HI 5000 Clinical Thinking

0 credits

This course is designed for students who do not have a clinical background and will provide an insight into the clinical care process. For clinicians, it will provide a refresher on terminology and the complexity of clinical decision-making. This course will teach basic medical terminology and an introduction to diagnostic thinking, its complexities and uncertainties, and its iterative nature. Topics include eliciting an anamnesis, synthesizing history and physical examination, clinical decision-making and thresholds for ordering tests, diagnostic biases, utilization of medical evidence in the design of treatment plans, and challenges secondary to health information technology in a complex environment.

After completion, students will be able to successfully navigate the health care system and will be able to converse with clinicians, communicate effectively, and will understand the needs and requirements to deliver care.

HI 5100 Capstone Project Plan

1 credit

The goal of the Capstone project is for students to combine their work experience with their academic coursework to produce a feasible, implementable Health Informatics project and provide an evaluation and academic, critical reflection on the project including its benefits, weaknesses, improvement opportunities, and overall assessment. Ideally, this project will teach students to support their organization's strategy and operations and to become leaders in the field of Health Informatics. After selecting a suitable faculty mentor approved by the program director, students will plan a project to be designed, implemented, and evaluated in the course of the second year. Students must prepare a formal needs assessment and will design a proposal. The proposal will be reviewed and critiqued by the students and faculty. Students may advance to implementation only after formal approval by the course director.

The final product of the Capstone course will be a manuscript prepared for publication in a scientific journal. Thus, students must address the expectations that publishers place on manuscripts. In this class, students will engage in learning how to properly design and format a manuscript. Emphasis should be placed on acquiring skills to create a manuscript for publication.

HI 5101 Ethics in Clinical Informatics

1 credit

This course is a systematic review of ethical concepts and standards of responsible conduct for a Clinical Informatics professional including the code of ethics developed by the American Medical Informatics Association. The course will review changes in power and influence introduced by clinical systems and a redistribution of work. Review of the governance process for data and clinical decision support will be paired with practical exercises in evaluating the effect of health information technology on health care workers and patients. Principles of respect for autonomy, nonmaleficence, beneficence, and justice will

be addressed as well as the effect of computers in the exam rooms. Other topics include ethics around patient portals and social media in health.

HI 5200 Practicum

2 credits

Students will be required to create an experience/rotation in health IT operational teams, health information technology companies, start-ups, or health information consulting companies based on expressed interests and team availability. The course director and preceptor have to approve the activity in advance. Rotations must support the application of material learned in the process of the program and must be congruent with the program objectives. Preceptors and course director will emphasize the need for meaningful, achievable objectives and deliverables.

HI 5301 The U.S. Health Care System

3 credits

This course provides an important introduction and overview to the American health care system, including familiarization with most actors and organizations comprising our broader health care systems. The class will briefly explore the history of health system design and medical education in the United States; examine the influence of social, cultural, and other factors on our current health and well-being; and examine the complexities of our current health care system. We will spend some time on the Affordable Care Act as well as emerging policies and their potential impact on our society. Additional topics include the latest changes in health care practice, laws, and technological trends that impact our current health care delivery system. The course begins with a discussion of our health care system and utilizes an internal critique to understand and address issues within the American health system including, but not limited to, public health issues, quality and cost of care, ongoing innovation in medicine and medical education, payment mechanisms, consumer behavior, the legal and regulatory framework, and emergency preparedness. It then articulates the demographic challenges ahead as well as the impact on both household and federal finances. It then provides students with an overview of the various methods and parties used to pay for health care as well as the massive and at times unnecessary complexity that imposes unparalleled burdens on physicians, other providers, and on health care delivery organizations. The course will also explore the impact of new technologies across the entire continuum of care – focusing on transitions and care in the home. It concludes with some coverage of both the opportunities and threats posed by rapid technology advancement.

Students will acquire fundamental knowledge and skills regarding the U.S. health system and will be exposed to the broader societal and cross-disciplinary context in which clinical informatics must be applied. This broader environment requires multiple groups to operate with greater degrees of coordination. It will argue the need for a new and more comprehensive approach to health informatics organization, overall governance, and national policies.

