Overview

Continuous improvement in individual and population health requires health professionals, health care delivery organizations, and ultra-large scale health systems that are capable of data-directed self-study and adaptive change. The multidisciplinary MS and PhD in Health Infrastructures and Learning Systems (HILS) programs will undertake research to address the social and technical challenges of making continuous health improvement routine.

The concept of infrastructure provides a point of focus and differentiation for the program. Infrastructure is defined as integrated technologies, policies, and patterns of human behavior that, together, support a broad range of valued activities in a given domain of human endeavor. Successful infrastructures are dynamic and able to adapt to changes in quantitative and qualitative demands that drive changes in relevant policies, and advancements in the technologies that support the infrastructure. Because health care delivery is an information and human intensive domain, we define health infrastructures as the creation, curation, and application of information at multiple levels of refinement ranging from raw data to actionable knowledge. The goal of health infrastructures is to improve the health of individuals and populations.

Learning systems promote improvement through simultaneous execution of multiple learning cycles, each of which is focused on a specific health problem or improvement goal. What makes these learning processes sustainable at a large scale, where hundreds and perhaps thousands of these cycles will be ongoing simultaneously, is a socio-technical infrastructure platform.

Program Objectives

- Develop leaders and researchers in Learning Health Systems
- Educate problem solvers who can conceptualize complex challenges in health care organization and deliver and apply innovative solutions
- Expand our understanding of how health infrastructures apply to different levels of scale
- Apply information and implementation sciences to understand and analyze complex health systems

The HILS program emphasizes the importance of interdisciplinary approaches to changes and challenges in healthcare. HILS is unique in the joint and equal emphasis on both the data and information sciences and social sciences related to behavior change and continuous improvement in health. While oriented toward applied research, the program is firmly based in scientific theory and methods, emphasizing interdisciplinary approaches to discovery and dissemination of knowledge to improve human health. The interdisciplinary nature of the program engages many schools and colleges across the University of Michigan: including but not limited to the School of Information, School of Public Health, College of Engineering, and School of Education.

Connecting a number of forces and enablers already taking shape, the MS and PhD in Health Infrastructures and Learning Systems envisions the disruptive transformation of healthcare and health, as well as the interdisciplinary science needed to underpin this vision. Graduates of this program will have unique skills placing them in demand for current and future employment opportunities, as well as empowering them to lead and invent the future.
Curriculum

Four types of courses are required for all students in the MS and PhD programs: research methods courses, courses in the components of the learning cycle, courses in health infrastructures, as well as at least one cognate and one elective course suited to the student’s area of scholarship. The cognate requirement is intended to foster intellectual breadth, which, due to the highly interdisciplinary nature of the HILS program, will be inherent in the courses required of and elected by students.

The curricular goal is to ensure that students are thoroughly grounded in each of the phases of the learning cycle and to the infrastructure required to enable the learning cycles to function in a Learning Health System (see figure). The health infrastructures courses bookmark the learning cycle sequence, ensuring that students gain an initial understanding of the concepts and approaches to building and maintaining health infrastructure, with opportunities to apply and experience actual creation and maintenance activities.

Courses required to achieve program objectives, master the domains, demonstrate skills, and have the capacity to create the products, include:

- Learning system infrastructure
- Health systems
- Research methods
- Behavior change/implementation methods
- Policy and ethics
- Aggregation and analytics
- Knowledge management

Doctoral students will complete a minimum of 36 credits of coursework, while MS students will complete a minimum of 27 credits. The MS program is intentionally designed to be less than two full years of study, to appeal to professional students (both clinicians and engineers, among others) who wish to gain new knowledge and skills but would prefer a shorter, more intense program.

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<thead>
<tr>
<th>Fall Year 1</th>
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<th>Fall Year 2</th>
<th>Winter Year 2</th>
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<td>MS + PhD</td>
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<tr>
<td>Research Methods for Learning Systems 1</td>
<td>Advanced/ Applied Research Methods Course</td>
<td>Cognate</td>
<td>End of MS program</td>
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<td>Health Infrastructures Pro Seminar 1</td>
<td>Implementation Science in Health 1</td>
<td>Implementation project</td>
<td>Implementation Science in Health 2</td>
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<td>Data Science in Health</td>
<td>Knowledge Representation &amp; Management in Health</td>
<td>Ethics &amp; Policy Issues for Learning Health Systems</td>
<td>Analysis / Statistics Course</td>
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Doctoral students will begin the dissertation proposal during winter term of their second year. Working closely with their advisor and planning committee, they will draft a proposal for their dissertation and a public proposal defense will be conducted. The dissertation research phase of the program is likely to be variable across candidates. We will encourage students and faculty to seek individual, external funding for dissertation research, which will support higher quality research. This may increase the length of time in the dissertation research phase of the program. On average, we expect students to complete their research within three years of the proposal defense. Students will defend their dissertations through a public examination by their PhD committees.
Faculty

The University of Michigan has broad and deep coverage of HILS domains among faculty across departments in many schools and colleges. An important role for the HILS Program is to foster increased intellectual ties and opportunities for synergy among these faculties. Multiple campus partners formally supported the program proposal.

Members of the faculty in the Department of Learning Health Sciences (DLHS), other departments in the University of Michigan Medical School, and other campus units pursue research and develop and teach courses related to health infrastructures and learning systems in health. Examples include work on social interventions for health and wellness and health information seeking, sharing and use in communities and families, education in the health professions, and development of informatics applications for enabling clinical, translational, public health, and health services research conducted in the School of Public Health.

Faculty in DLHS hold external and internal research funding and are active in conducting research related to HILS domains. As a result, DLHS faculty are able to provide graduate student research assistant funding for graduate students in the HILS program, as well as opportunities for implementation projects and dissertation research.

MS & PhD Admissions

The HILS program will attract students and scholars with backgrounds from a variety of disciplines, including, but not restricted to: information, computing and statistical sciences; public health; health sciences; informatics; complexity and systems science; behavioral and social sciences; organizational and policy sciences; engineering; and economics. Prospective students will be interested in collaboratively addressing the grand challenge of transforming health-related systems locally and globally into entities that learn and improve through self-study in order to benefit the health of individuals and populations.

DLHS is fully committed to establishing and supporting a diverse faculty, staff, and student community. Creating an academic community that is representative of our national and global community is essential to the healthy development of all our learning, teaching, and research activities, and to those of the HILS program in particular. The impact of growing a new body of science, and new scientists, demands consideration of a wide variety of experiences and viewpoints, particularly those of traditionally underrepresented populations in the health sciences and essential related disciplines.

Applications for admission to the PhD and MS programs are now available via the Rackham Graduate School. Overview of the Application Process and Rackham’s Checklist for Completing your Application provide detailed instructions and requirements. The first cohorts of MS and PhD students will be admitted to begin studies Fall 2016. Admitted doctoral students are guaranteed at least four years of full funding: tuition, stipend, and graduate student health insurance.

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Kathleen O’Connor, Education Programs Manager, is the admissions contact within the Department of Learning Health Sciences: kgoc@umich.edu or (734) 615-6129.

Applications can be submitted via Rackham Graduate School, http://www.rackham.umich.edu/admissions.