Committee on Clinical and Translational Science

Department Website: http://chess.uchicago.edu/CCTS (http://chess.uchicago.edu/CCTS/)

The Committee on Clinical & Translational Science (CCTS) is a freestanding academic unit housed within the Biological Sciences Division. Our mission is to enhance multidisciplinary training in clinical and translational science at the University of Chicago. We seek to offer high-quality curriculum and mentorship to a new generation of researchers who will synthesize social and biological science to significantly advance medical science and practice.

With joint input from CHeSS and the Institute for Translational Medicine, the CCTS mobilizes faculty from across the University of Chicago to enhance course offerings at the university in clinical and translational science. We organize these courses into coherent areas of concentration designed to provide graduate-level trainees, postdoctoral fellows, and junior faculty with state-of-the-art skills in the field. For more information contact Absera Melaku, committee administrator at amelaku@bsd.uchicago.edu. You can also visit our website at chess.uchicago.edu. (http://chess.uchicago.edu/CCTS/)

Current Areas of Concentration include:

- Comparative Effectiveness Research
- Translational Informatics
- Health Services Research
- Quality & Safety
- Clinical Research
- Community-Based Research
- Global Health
- Pharmacogenomics

In the "courses" tab there is a list of graduate courses that have been offered over the past two years. Refer to the CCTS section of the CHeSS website for current course offerings and prerequisites for each course:

http://chess.uchicago.edu (http://chess.uchicago.edu/CCTS/)

Clinical and Translational Science Courses

CCTS 32000. Religion, Medicine, and Human Flourishing on the South Side of Chicago. 100 Units.
Historically, medicine has promoted health as central to the good life. The contemporary turn in the medical and social sciences to the more capacious concept of human flourishing, however, presses these disciplines into conversation with longer traditions of inquiry-more specifically religious traditions-on the nature of the good life for individuals and communities. How might religious traditions reveal the possibilities and limits of contemporary views of human flourishing? How might they add elements to discourses of health such as forgiveness, dignity, and character, that might otherwise be missing from medical conversations? How might they challenge assumptions around our understanding not only of the health of the person (human flourishing) but also the health of the body? Just as medicine is understood best in its practice, so too this course seeks to understand religious traditions as embedded within and responsive to the communities they serve through religious nonprofits and congregations. How does the on-the-ground experience of these community organizations seeking to advance human flourishing on the south side of Chicago challenge these categories? Note: Instructor's prior consent required for course enrollment to ensure students fully appreciate the dimensions of field education and experiential learning expected from this course. This course prioritizes enrollment for fourth year students (or third year students graduating early).
Instructor(s): John Yoon, MD Terms Offered: Spring
Equivalent Course(s): HMRT 26306, CHST 26306, HIPS 26306, HLTH 26306, RLST 26306

CCTS 33000. Scientists Advancing the Forefront. 000 Units.
In this survey course, leading basic and translational biomedical scientists will review cutting-edge themes that constitute the forefront of medical research. Learners will emerge with a broad understanding of: •
Instructor(s): Erika Claud, Ronald Cohen Terms Offered: Spring Winter. Students who register in fall and spring will earn 50 credit units in spring.
Prerequisite(s): Course open to MS1 students
Note(s): Students should email Natasha Beals at nbeals@bsd.uchicago.edu to request permission to enroll.
Equivalent Course(s): MEDC 33000, MOLM 33000

CCTS 38300. Health Economics and Public Policy. 100 Units.
This course analyzes the economics of health and medical care in the United States with particular attention to the role of government. The first part of the course examines the demand for health and medical and the structure and the consequences of public and private insurance. The second part of the course examines the

supply of medical care, including professional training, specialization and compensation, hospital competition, and finance and the determinants and consequences of technological change in medicine. The course concludes with an examination of recent proposals and initiatives for health care reform. Must have completed PPHA 32300 Principles of Microeconomics and Public Policy I or equivalent to enroll.
Instructor(s): Meltzer, D Terms Offered: Spring
Equivalent Course(s): PPHA 38300, ECON 27700, PBPL 28300

