Certificate in Health and Biomedical Informatics
Department of Population and Quantitative Health Sciences

Overview

The Biomedical and Health Informatics Certificate program is a twelve-fifteen (12-15) credit hour program. The twelve (12) credit option is suited for some students, such as medical fellows, who may only have time to take one course per semester over two years. The 12-credit certificate provides the background necessary to complete the competencies from the American Medical Informatics Association).

The Graduate Certificate in Biomedical & Health Informatics (12 credits) is issued through the Department of Population and Quantitative Health Sciences. This Graduate Certificate will not appear on any CWRU transcripts. Courses taken toward the Graduate Certificate in Biomedical & Health Informatics (12 credits) can be used to fulfill requirements for other degrees and will appear on CWRU transcripts.

Students seeking to have their Graduate Certificate appear on their CWRU transcripts are required to take an additional 3 credits of course work beyond the 12 credits required for the certificate. All 15-credit hour Graduate Certificates in Biomedical & Health Informatics are issued through the School of Graduate Studies and not through the Department of Population and Quantitative Health Sciences.

Credits from the certificate program are fully transferable for other advanced degrees, notably the MS or PhD in Biomedical and Health Informatics.

If you are a staff member or faculty member of CWRU, be sure to discuss certificate options with the program administrator to be sure you know how to apply your tuition benefits.

Admissions, Performance, and Assessment

Entrance standards

Entrance to the certificate program will be administered by the Department of Population and Quantitative Health Sciences. Individuals who want to participate in the program should complete an application form that includes a brief personal statement describing the reason(s) for seeking health informatics training and a recent CV or resume.

We assume that most applicants to the certificate program will have already obtained a postsecondary (e.g. AS, BS, BA, MS, PhD) or advanced clinical (e.g. MD, MSN, DMD) degree and be a current health or clinical professional.

How to apply

Per CWRU School of Graduate Studies requirements, individuals who are not already graduate degree-seeking students at CWRU must submit to the School of Graduate Studies a completed non-degree application form. This is found on the CWRU School of Graduate Studies section of the CWRU site under Prospective Students. http://bit.ly/ApplyGraduateNonDegree

All applicants must also submit a transcript copy of their diploma, documenting completion of a baccalaureate degree.

Per School of Graduate Studies requirements, non-degree-seeking individuals will not be required to provide their Test of English as a Foreign Language (TOEFL). However, the program may optionally require the TOEFL for individual students.

Individuals will be accepted into the program based on the Graduate Committee on Informatics' review of the personal statement, letters of reference, transcripts, and any supporting documentation required by the School of Graduate Studies. Majority vote of acceptance by the Committee members will be necessary for admittance. Once accepted into the Certificate program, participants will register for the courses through the Student Information System.

Rolling admissions

The program will have rolling admissions, so students may start in the fall, the spring, or the summer. Deadlines to apply to program will be the following: May 1st for summer, June 30th for fall, and December 1st for spring.

Length of program

Once accepted into the program, individuals will have three (3) calendar years to complete the requirements. Most students will complete the program within four (4) semesters of acceptance, but the program can be completed in as little as two (2) semesters.

Performance standards

A grade of B or higher in each core course, and C or higher in every elective graded course and an overall GPA of 3.00 will be required for successful completion of the Certificate program. A minimum of twelve (12) credits must be graded. Enrollees will be responsible for keeping track of the proper sequence of courses. To oversee students' progress in the program, enrollees will be required to submit a one-page Program Progress

Transcript documentation

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Documenting progress

To assure our students are progressing in this program, the Administrative Director of Non-Clinical Graduate Education will check in with students and the Department leadership at the end of each semester indicating the course(s) completed that semester. The Administrative Director of Non- Clinical Graduate Education will notify the Department Graduate Committee on Informatics if any students are not making adequate progress towards the Certificate. The Committee will make recommendations for remediation or any further action to assist students in successfully completing the program.

