bldg, Rm 351
Aurora, CO 80045

Official electronic transcripts are encouraged and should be amanda.g.whiting@ucdenver.edu

Degree Requirements

Clinical Investigation Track

Code	Title	Hours
BIOS 6601	Applied Biostatistics I	3
BIOS 6602	Applied Biostatistics II	3
CLSC 7150	Ethics and Responsible Conduct of Research	1
EPID 6630	Epidemiology	3
CLSC 6270	Critical Appraisal Seminars in Clinical Science	1
CLSC 7202	Clinical Outcomes and Applications	3
CLSC 7300	Scientific Grant Review Process: CCTSI Proposals	1
<i>Choose 1 from the following:</i>		
BIOS 6648	Design and Conduct of Clinical Research	
EPID 6626	Research Methods in Epidemiology	
BIOS 6623	Advanced Data Analysis	
EPID 6631	Analytical Epidemiology	3
CLSC 6210	Research Seminars in Clinical Science	1
CLSC 7101	Grant Writing I	1
CLSC 8990	Doctoral Thesis	1-10

- 22-23 Required Clinical Investigation Course Credits
- 7-8 Elective Course Credits
- **Total required course hours for degree = 30**

Health Information Technology Track

Code	Title	Hours
BIOS 6601	Applied Biostatistics I	3
BIOS 6602	Applied Biostatistics II	3
CLSC 7150	Ethics and Responsible Conduct of Research	1
EPID 6630	Epidemiology	3
CLSC 6270	Critical Appraisal Seminars in Clinical Science	1
<i>Choose 1 from the following:</i>		
EPID 6626	Research Methods in Epidemiology	
EPID 6631	Analytical Epidemiology	
BIOS 6648	Design and Conduct of Clinical Research	
CLSC 6270	Critical Appraisal Seminars in Clinical Science	
CLSC 7202	Clinical Outcomes and Applications	
CLSC 7202	Clinical Outcomes and Applications	3
<i>Choose 1 from the following:</i>		
EPID 6626	Research Methods in Epidemiology	
EPID 6631	Analytical Epidemiology	
CLSC 6270	Critical Appraisal Seminars in Clinical Science	
BIOS 6648	Design and Conduct of Clinical Research	
CLSC 7202	Clinical Outcomes and Applications	
CLSC 6800	Introduction to Health Information Technology	3
CLSC 6820	Management of Healthcare Information Technology	3
or NURS 6289	Information Systems Life Cycle	
NURS 6293	Database Mgmt Systems	3
or ISMG 6080	Database Management Systems	
<i>Choose 1 from the following:</i>		
BIOS 6648	Design and Conduct of Clinical Research	
EPID 6626	Research Methods in Epidemiology	
BIOS 6623	Advanced Data Analysis	
EPID 6631	Analytical Epidemiology	
<i>Choose 1 from the following:</i>		
EPID 6626	Research Methods in Epidemiology	
EPID 6631	Analytical Epidemiology	
BIOS 6648	Design and Conduct of Clinical Research	
CLSC 6270	Critical Appraisal Seminars in Clinical Science	
CLSC 7202	Clinical Outcomes and Applications	
CLSC 6210	Research Seminars in Clinical Science	1
CLSC 7101	Grant Writing I	1
CLSC 8990	Doctoral Thesis	1-10

- 27-29 required Health Information Technology course credits
- 1 - 3 elective course credits
- **Total required course hours for degree = 30**

Learning Objectives

Clinical investigation is the discipline by which physicians, clinicians and other health related disciplines translate knowledge gained in the basic sciences or the laboratory setting to develop interventions and strategies to improve health outcomes. It can also involve translating knowledge gained about the efficacy of successful strategies conducted in the academic clinical setting to the community setting to improve health related outcomes.

The mission of the Clinical Investigation Track is to train the next generation of clinician scientists who will pursue careers in clinical translational research. Clinical investigation is clearly a primary mission of academic medical and health centers, and properly trained clinicians and scientists are uniquely qualified to engage in investigative and translational studies. Training occurs across many disciplines:

- Clinical trial design
- Biopharmaceutics and pharmacokinetics
- Biodiagnostics
- Laboratory-based molecular biology techniques that assist in bridging basic and clinical sciences

Core Competencies

- Apply relevant study design methods commonly used in clinical translational investigative studies
- Interpret results from common molecular and cellular biology laboratory experiments
- Develop a well-designed research thesis project relevant to the clinical and translational sciences