CCTS 40004. Advanced Clinical Pharmacology I. 50 Units.
This course provides an interactive introduction to fundamental principles of the practice of clinical pharmacology relevant to drug development and personalized therapeutics. Topics include: pharmacokinetics, drug metabolism, protein binding, absorption and renal and hepatic elimination, pharmacodynamics, introduction to modeling methods, evaluation of adverse events, and pre-clinical and clinical elements of drug development.
Instructor(s): Mark Applebaum and Randall Knoebel Terms Offered: Autumn
Prerequisite(s): MEDC 30777, equivalent Intro to Pharmacology course, or instructor approval.

CCTS 40200. Cancer Biology II: Molecular Mechanisms in Cancer Biology. 100 Units.
This course focuses on the molecular events that drive cancer initiation and progression. Specific focuses include genome instability and mutations, roles of epigenetic regulation in cancer, and common signaling cascades. We also explore the role of the tumor microenvironment in these processes, including roles of other cell types and tumor metabolism. These lectures are taught in parallel with examinations of current and classic literature in these topics, with a strong emphasis on understanding state-of-the-art techniques.
Instructor(s): Faubert, Piunti Terms Offered: Winter
Equivalent Course(s): CABI 30900

CCTS 40400. Health Disparities In Breast Cancer and Other Cancers. 100 Units.
Across the globe, breast cancer is the most common women's cancer. In the last two decades, there have been significant advances in breast cancer detection and treatment that have resulted in improved survival rates. Yet, not all populations have benefited equally from these improvements, and there continues to be a disproportionate burden of breast cancer felt by different populations. In the U.S., for example, white women have the highest incidence of breast cancer but African-American women have the highest breast cancer mortality overall. The socioeconomic, environmental, biological, and cultural factors that collectively contribute to these disparities are being identified with a growing emphasis on health disparities research efforts. In this 9-week discussion-based course students will meet twice weekly and cover major aspects of disparities in breast cancer and other cancers.
Instructor(s): E. Dolan, S. Conzen Terms Offered: Winter
Prerequisite(s): BIOS 25108
Note(s): GP.
Equivalent Course(s): CCTS 20400, BIOS 25327, GNSE 20408, GNSE 30408, HLTH 20400

CCTS 40500. Machine Learning & Advanced Analytics for Biomedicine. 100 Units.
The age of ubiquitous data is rapidly transforming scientific research, and advanced analytics powered by sophisticated learning algorithms is uncovering new insights in complex open problems in biology and biomedicine. The goal of this course is to provide an introductory overview of the key concepts in machine learning, outlining the potential applications in biomedicine. Beginning from basic statistical concepts, we will discuss concepts and implementations of standard and state of the art classification and prediction algorithms, and go on to discuss more advanced topics in unsupervised learning, deep learning architectures, and stochastic time series analysis. We will also cover emerging ideas in data-driven causal inference, and demonstrate applications in uncovering etiological insights from large scale clinical databases of electronic health records, and publicly available sequence and omics datasets. The acquisition of hands-on skills will be emphasized over machine learning theory. On successfully completing the course, students will have acquired enough knowledge of the underlying machinery to intuit and implement solutions to non-trivial data science problems arising in biology and medicine.
Instructor(s): Ishanu Chattopadhyay Terms Offered: Winter. Not offered every year
Prerequisite(s): Rudimentary knowledge of probability theory, and basic exposure to scripting languages such as python/R is required. This course does not qualify in the Biological Sciences major.
Equivalent Course(s): CCTS 20500

CCTS 41005. Scholars in Ethics and Medicine Cohort (SEM) 100.00 Units.
This multidisciplinary course draws insights from medicine, sociology, moral psychology, philosophy, ethics, and theology to explore answers to the unique challenges that medicine faces in the context of late modernity: How does one become a "good physician" in an era of growing moral pluralism and health care complexity? Students will engage relevant literature from across these disciplines to address issues regarding the legitimate goals of medicine, medical professionalism, the doctor-patient relationship, vocation and calling, the role of religion in medicine, and character development in medical education. The course will first introduce the challenges that moral pluralism in contemporary society presents to the profession of medicine along with the subsequent calls for a renewed pursuit of clinical excellence in today's complex health care system. It will then survey the resurgence of a philosophical discipline (virtue ethics) that has begun to shape contemporary debate regarding what types of "excellences" are needed for a good medical practice dominated by medical science and technology.

