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.

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:

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

Clinical and Translational Science Courses

CCTS 32411. Mediation, Moderation, and Spillover Effects. 100 Units.
This course is designed for graduate students and advanced undergraduate students from social sciences, statistics, health studies, public policy, and social services administration who will be or are currently involved in quantitative research. Research questions about why an intervention works, for whom, under what conditions, and whether one individual's treatment could affect other individuals' outcomes are often key to the advancement of scientific knowledge yet pose major analytic challenges. This course introduces cutting-edge theoretical concepts and methodological approaches with regard to mediation of intervention effects, moderated intervention effects, and spillover effects in a variety of settings. The course content is organized around six case studies. In each case, students will be involved in critical examinations of a working paper currently under review. Background readings will reflect the latest developments and controversies. Weekly labs will provide supplementary tutorials and hands-on experiences with mediation and moderation analyses. All students are expected to contribute to the knowledge building in class through participation in discussions. Students are encouraged to form study groups, while the two written assignments are to be finished and graded on an individual basis.
Equivalent Course(s): EDSO 32411, PSYC 32411, CHDV 32411, SOCI 30318, PBPL 29411, STAT 33211

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: •
Equivalent Course(s): MOLM 33000, MEDC 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 care 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.
Equivalent Course(s): PBPL 28300, ECON 27700, PPHA 38300
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.

CCTS 40006. Pharmacogenomics: Discovery and Implementation. 100 Units.
Pharmacogenomics is aimed at advancing our knowledge of the genetic basis for variable drug response. Advances in genetic knowledge gained through sequencing have been applied to drug response, and identifying heritable genetic variants that predict response and toxicity is an area of great interest to researchers. The ultimate goal is to identify clinically significant variations to predict the right choice and dose of medications for individuals—"personalizing medicine." The study of pharmacogenomics is complicated by the fact that response and toxicity are multifactorial traits and are often confounded by nongenetic factors (e.g., age, co-morbidities, drug-drug interactions, environment, diet). Using knowledge of an individual's DNA sequence as an integral determinant of drug therapy has not yet become standard clinical practice; however, several genetics-guided recommendations for physicians have been developed and are highlighted. The ethics and economics of pharmacogenomics are also discussed.
Equivalent Course(s): CABI 47510

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.
Equivalent Course(s): CABI 30900

CCTS 40400. Health Disparities in Breast Cancer. 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 10-week discussion-based course students will meet twice weekly and cover major aspects of breast cancer disparities.
Equivalent Course(s): GNSE 30408, CCTS 20400, GNSE 20408, HLTH 20400, BIOS 25327

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.
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.
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

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.
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.
Equivalent Course(s): CCTS 21011, HLTH 21011, PBPL 21011, BIOS 29331

CCTS 41017. Good Vibes Only: Spiritual Energy Healing and Alternative Medicine in America. 100 Units.
Can I manifest health and happiness by aligning my energy with “good vibes”? Which crystal can I use to cure a headache? Is spiritual energy healing just a capitalist scam? Practices of harnessing positive vibrations and energies for health and human flourishing are increasingly prevalent in the United States, flooding our Instagram and TikTok feeds with conversations centered around questions like the above. But these ideas are not new. This course introduces students to a modern tradition of alternative medicine, spanning from the nineteenth century to the present, that hinges on a spiritual interpretation of scientific discoveries about energy. This tradition of spiritual energy healing will serve as our window into examining a larger theoretical framework that articulates a medical paradigm of “holistic healing” in opposition to mainstream biomedicine. We will examine spiritual energy healing and its holistic framework through a social scientific lens. In other words, rather than evaluating its validity or efficacy, we will work to understand this tradition’s social and historical presence in American culture. Central questions include: How does spiritual energy healing interact with biomedicine, in both complementary and oppositional ways? How has it appropriated Eastern and Indigenous medical traditions? What exactly is its relationship to physics, and to scientific understandings of energy and vibration?
Equivalent Course(s): HLTH 21017, KNOW 41017, CCTS 21017, RLST 26321, KNOW 21017

CCTS 42001. Global Health Sciences III: Topics in Global Health. 100 Units.
This course will review the major factors that influence the health of individuals and communities worldwide and seek to gain a better understanding of the complexities of global health. Students will study both broad and disease-specific global health challenges (e.g., cancer, diabetes, and cardiopulmonary disease) and strategies for responding to them; key institutions and stakeholders; environmental impacts on health; ethical considerations in research and interventions; maternal and child health; health and human rights; and international legal frameworks within global health diplomacy. The course encompasses lectures, student presentations, and the preparation of a proposal addressing a significant global health problem with major impact.
Equivalent Course(s): BIOS 29812, CCTS 22001

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.

Equivalent Course(s): BIOS 29814, CCTS 22003

### 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.

Equivalent Course(s): PPHA 42006, CCTS 22006

### CCTS 43000. Introduction to Global Health. 100 Units.

This course provides an overview of global health from the historical perspective to the current state of global health. The course features weekly guest lecturers with a broad range of expertise in the field: topics include the social and economic determinants of health, the economics of global health, global burden of disease, and globalization of health risks, as well as the importance of ethics, human rights, and diplomacy in promoting a healthier world. The course is designed for graduate-level students and senior undergraduates with an interest in global health work in resource-limited settings.

Equivalent Course(s): PBPL 29294, BIOS 29294

### 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.

Equivalent Course(s): PBPL 23007, HLTH 21007, CCTS 21007, BIOS 29329

### 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.

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.

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

CCTS 46001. Fundamentals of Quality Improvement and Patient Safety (QI & PS 101) 25 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.

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.

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.

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 second course of a year-long sequence and is worth 100 units. Registration for the full year is expected.

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.