

THE UNIVERSITY OF MICHIGAN
REGENTS' COMMUNICATION

ACTION REQUEST

SUBJECT: New Joint Master's Degree and Graduate Certificate Program in Health Informatics

ACTION REQUESTED: Approval to offer a new joint Master's Degree and Graduate Certificate Program in Health Informatics, School of Information and School of Public Health, University of Michigan-Ann Arbor campus

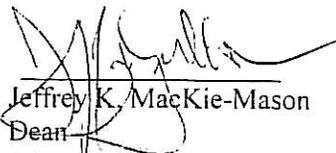
The University of Michigan-Ann Arbor campus, School of Information and School of Public Health, propose a joint master's degree and graduate certificate in Health Informatics.

The Master of Health Informatics and the Graduate Certificate in Health Informatics combines the strength of two professional schools at the University of Michigan that currently have highly successful master's programs. The objective of the proposed health informatics program is to train a cadre of experts who will bring a human-centered approach to the development and deployment of health information technologies.

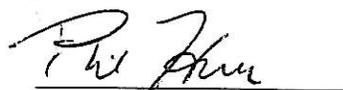
The proposed master's program will require 52 total credit hours for completion, normally two years of full time study. In addition, students enrolled in other graduate programs at the University of Michigan will be able to take six courses totaling 18 credits to earn a Graduate Certificate in Health Informatics.

We request that the Board of Regent's approve the offering of a new joint master's degree and graduate certificate in Health Informatics. Pending approval at the University and state levels, the target date for enrollment of the first graduate certificate students would be Fall 2011; target date for enrollment of the first master's degree students would be Fall 2012.

RECOMMENDED BY:


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Dean
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Provost and Executive Vice
President for Academic Affairs

**University of Michigan
Ann Arbor Campus**

**School of Information
and
School of Public Health**

**Proposal for a Joint Master's Degree
and
Graduate Certificate Program**

in

Health Informatics

February 2011



Proposal to Launch a Master's Degree and Graduate Certificate Program in Health Informatics

2011 February 28

SECTION I: INTRODUCTION

A. Overview of the Proposed Program in Health Informatics

The University of Michigan School of Information and School of Public Health propose a joint master's degree and graduate certificate in Health Informatics. The primary objective is to train a cadre of experts who will bring a human-centered approach to the development and deployment of health information technologies.

There is an urgent societal need for trained experts to support the deployment of current health information technologies. A major national effort is underway to encourage the widespread use of new information tools in health care, so as to increase the quality of care and decrease its costs¹. This initiative represents a fundamental change in the core activities of a sector that occupies about one sixth of the U.S. economy. Such laudable policy goals cannot be successfully accomplished without a large increase in well-trained health informatics personnel. Our program will train professional students for leadership roles in this rapidly expanding area.

Many undergraduate and graduate students at the University of Michigan are aware of the opportunities in this field and have expressed interest in pursuing health informatics training. For example, results from a survey of students entering the School of Public Health in the fall term of 2010 indicated that 66% of students would have, or may have, been interested in a degree program in Health Informatics had it been available at the time that they applied. Additionally, faculty members from both the School of Information and the School of Public Health are seeing increased interest in health informatics from student advisees. A group of graduate students from the Schools of Information and Public health is also in the process of establishing a health informatics student organization.

At the University of Michigan, the elements of interdisciplinary education and research in health informatics already exist, but are not formally organized as an academic program. Our proposed partnership between the Schools of Information and Public Health provides the foundation for a comprehensive program that traverses clinical, consumer, and public health informatics fields. Both Schools have many outstanding programs of related research and highly regarded master's level professional degree programs. This program joins those resources to create a new degree at the University of Michigan, one that combines the deep and varied expertise of the School of Public Health in epidemiology, health behavior and education, and health care institutions and policies with that of the School of Information in the design and evaluation of innovative and effective information systems and services. Both schools will contribute key faculty for the proposed program.

The breadth of expertise across the two Schools addresses needs for health informatics specialists with diverse competencies. In addition to clinical informatics, which focuses on effective use of information systems in physician practices and hospitals, the coming transformation of the health sector will require knowledge and skills in a range of other growing health informatics sub-specialties. For example, there will be increasing emphasis on consumer health informatics, including information technologies that support maintaining health outside clinical settings—such as wellness programs, personal health records, high-quality online health

¹ See, for example, *American Recovery and Reinvestment Act of 2009 - Title XII: Health Information Technology for Economic and Clinical Health Act*, (February 17th, 2009)

information and extra-clinical support for chronic conditions. Important opportunities are also emerging in public health informatics, such as expanded capabilities for supporting health research by more tightly coupling clinical and consumer health data to analytic capabilities such as epidemiological analysis and clinical data mining.