Instructor(s): Kathryn Rowland Terms Offered: Autumn Spring Winter
Note(s): This course is limited to those who have been accepted into the Scholars in Ethics and Medicine (Hyde Park Institute, https://hydeparkinstitute.org/sem). Depending on space availability, other students interested in enrolling will need prior approval from course instructor(s). This is a yearlong course with several two-hour lecture discussions throughout the year, and two all-day Saturday sessions (Fall/Winter). Students register for winter or spring to receive credit, though must participate in each quarter.
Equivalent Course(s): CCTS 21005, MEDC 31005

CCTS 41006. Discourse of Islamic Bioethics. 50 Units.
This course is a mentored and directed reading course that introduces students to critical concepts in Islamic theology and law that undergird normative ethical frameworks within Islam and exposes the student to exemplar works from the wide range of Islamic bioethics literature. The first part of the course will focus on the theoretical aspects of the Islamic moral and ethical tradition and cover scholarly contestations regarding Islamic moral theology as they relate to an Islamic bioethics. The latter half of course will focus on the practical aspects of the emerging field by considering research methods for the field and selected literature reviews of Islamic responses to pressing bioethical issues. Read more about the course at chess.uchicago.edu/CCTS
Instructor(s): Aasim Padela Terms Offered: Summer. Not offered every year
Prerequisite(s): None

CCTS 41008. Health Systems in Low- and Middle-Income Countries. 100 Units.
Strengthening health systems is imperative to achieving lasting improvements in health. This course provides students with a comprehensive overview of health systems in low- and middle-income countries. We will learn key frameworks and tools to analyze, assess and influence health systems in these contexts. The course is organized around core components of health systems, including service delivery, human resources for health, health financing, supply chain systems, governance, community engagement and information systems. Each class draws upon contemporary case studies from a variety of low- and middle-income countries to illustrate challenges, controversies and opportunities in these contexts. We will examine historical, social and political contexts, and key international, national and local stakeholders that influence health systems presently. We will consider the impact of external shocks, such as conflict, natural disasters, and economic and political crises, on the structure and functioning of health systems. Finally, recognizing the convergence between global and local, we will situate current challenges in the U.S. health system in a global context.
Instructor(s): Veena Sriram Terms Offered: Autumn. Not offered every year.
Prerequisite(s): Open to graduate students and third- and fourth-year undergraduate students. First- and second-year undergraduates interested in taking the course may write to the course instructor for permission.
Equivalent Course(s): HLTH 21008, CCTS 21008

CCTS 41011. Clinical Research Design and Interpretation of Health Data. 100 Units.
This course will introduce the interdisciplinary field of clinically oriented health services research with a focus on the interpretation of health-related metrics and policy-related applications. We will examine how translational medical science informs healthcare providers, payers, and professional societies. COVID-19 and postmenopausal hormone replacement therapy will illustrate the challenges of data interpretation, translation of research findings into clinical medicine, and the adoption of evidence-based guidelines. Using a highly interactive approach, students will gain experience in selection of research study designs, measurement of health status, risk adjustment, causal inference, and understanding the placebo effect. We will discuss how clinicians, administrators, and public reporting entities judge and use information derived from investigations. The COVID-19 pandemic will demonstrate the challenges that varied clinical presentations, diagnostic accuracy, and case definition (identification of diseased patients) create in the formulation of health statistics (e.g., case-fatality rates and disease attribution of mortality). We will also discuss methods of defining study populations for both clinical research and public health reporting.
Instructor(s): Gregory Ruhnke Terms Offered: Spring
Equivalent Course(s): BIOS 29331, CCTS 21011, PBPL 21011, HLTH 21011