HIT: Provides a background in clinical informatics: the study of how medical data and knowledge can be stored, analyzed, and delivered to facilitate research and to improve the quality, safety, and efficiency of care. Students will develop a fundamental understanding of the technical and organizational challenges particular to the field of health information technology and will train in evaluation and research methods. Graduates will be prepared for leadership roles in developing, implementing, and evaluating clinical informatics applications in academia, industry and clinical practice. Training occurs in the following disciplines:

- Electronic health records
- Decision support
- Telehealth
- Public health informatics
- Research informatics
- Standards and data integrity
- Privacy and security

Core Competencies

- Demonstrate understanding of relevant standards and terminologies for communication and representation of health data
- Demonstrate understanding of major types of clinical and administrative information systems and how they are integrated
- Demonstrate understanding of computerized provider order entry (CPOE) and clinical decision support systems (CDSS), including
 - Success factors for implementation
 - Methods of encoding rules/logic
- Ability to assess and develop methods to protect privacy (e.g. HIPAA issues) and security (confidentiality, integrity, and availability) of health information
- Design appropriate research and evaluation studies in HIT, with understanding of both experimental and quasi-experimental research designs
- Ability to apply systems life cycle approach to HIT planning, analysis, design, implementation and evaluation, including translation of user needs into functional requirement

- Apply database concepts to the design and implementation of databases for clinical, research, and public health applications

Courses

BIOS 6601 - Applied Biostatistics I (3 Credits)

Applied biostatistical methods including descriptive and statistical inference; odds ratio and relative risk, probability theory, parameter estimation, tests for comparing statistics of two or more groups, correlation and linear regression and overviews of: multiple and logistic regression and survival analysis.

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Fall, Spring, Summer.

BIOS 6602 - Applied Biostatistics II (3 Credits)

A continuation of BIOS 6601 extending the basic principles of descriptive and inferential statistics to modeling more complex relationships using linear regression, logistic regression, and Cox regression. The statistical package SAS is used extensively. Multiple optional lab sessions offered.

Prerequisite: BIOS 6601

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Spring.

BIOS 6623 - Advanced Data Analysis (3 Credits)

This course teaches the students how to be effective collaborators. Students will learn to modify project hypotheses to be statistical hypotheses. The students will identify and perform the appropriate data analyses and communicate their analyses both verbally and in writing. prerequisite: BIOS 6601 and BIOS 6602 or BIOS 6611 and BIOS 6612 or permission of instructor.

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Fall.

BIOS 6648 - Design and Conduct of Clinical Research (2 Credits)

Design and conduct of clinical research studies. Intended for non-biostatistics students. Topics include: specifying the research question, study endpoints, study populations, study interventions, sample size evaluation, and choice of comparison groups. Common study designs and methods for study conduct are described. Prerequisite: BIOS 6601 or BIOS 6611 or consent of instructor. Offered in odd years.

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only.
Typically Offered: Fall.

CLSC 6210 - Research Seminars in Clinical Science (1 Credit)

This course provides an overview of the types of clinical translational studies being conducted by senior CLSC doctoral students. The interactive seminar series structure allows for interdisciplinary scientific dialogue among students at various stages of training, mentors and faculty.

Grading Basis: Letter Grade with IP

Repeatable. Max Credits: 3.

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring, Summer.

CLSC 6270 - Critical Appraisal Seminars in Clinical Science (1 Credit)

This course provides an overview of the approaches for critically appraising common study designs published in the clinical and translational sciences literature, as well as other sources of information.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

CLSC 6800 - Introduction to Health Information Technology (3 Credits)

Course intended as overview to dynamic environment of healthcare informatics. The goal of course is to prepare healthcare professionals to better utilize/manage the emerging communication technologies. A brief introduction to e-health, telehealth, electronic medical records, telecommunications and bio-informatics is provided.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

CLSC 6820 - Management of Healthcare Information Technology (3 Credits)

This course will provide an introduction to management of information technology in healthcare. A description of information processing, the origin, content and evolution of healthcare information systems and the methodologies deployed to acquire and manage information requirements will be discussed. Crosslisted: HLTH 6072.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

CLSC 7101 - Grant Writing I (1 Credit)

The purpose of this course is to develop and improve your skills in writing successful grant applications and participating in the critique and review process of grants. Prerequisites: BIOS 6601 and EPID 6630. Course Restrictions: CLSC students, unless written approval of Course Director.

Grading Basis: Letter Grade

Repeatable. Max Credits: 3.

A-GRAD Restricted to graduate students only.

Typically Offered: Spring.

CLSC 7150 - Ethics and Responsible Conduct of Research (1 Credit)

Course provides overview of the field of ethics in clinical research. Topics include historical background, current regulations, IRB requirements on human subjects protection issues. Students will learn how to develop approaches to conduct ethical human subjects research in an optimal manner.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring, Summer.