Exit Standards

Students who complete all required coursework will submit a checklist to the Administrative Director of Non-Clinical Graduate Education that all coursework is completed. This administrator will verify with the

registrar's office that all requirements have been met. After this verification, the Academic Program Director will approve the awarding of the certificate in writing, and the Program Director will issue a certificate to the enrollee documenting completion of the program. If the student has opted for the fifteen (15) credit certificate, the program will certify the student for graduation and submit paperwork to the School of Graduate Studies for processing, to ensure the awarding of the certificate appears on the student's official transcript.

Core Courses - Required

MPHP 532 / HSMC 432 (3 Credit Hours) – Introduction to Health Informatics
The course is intended to develop competence and confidence in the participant's ability to understand and manage the complex information environment, plan for computer-based information systems, specify their functional design, manage a system adoption project, deal with system vendors, and function as an intra- or extra-organizational consultant on health- related information systems. The course covers such issues as the evolution of health care information systems; the kinds of systems in use; information management and planning; the successful design, acquisition, implementation and evaluation of systems; legal and ethical issues; and the future of HCIS.

EECS / EBME 480N (3 Credit Hours) – Health Informatics Core Issues
This course is designed to provide students with a basic understanding of healthcare-related decision and knowledge support systems (HDSS & HKSS) and their use cases, to enable students to effectively interact with health and medical professionals, and to consider the opportunities for wireless health solutions to contribute to effective KSS, DSS and health care. The course is pragmatic, covering such issues as the current state and emerging trends in use of decision support and knowledge support systems in health care delivery; information, knowledge & decision principles; health data; clinical decision & knowledge support, DSS/KSS development & adoption, regulatory issues, and the impact of wireless technology on emerging DSS/KSS and processes. Previously offered as EECS/EBME 480N, this course is in the process of being moved to Weatherhead and will receive a new course listing, but will continue to be offered by the same instructor (Alan Dowling).

Electives

EBME 473 / SYBB421 (3 Credit Hours) – Fundamentals of Clinical Information Systems
Technology has played a significant role in the evolution of medical science and treatment. While we often think about progress in terms of the practical application of, say, imaging to the diagnosis and monitoring of disease, technology is increasingly expected to improve the organization and delivery of healthcare services, too. Information technology plays a key role in the transformation of administrative support systems (finance and administration), clinical information systems (information to support patient care), and decision support systems (managerial decision-making). This introductory graduate course provides the student with the opportunity to gain insight and situational experience with clinical information systems (CIS). Often considered synonymous with electronic medical records, the "art" of CIS more fundamentally examines the effective use of data and information technology to assist in the migration away from paper-based systems and improve organizational performance. In this course we examine clinical information systems in the context of (A) operational and strategic information needs, (B) information technology and analytic tools for workflow design, and (C) subsequent implementation of clinical information systems in patient care. Legal and ethical issues are explored. The student learns the process of "plan, design, implement" through hands-on applications to select CIS problems, while at the same time gaining insights and understanding of the impacts placed on patients and health care providers.

EECS / SYBB 459 (3 Credit Hours) - Bioinformatics for Systems Biology
Description of omic data (biological sequences, gene expression, protein-protein interactions, protein-DNA interactions, protein expression, metabolomics, biological ontologies), regulatory network inference, topology of regulatory networks, computational inference of protein-protein interactions, protein interaction databases, topology of protein interaction networks, module and protein complex discovery, network alignment and mining, computational models for network evolution, network-based functional inference, metabolic pathway databases, topology of metabolic pathways, flux models for analysis of metabolic networks, network integration, inference of domain-domain interactions, signaling pathway inference from protein interaction networks, network models and algorithms for disease gene identification, identification of dysregulated subnetworks network-based disease classification.

PQHS 431 (3 Credit Hours) - Statistical Methods I
Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs. First part of year-long sequence.

PQHS 451 (3 Credit Hours) - A Data-Driven Introduction to Genomics and Human Health
This course introduces the foundational concepts of genomics and genetic epidemiology through four key principles: 1) Teaching students how to query relational databases using Structure Query Language (SQL); 2) Exposing students to the most current data used in genomics and bioinformatics research, providing a quantitative understanding of biological concepts; 3) Integrating newly learned concepts with prior ones to discover new relationships among biological concepts; and 4) providing historical context to how and why data were generated and stored in the way they were, and how this gave rise to modern concepts in genomics.