CCTS 42003. Biological and Social Determinants of Health. 100 Units.
Global health is an interdisciplinary and empirical field, requiring holistic and innovative approaches to navigate an ever-changing environment in the pursuit of health equity. This course will emphasize specific health challenges facing vulnerable populations in low resource settings including in the United States and the large scale social, political, and economic forces that contribute to them through topical events and case studies. Students will study the importance of science and technology, key institutions and stakeholders; environmental impacts on health; ethical considerations in research and interventions; maternal and child health; health and human rights; international legal frameworks and global health diplomacy. Students will gain skills in technical writing as they construct position statements and policy briefs on global health issues of interest. Career opportunities in global health will be explored throughout the course.
Instructor(s): C. Olopade and F. Olopade Terms Offered: Winter. This course is offered every Winter quarter in Paris.
Prerequisite(s): BIOS 27810 or consent of instructor.
Note(s): This course counts towards the Biological Sciences major ONLY for students in the Global & Public Health Track.
Equivalent Course(s): CCTS 22003, BIOS 29814

CCTS 42005. Global Health and Social Policy. 100 Units.
TBD
Equivalent Course(s): BUSN 42300

CCTS 42006. Decision Modeling for Health Economic Evaluation. 100 Units.
This course introduces decision science and economic evaluation that has been increasingly used to inform public health and health care decisions. With a specific focus on the development and application of decision-analytic models, students will learn the state of the current practice of economic evaluation, new tools and methodologies to conduct decision modeling, and emerging areas of research, including the value of information analysis. The course will provide hands-on computer-based learning using the R programming language for data analysis and modeling. A prior experience in R is welcomed, but not required. Applying the concepts and techniques learned in the course, students will undertake a course project of their choice to conduct economic evaluation using decision-analytic models. By the end of this course, students will gain knowledge and practical skills in economic evaluation and decision modeling to help make informed decisions.
Instructor(s): David Kim Terms Offered: Winter
Equivalent Course(s): PBPL 22006, HLTH 22006, CCTS 22006, PPHA 42006, PBHS 38120

CCTS 43007. Clinical and Health Services Research: Methods and Applications. 100 Units.
This course will introduce the interdisciplinary field of clinically-oriented health services research with a focus on policy-related implications. Through exposure to theoretical foundations, methodologies, and applications, students without significant investigative experience will learn about the design and conduct of research studies. We will cover the integration of research within the stages of translational medicine, and how science conducted across the translational medicine spectrum informs policy through purveyors of clinical services (e.g. physicians, hospitals), government, insurers, and professional societies. We will use the examples of postmenopausal hormone replacement therapy and autologous bone marrow transplantation to illustrate pitfalls in the progression from basic science research to clinical trials leading to diffusion in clinical medicine that can complicate the creation of logical, evidence-based practice guidelines, reimbursement, and clinical practice.
Instructor(s): Greg Ruhnke Terms Offered: Spring
Equivalent Course(s): BIOS 29329, CCTS 21007, HLTH 21007, PBPL 23007

CCTS 45200. Fundamentals of Health Services Research: Theory, Methods and Applications. 100 Units.
This course is designed to provide an introduction to the fundamentals of health services research. The basic concepts of health services research will be taught with an emphasis on both their social scientific foundations and the methods needed for their practical application to empirically relevant research. Theoretical foundations will draw on principles from economics, sociology, psychology, and the other social sciences. Methodological topics to be covered will include techniques for data collection and analysis, including outcomes measurement, survey methods, large data set research, population-based study design, community based participatory research, research based in clinical settings, qualitative methods, cost-effectiveness analysis, and tools of economic and sociological analysis. The theoretical and empirical techniques taught will emphasize those relevant to the examination of health care costs, quality, and access. Major applications will include: measurement and improvement of health care quality, analysis of health disparities, analysis of health care technology, and analysis of health care systems and markets. Students prepare a grant proposal as the final assignment for this course.
Instructor(s): D. Meltzer, M. H. Chin Terms Offered: Summer
Equivalent Course(s): PPHA 47900