CLSC 7202 - Clinical Outcomes and Applications (3 Credits)

This course focuses on research methodologies in clinical care, costs, health systems, policy, and health outcomes, as well as an overview of major issues in clinical outcomes research. Students are provided with both theory and application through case studies.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall.

CLSC 7300 - Scientific Grant Review Process: CCTSI Proposals (1 Credit)

Students will understand and participate in the process of scientific review of human subject research protocols submitted to the University of Colorado Denver Clinical Translational Research Centers at University Hospital and the Children's Hospital. Prereq: BIOS 6601 BIOS 6602 or BIOS 6611 and BIOS 6612.

Grading Basis: Letter Grade

A-GRAD Restricted to graduate students only.

Typically Offered: Fall, Spring.

CLSC 8990 - Doctoral Thesis (1-10 Credits)

This course involves the student working with his/her research mentor and research project committee develop, design and execute a clinical science doctoral study as well as to write up the project as a thesis.

Prerequisite: Program consent. BIOS 6601 or BIOS 6611, BIOS 6602 or BIOS 6680 and HSMP 6617, CLSC 7150, EPID 6630, BIOS 6648 or EPID 6626 or HSMP 6670. Restrictions: Only CLSC PhD students or collaborative CLSC and CSPH Health Services Research Students.

Grading Basis: Letter Grade with IP

Repeatable. Max Credits: 99.

A-GRAD Restricted to graduate students only.

Additional Information: Report as Full Time.

Typically Offered: Fall, Spring, Summer.

EPID 6626 - Research Methods in Epidemiology (3 Credits)

Principles, concepts and methods for conducting ethical, valid and scientifically correct observational studies in epidemiological research are the focus of this class. Lectures and practical experience reinforce hypothesis formulation, study design, data collection and management, analysis and publication strategies. Prereq: BIOS 6601, BIOS 6680, EPID 6630.

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only. Typically Offered: Spring.

EPID 6630 - Epidemiology (3 Credits)

This course provides an introduction to descriptive and analytic methods in epidemiology and their application to research, preventive medicine and public health practice.

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only. Typically Offered: Fall, Spring.

EPID 6631 - Analytical Epidemiology (3 Credits)

Fundamental analytical skills for assessing and reporting disease status, determinants of disease and their impact on public health including determining rates of disease occurrence, measures of associations between exposures and disease, and techniques for identifying and correcting for misclassifications, effect modifiers and confounder.

Prerequisites: EPID 6630 and BIOS 6601 or BIOS 6611

Grading Basis: Letter Grade

A-PUBH1 Graduate students and public health certificate students only. Typically Offered: Fall.

ISMG 6080 - Database Management Systems (3 Credits)

The success of today's business often hinges on the ability to utilize critical information to make the right decisions quickly and efficiently. Transforming mountains of data into critical information to improve decision making is a skill every business decision maker must possess. This focus course covers the database design topics with a focus on enabling business decision making. Detailed topics include collecting, capturing, querying and manipulating data (using SQL and QBE) for simple to medium complex business applications. Commercial database products are utilized to demonstrate the design of database applications in management, marketing, finance, accounting, and other business areas. Students will be able to design and implement simple to medium complex database applications after successful completion of this course. Restrictions: Restricted to graduate majors and NDGR majors with a sub-plan of NBA within the Business School, graduate majors within the College of Engineering, Design and Computing, PHCS PhD majors and PhD majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Restrictions: Restricted to graduate majors and NDGR majors with a sub-plan of NBA within the Business School, graduate majors within the College of Engineering, Design and Computing, PHCS PhD majors and PhD majors

Typically Offered: Fall.

NURS 6289 - Information Systems Life Cycle (4 Credits)

This course focuses on a structured approach to information system development and implementation. The course addresses the five phases of the life cycle: planning, analysis, design, implementation and evaluation. Prereq: Minimum of one informatics course or permission of instructor.

Grading Basis: Letter Grade

Typically Offered: Fall.

NURS 6293 - Database Mgmt Systems (3 Credits)

An interdisciplinary course focused on design and application challenges in database management systems. Concepts of database modeling, querying, and reporting are explored. Students apply database concepts to clinical registries and Meaningful Use queries. Prereq: NURS 6304 or permission of instructor.

Grading Basis: Letter Grade

Typically Offered: Fall, Spring, Summer.

Policies

Please refer to the Graduate School Policies page (<http://catalog.ucdenver.edu/cu-anschutz/schools-colleges-programs/graduate-school/#policiestext>).

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