PQHS 457 (3 Credit Hours) - Current Issues in Genetic Epidemiology: Design and Analysis of Sequencing Studies
Statistical methods to deal with the opportunities and challenges in Genetic Epidemiology brought about by modern sequencing technology. Some computational issues that arise in the analysis of large sequence data sets will be discussed. The course includes hands-on experience in the analysis of large sequence data sets, in a collaborative setting.

PQHS 471 (3 Credit Hours) - Machine Learning & Data Mining
Vast amount of data are being collected in medical and social research and in many industries. Such big data generate a demand for efficient and practical tools to analyze the data and to identify unknown patterns. We will cover a variety of statistical machine learning techniques (supervised learning) and data mining techniques (unsupervised learning), with data examples from biomedical and social research.

Specifically, we will cover prediction model building and model selection (shrinkage, Lasso), classification (logistic regression, discriminant analysis, k-nearest neighbors), tree-based methods (bagging, random forests, boosting), support vector machines, association rules, clustering and hierarchical clustering. Basic techniques that are applicable to many of the areas, such as cross-validation, the bootstrap, dimensionality reduction, and splines, will be explained and used repeatedly. The field is fast evolving and new topics and techniques may be included when necessary.

PQHS 515 (3 Credit Hours) - Secondary Analysis of Large Health Care Data Bases
Development of skills in working with the large-scale secondary data bases generated for research, health care administration/billing, or other purposes. Students will become familiar with the content, strength, and limitations of several data bases; with the logistics of obtaining access to data bases; the strengths and limitations of routinely collected variables; basic techniques for preparing and analyzing secondary data bases and how to apply the techniques to initiate and complete empirical analysis.

MPHP 405 (3 Credit Hours) - Statistical Methods in Public Health
This one-semester survey course for public health students is intended to provide the fundamental concepts and methods of biostatistics as applied predominantly to public health problems. The emphasis is on interpretation and concepts rather than calculations. Topics include descriptive statistics; vital statistics; sampling; estimation and significance testing; sample size and power; correlation and regression; spatial and temporal trends; small area analysis; statistical issues in policy development.
Examples of statistical methods will be drawn from public health practice. Use of computer statistical packages will be introduced.

MPHP 458 / PQHS 458 (3 Credit Hours) - Statistical Methods for Clinical Trials
This course will focus on special statistical methods and philosophical issues in the design and analysis of clinical trials. The emphasis will be on practically important issues that are typically not covered in standard biostatistics courses. Topics will include: randomization techniques, intent-to-treat analysis, analysis of compliance data, equivalency testing, surrogate endpoints, multiple comparisons, sequential testing, and Bayesian methods.

MPHP 467 / PQHS 467 (1-3 Credit Hours) - Comparative and Cost Effectiveness Research
Comparative effectiveness research is a cornerstone of healthcare reform. It holds the promise of improved health outcomes and cost containment. This course is presented in a convenient 5-day intensive format in June. There are reading assignments due prior to the 1st session. Module A, Days 1-2: Overview of comparative effectiveness research (CER) from a wide array of perspectives: individual provider, institution, insurer, patient, government, and society. Legal, ethical and social issues, as well as implications for population and public health, including health disparities will also be a component.

Module B, Day 3: Introduction to the various methods, and their strengths, weaknesses and limitations. How to read and understand CER papers. Module C, Days 4-5: Cost-Effectiveness Analysis. This will cover costing, cost analysis, clinical decision analysis, quality of life and cost-effectiveness analysis for comparing alternative health care strategies. Trial version of TreeAge software will be used to create and analyze a simple cost-effectiveness model. The full 3-credit course is for taking all 3 modules. Modules A or C can be taken alone for 1 credit. Modules A and B or Modules B and C can be taken together for a total of 2 credits. Module B cannot be taken alone. If taking for 2 or 3 credits, some combination of term paper, project and/or exam will be due 30 days later.

MPHP / PQHS 468 (3 Credit Hours) - The Continual Improvement of Healthcare: An Interdisciplinary Course
This course prepares students to be members of interprofessional teams to engage in the continual improvement in health care. The focus is on working together for the benefit of patients and communities to enhance quality and safety.