CCTS 45400. Advanced PCOR Methods: Cost Effectiveness and Modeling. 50 Units.
This course is the first module of a two module sequence in Advanced Patient Centered Outcomes Research (PCOR). This module includes an overview of cost effectiveness analysis, modeling (both markov and probabilistic sensitivity analysis), and discrete events and agent based simulation. Students will gain hands on experience with software such as Treeage, Simio, and Net logo. The second course will be taught in Winter Quarter and will cover topics in evidence generation and synthesis. Students and postdocs must contact Kelsey Bogue at kbogue@bsd.uchicago.edu with a CV and unofficial transcript (if current UChicago student) for approval to attend the course. Appropriate prerequisites include SSAD 45600 and PPHA 38300, or other introductory courses in cost effectiveness analysis or statistical modeling.

CCTS 45500. Health Services Research: Data, Quantitative Methods, and Applications. 100 Units.
This course will use an application oriented approach to help students learn fundamental skills in how to use data and quantitative methods to answer questions in health research. Students will learn about different data sources and structures as well as the study designs that are best suited for each type of data structure. Students will also learn to apply statistical techniques, including basic tests of differences and linear and logistic regression, to the analysis of various research questions in practice datasets. Other topics covered will include calculating power/sample sizes, data linking, and data simulation. Basic programming will be done in Stata. Accompanied by online instruction in Understanding Clinical Research: Behind the Statistics, which provides an introduction to foundational statistical concepts, students will learn about working with data captured in EPIC, available in public and private insurance claims, captured in the Clinical Research Data Warehouse (CRDW), compiled in aggregated sources such as N3C (National COVID Cohort Collaborative) and CAPriCORN (Chicago Area Patient Centered Outcomes Research Network), generated from sensors and wearable devices, and collected as part of ongoing surveys such as the Hospitalist Project. There will be dedicated time to practice

statistical programming in Stata, and fellows who are already working with a particular data set will have the opportunity to advance their analyses in class.
Instructor(s): Andrea Flores Terms Offered: Summer

CCTS 46000. Technology Transfer Seminar Series. 50 Units.
TBD

CCTS 46001. Fundamentals of Quality Improvement and Patient Safety (QI & PS 101) 50 Units.
This course was designed for faculty and staff at UChicago Medicine (UCM) with the support of the Center for Clinical and Translational Science (CCTS) and the UChicago Medicine Quality Performance Improvement Team (QPI). The course provides an overview of concepts and methodologies for improving the quality, equity, and safety of care. Participants will design quality improvement projects using skills learned in class. In addition, UCM leaders will speak on key topics throughout the course. QI experts from the QPI Team will be involved in implementing the course. Participants will become familiar with tools for improving quality of care and service delivery, such as the Model for Improvement and Lean Performance Improvement. The course will provide guidance on how to incorporate Health Equity into health care improvement projects. The course will also cover other factors impacting delivery of safe and high quality care in health care organizations such as teamwork, good communication and organization culture. The course will address "Systems Thinking" and other key concepts in patient safety such as Human Factors and Reliability. Participants will understand the key role of QI in today's health care environment as a mechanism for improving organizational effectiveness and the patient experience. The course is comprised of six classes total. Faculty, staff, and students/trainees at UCM are welcome to audit the course. Contact amelaku@bsd.uchicago.edu to register.
Instructor(s): A. Davis Terms Offered: Autumn Spring

CCTS 47001. Advanced Community Based Participatory Research (CBPR) Training Program I. 000 Units.
The goal of health-related research is to improve the lives of people in the community studied. In traditional research, the community is not actively involved in designing the projects. Community-based participatory research is a partnership approach to research that equitably involves community members, organizational representatives, and academic researchers in all aspects of the research process. The Advanced CBPR Training Program is designed to help meet the growing need and demand for educational resources that help build the knowledge and skills needed to develop and sustain effective CBPR partnerships. The Program consists of six sessions that are offered on various Fridays throughout the year.
Instructor(s): D. Miller, D. Burnet Terms Offered: Autumn. Students must register for two-course sequence in order to receive course credit; CCTS 47001 and CCTS 47002 in Winter Quarter. Students must also register online. Contact CCTS administrator Kelsey Bogue at kbogue@bsd.uchicago.edu for more details.