HI 5302 Health Information Technology

3 credits

Students will learn about the current state of health information technology in a variety of clinical settings through a review of systems and tools in practice, the interactions and relationship of various information systems, and the overall architecture of health information systems, data networks, and data flow. Learners will understand the types and structure of health data, as well as principles of data exchange, interoperability, and data integration. HIS accreditation and quality assessment will be taught.

An important aspect of the course will be institutional and local data governance. Key concepts of data security and privacy will be taught. This course will further address the use of information technology in health and its impact on care delivery and the health care marketplace.

Specific topics include the history of health informatics, electronic health records, consumer portals, health information exchange, effect of health information tools on quality and safety, clinical decision support, provider order entry, knowledge management, clinical documentation, dashboards, the role of registries (such as immunization registries), and the development and successful execution of new care delivery models using health information technology (e.g., IT- enabled communication, collaborative workspaces, population health tools).

HI 5303 Evidence-Based Medicine and Clinical Decision Support

3 credits

The development and maintenance of high-quality, patient-centered, evidence-based clinical decision support using electronic health records and other clinical information systems is a complex effort that is critical to every health care organization's success. This course will cover the core aspects of the strategy, design, implementation, operation, and evaluation of evidence-based medicine (EBM) and clinical decision support (CDS).

After completion of the course, students will be able to:

- Appreciate the principles of evidence-based guideline generation and describe tools to make guidelines implementable;
- Demonstrate the ability to analyze a clinical problem, determine data requirements and workflow challenges, and design and propose a clinical decision support (CDS) solution;
- Analyze the applicability of CDS and be able to voice exceptions and exclusions, design 'key action statements' and specific conditions for their execution;
- Clearly report, interpret, and communicate the results of CDS evaluation;
- Conceptualize a suitable topic and design a study evaluating the effect of a CDS intervention on patient care, effectively communicating this in writing and oral presentation;
- Describe ethical concerns in CDS and recognize professional responsibilities to ensure the integrity of CDS informatics;
- Demonstrate proficiency in knowledge as it relates to the topics of CDS covered in the course;

- Collaborate effectively across multidisciplinary teams communicating at the level of team members.

HI 5304 Data Analytics

3 credits

Students will be exposed to scientific methods and processes to extract knowledge and insights from structured and unstructured data in this course. This course will leverage advanced statistics, data analysis, machine learning, and related data methodologies to analyze, understand, model, and gain novel knowledge from data. I shall present an introduction to clinical epidemiology, predictive analytics, comparative effectiveness and health services research, clinical prediction rules, and patient-centered outcomes research. Students will learn to apply health care analytics, including using methodologies to extract, transform, and load data while maintaining data quality, performance improvement, and innovation projects. An introduction to research informatics tools such as REDCap, i2b2, and TriNetX will be presented during the course. The OMOP Common Data Model will be introduced. Students will learn database design and modeling using a hands-on experience with a specific focus on the conceptual model: the logical structure of the entire database. The course will address conceptual schemas, database design, entity-relationship diagram (ERD), external and internal models, normalization, and data independence (logical and physical). This course will have a heavily applied aspect, with students utilizing Python, JavaScript, HTML5/CSS, API Interactions, SQL, Tableau, R, and Git/GitHub.

Upon completing the course, students will know how to describe and utilize the basic and essential tools of fused data analysis, epidemiology, and statistics.

HI 5305 Biomedical and Basic Science Informatics

3 credits

This course will introduce the methodology and thinking required for approaching biomedical and basic science informatics research problems. Students will learn to independently clean, organize, analyze, explore, visualize, and model data using the programming language R. Additionally, this course should prepare students to have the confidence and capability to break down, understand, and interrogate scientific code and analytical workflows found in literature. Beginning with the basics of R programming, the course will develop foundational knowledge in statistics, numerical analysis, and data modeling, including elements of machine learning.

HI 5306 Workflow Process Analysis System Development, Human Factors, and Usability

3 credits

This course teaches the students necessary terminology and how to apply workflow process mapping, analysis, and process (re)design in clinical environments in the scope of electronic health records and other clinical systems. The course will leverage structured system analysis and design and object-

oriented analysis and design with associated modeling frameworks. Students will be able to define workflow and system requirements using process modeling notation. The stages of health information system development are taught. Students are introduced to human factors engineering, human-computer interaction, and usability evaluation with the goal to enhance quality, patient care experience, efficiency, safety, and satisfaction and to reduce costs. This course will teach qualitative, quantitative, and computational methods used for the design, implementation, and evaluation of health information technology in ambulatory, hospital, home health, and other locations where care is delivered.