CRSP 401 (3 Credit Hours) - Introduction to Clinical Research Summer Series
This course is designed to familiarize one with the language and concepts of clinical investigation and statistical computing, as well as provide opportunities for problem-solving, and practical application of the information derived from the lectures. The material is organized along the internal logic of the research process, beginning with mechanisms of choosing a research question and moving into the information needed to design the protocol, implement it, analyze the findings, and draw and disseminate the conclusion(s).

ACCT 401H (3 Credit Hours) - Accounting for Healthcare
This course exposes MSM-Healthcare students to ways that accounting information helps managers monitor and improve the performance of organizations. After studying the nature and limitations of accounting information, we explore how financial, cost, tax, and regulatory accounting are used by various stakeholders. From this effort, students become comfortable evaluating accounting recognition, valuation, classification, and disclosure issues that arise in an executive's career. Finally, we study how accounting is a feedback loop that enables managers to assess consequences of past decisions and think about what should be done going forward. Feedback loops, in turn, can give rise to observer effects and/or unpredictable outcomes. Course content contributes to achieving the program goal of strengthening a student's ability to promote positive change in healthcare.

HSMC 412 (3 Credit Hours) – Lean Service Operations
The course will be delivered over four modules: 1) Service Process Blueprints, 2) Managing Capacity in Service Systems, 3) Mapping the Value Stream (current and future state), and 4) Inventory Management in Service Systems. The topics considered are viewed in the context of healthcare management, financial services, insurance firms, call centers, back-office operations, and other applications. Through these topics, the participants will be trained in tools that help them understand customers' expectations and needs and to identify service system characteristics that can meet these needs. We will learn how to identify errors in service and troubleshoot these problems by identifying the root causes of errors. Subsequently, we will discuss how one can modify the product or service design so as to prevent defects from occurring. Finally, we will establish performance metrics that help evaluate the effectiveness of the Lean system in place.
These efforts will result to improved quality. This course is not oriented toward specialists in service management. Its goal is to introduce you to the environments and help you appreciate the problems that operations managers are confronted with. Then, we will typically discuss some system specifics and emphasize the principles and issues that play key role in their management.

HSMC 420 (3 Credit Hours) – Health Finance
Exploration of economic, medical, financial and payment factors in the U.S. healthcare system sets the framework for the study of decisions by providers, insurers, and purchasers in this course. The mix of students from various programs and professions allows wide discussion from multiple viewpoints.

HSMC 456 (3 Credit Hours) – Health Policy and Management Decisions
This seminar course combines broad health care policy issue analysis with study of the implications for specific management decisions in organizations. This course is intended as an applied, practical course where the policy context is made relevant to the individual manager.

Appendix

Electives by Domain of Academic Interest (pick 2 from 1 domain)

For a 15 credit certificate, which will appear on a CWRU transcript, pick one additional elective from any domain or from other electives in consultation with your academic advisor.

Health Informatics Management Concentration (Health Care Professionals)	**Clinical Informatics Concentration (MPH/PhD PQHS Students)**	**Bioinformatics Concentration (MPH/PhD PQHS Students)**
EBME 473 – Introduction to Clinical Information Systems	PQHS 515 – Large database / Healthcare analytics	PQHS 451 – A Data-Driven Introduction to Genomics and Human Health
CRSP 401 – Introduction to Clinical Research **OR** PQHS 431 – Statistical Methods 1	PQHS 471 – Machine learning and data mining	PQHS 471 – Machine learning and data mining
PQHS 471 – Machine Learning/Data Mining	EBME 473 / SYBB 431 – Introduction to Clinical Information Systems	EECS / SYBB 459 – Bioinformatics for Systems Biology
HSMC 420 – Health Finance	CRSP 401 – Introduction to Clinical Research **OR** PQHS 431 – Statistical Methods 1 **OR** MPHP 405 – Statistical Methods in Public Health	
HSMC 412 – Lean Service Operations	MPHP 467 – Comparative and Cost Effectiveness Research	
HSMC 456 – Health Policy and Management Decisions	MPHP 468 – The Continual Improvement of Healthcare: An Interdisciplinary Course	
	MPHP 458 – Statistical Methods for Clinical Trials	

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