CCTS 47002. Advanced Community Based Participatory Research (CBPR) Training Program II. 25 Units.
The goal of health-related research is to improve the lives of people in the community studied. In traditional research, the community is not actively involved in designing the projects. Community-based participatory research is a partnership approach to research that equitably involves community members, organizational representatives, and academic researchers in all aspects of the research process. The Advanced CBPR Training Program is designed to help meet the growing need and demand for educational resources that help build the knowledge and skills needed to develop and sustain effective CBPR partnerships. The Program consists of six sessions that are offered on various Fridays throughout the year.
Instructor(s): D. Miller, D. Burnet Terms Offered: Winter. Students must register for two-course sequence in order to receive course credit; CCTS 47001 and CCTS 47002 in Winter Quarter. Students must also register online. Contact CCTS administrator Kelsey Bogue at kbogue@bsd.uchicago.edu for more details.

CCTS 47005. Methods in Health and Biomedical Informatics. 100 Units.
Most Health and Biomedical Informatics (HBMI) Graduate Programs around the country have independently come to the conclusion that the computational methods that informatics graduate students need to be familiar with is too broad and numerous to be addressed by a series of independent courses. Therefore, most programs have created a set of integrated courses that expose the students to a wide variety of informatics methods in short modules. Typically, these required methods series are organized as a series of required courses taken during the first year of graduate study. This course is the result of discussions by Health and Biomedical Informatics researchers and educators from the Chicago Biomedical Informatics Training (CBIT) initiative. This course is designed as the first course of a year-long sequence and is worth 100 units. Registration for the full year is expected.
Instructor(s): S. Volchenboum, D. McClintock, UIC & NU faculty Terms Offered: Autumn. Course location rotates between Northwestern's downtown campus, UChicago, and UIC
Prerequisite(s): Basic understanding of Python programming language; prior or simultaneous enrollment in Health & Biomedical Informatics (HBMI) intro course.

CCTS 47006. Methods in Health and Biomedical Informatics II. 100 Units.
Most Health and Biomedical Informatics (HBMI) Graduate Programs around the country have independently come to the conclusion that the computational methods that informatics graduate students need to be familiar with is too broad and numerous to be addressed by a series of independent courses. Therefore, most programs have created a set of integrated courses that expose the students to a wide variety of informatics methods in short modules. Typically, these required methods series are organized as a series of required courses taken during the first year of graduate study. This course is the result of discussions by Health and Biomedical Informatics

researchers and educators from the Chicago Biomedical Informatics Training (CBIT) initiative. This course is designed as the second course of a year-long sequence and is worth 100 units. Registration for the full year is expected.
Instructor(s): David McClintock and Samuel Volchenboum; Northwestern and UIC faculty Terms Offered: Winter. Course location rotates between Northwestern's downtown campus, UChicago, and UIC
Prerequisite(s): CCTS 47005 in Autumn Quarter.

CCTS 47007. Methods in Health and Biomedical Informatics III. 100 Units.
Most Health and Biomedical Informatics (HBMI) Graduate Programs around the country have independently come to the conclusion that the computational methods that informatics graduate students need to be familiar with is too broad and numerous to be addressed by a series of independent courses. Therefore, most programs have created a set of integrated courses that expose the students to a wide variety of informatics methods in short modules. Typically, these required methods series are organized as a series of required courses taken during the first year of graduate study. This course is the result of discussions by Health and Biomedical Informatics researchers and educators from the Chicago Biomedical Informatics Training (CBIT) initiative. This course is designed as the third course of a year-long sequence and is worth 100 units. Registration for the full year is expected.
Instructor(s): David McClintock and Samuel Volchenboum; Northwestern and UIC faculty Terms Offered: Spring. Course location rotates between Northwestern's downtown campus, UChicago, and UIC
Prerequisite(s): CCTS 47005 in Autumn Quarter and CCTS 47006 in Winter Quarter.