Students will demonstrate their ability to review workflows, understand requirements, and synthesize to implement and evaluate systems.

HI 5307 Health Information Management

3 credits

This course provides an overview of Health Information Management (HIM) discipline and can be described as a "translator" of health care data, regardless of where the data is generated, by creating trusted information. The creation and normalization of data is an important element within an informatics program. The HIM profession supports these initiatives with data normalization across platforms by leveraging standards, classification systems, clinical vocabularies, and nomenclatures. HIM competencies include the practice of acquiring, analyzing, and protecting digital and traditional medical information vital to delivering quality patient care in addition to providing trusted data for public health analysis, quality initiatives, performance improvement efforts, and strategic planning.

Students will gain an understanding of the factors that impact the health record including coding and reimbursement systems, data generation methodologies, quality management, standards, classification systems, vocabularies, terminologies, nomenclatures, policy, environmental factors, regulatory agencies, reimbursement, data governance, and case-law influence. This increased knowledge will support health care planning and provision, resource allocation, and executive decision-making.

HI 5308 Project Management & Clinical System Life Cycle

3 credits

Students will get a practical understanding of managing the life cycle of clinical and operational technologies in health care (health systems, payers, community services, etc.). This will incorporate gaining an understanding of tools and processes such as agile management, resource prioritization, balancing innovation with keeping the lights on, scoping, stakeholder responsiveness, etc.

Through a real-life example of implementing a clinical application to solve a critical problem in a health setting, students will learn:

- The process of project management and the toolkit that they will be able to utilize in their jobs.
- The importance of leadership, influence, and managing bureaucracy for successful management of clinical informatics projects.

- The importance of aligning with organizational values and using systems thinking to manage these complex projects.

HI 5309 Application Development

3 credits

This course will provide students with knowledge and skills for the development of web and mobile computer applications. Learners will acquire an understanding of wireframes and prototypes, the languages and frameworks most commonly used, and fundamental skills in programming and design through immersive project-based courses.

The goal of the Application Development course is to expose students to the process of developing software applications specifically in the context of health care systems. We will focus specifically on development built on the "Substitutable Medical Applications and Reusable Technologies" ("SMART") and "Fast Healthcare Interoperability Resources" ("FHIR") standards, as they allow for rapid development and deployment of applications designed to operate on health care data.

Students will acquire knowledge of the design of user interfaces and software systems and networking, hosting infrastructure, and security. Upon completion of the course, students will:

- Learn the steps of the software development life cycle ("SDLC") and how to perform each
- Learn the basics of JavaScript development
- Design, develop, and deploy a functional SMART on FHIR application in a group setting

HI 5500 Capstone Project Implementation and Evaluations

5 credits

The MS Health Informatics capstone project is a culmination of knowledge, skills, and experiences acquired throughout the program to solve a real-world problem or address a significant challenge in the field of health care using information technology and data analytics. The capstone project will require students to work closely with a selected mentor, health care professionals, and other stakeholders to identify a relevant issue, develop a solution or strategy, and implement it using various informatics tools and methodologies. The goal is to demonstrate the ability to analyze complex health care data, design effective informatics solutions, and communicate findings or recommendations effectively.

The capstone project has the option to be completed in small groups (prior approval required) but is generally intended to be completed by individual students. Project feasibility will be important as students are expected at a minimum to develop an implementation plan. Students will engage in the following stages of development and deployment of the capstone project: project selection, problem identification, research and planning, implementation, evaluation, documentation and presentation.

Upon successful completion of the course, students will:

- Acquire real-life experience

- Translate and apply newly acquired academic knowledge into projects
- Leverage evaluation, data analytics, and other scientific methodologies in the evaluation of the project
- Implement and evaluate the project
- Provide a scientific manuscript
- Formally present capstone project results to fellow learners, colleagues, and faculty

The MSHI capstone project serves as a valuable opportunity for students to demonstrate their mastery of informatics concepts and techniques while making a meaningful contribution to the field of health care.