We expect clinical, consumer and public health informatics will be strong elements of the proposed program, but we do not assume that these are the only areas of health informatics that will be important in the future. On the contrary, experience in the information technology field has shown that new lines of work are defined constantly, as the potential of new technologies is exploited in one field after another. There is every reason to expect that the health informatics field will develop important new subfields over the coming years. Our proposal responds to the diversity of current needs and the foreseeable change within the health informatics area by defining a critical core of knowledge and practical experience that all students should possess, while allowing for additional study in new or emerging areas.

At the center of the master's program will be a set of core courses that are considered foundational for all work in the health informatics sector. The core material will cover the following: the structure of the U.S. health care system; basic concepts in the fields of health information and related systems; and fundamentals of data management, statistical analysis, computing and project management. All students will complete internships that link classroom concepts to significant on-the-job experience. In addition, the program will offer a wide range of opportunities for specialization in one of the many applied areas that are essential to realizing the opportunities inherent in health information systems. For example, students might develop expertise in: user interface design for clinical information systems, health information privacy protection and policy, or health data mining—to name just a few.

The proposed master's program will require 52 total credit hours for completion, normally two years of full time study. In addition, students enrolled in other graduate programs at the University of Michigan will be able to take six courses totaling 18 credits to earn a Graduate Certificate in Health Informatics. Such students may come from the School of Public Health, the School of Information, the School of Social Work, the College of Engineering, the School of Nursing or the Medical School.

B. Prospects of the Job Market in Health Informatics

The current climate for healthcare reform, combined with the explosive advances in information technology, have created the need for skilled individuals who are able to design, manage, and integrate clinical and administrative information, technologies, and systems in healthcare organizations. Forecasts of national demand provide a strong indication of high level of future demand in this area. The U.S. Bureau of Labor Statistics (BLS), for example, projects that health information management and health informatics employment will grow nearly 18% by 2016. The BLS projects a need for more than 6,000 new professionals each year through 2014—but only 2,600 graduates have entered the field this past year. Similarly, according to the Occupation Outlook Handbook 2010–2011, employment in the health informatics field is expected to grow (projected 20% increase) much faster than the average across all fields. Graduates with a strong understanding of technology, computer software, and electronic records management will be in particularly high demand.

Further, the U.S. News & World 2009 Report ranks the field of health informatics as one of the “Ahead of the Curve Cutting-Edge Careers”—which means it is identified as an exciting, emerging career path with a strong job market. This ranking is based on the following criteria: job outlook, average job satisfaction, difficulty of the required training, prestige and pay.² Similarly, CareerBuilder.com declares health informatics as one of the “hottest” career trends on the job market.³ As government and private sector organizations continue to move towards digitizing medical practices and patient records, there will be literally thousands of job opportunities for people with the right skill set.

² <http://www.usnews.com/money/careers/articles/2008/12/11/ahead-of-the-curve-health-informatics-specialist-2009.html>

³ <http://www.careerbuilder.com/Article/CB-1302-Job-Info-Trends-7-Emerging-Jobs/>

Locally, the Michigan Center for Effective IT Adoption (M-CEITA) alone is projected to generate over 100 job opportunities in the next few years, in addition to concomitant hires in physician offices, hospitals, and other health care related firms and organizations in response to government incentive programs that aim to accelerate adoption of Health Information Technology (HIT). M-CEITA is one of the federally funded HIT Regional Extension Centers, which were funded under the provisions of the American Reinvestment and Recovery Act of 2009. By the end of 2009, it had received \$20 million in funding from the Office of the National Coordinator for Health Information Technology. M-CEITA is co-housed at the Altarum Institute, a non-profit organization that is a strong external supporter of the proposed joint degree program. In addition, collaborative agreements exist, or are in development, with the following firms and organizations located in Ann Arbor and environs to provide prospective students with internship and job placement opportunities:

- University of Michigan Health System (UMHS)
- UMHS Medical Center of Information Technology
- UMHS Health Information Management
- The Altarum Institute
- The Michigan Coalition for Health Information Technology
- HealthMedia, Inc.
- Cielo MedSolutions LLC

There are also a number of employers locally and nationally (see Appendix A) with whom existing School of Information or School of Public Health alumni work in job capacities related to health informatics, in addition to advanced degree programs where our past graduates are enrolled.

University of Michigan alumni at these institutions provide additional evidence of the diverse job opportunities available to graduates of this area, while pointing to a nascent network, which can be further developed to enrich student internship and job placement opportunities.

It is also worth noting that the State of Michigan has been selected for one of eight Centers for Medicare & Medicaid Services' Multi-Payer Advanced Primary Care Practice Demonstration projects. These projects are intended to improve the efficiency and effectiveness of health care, strengthen the patient and primary care physician relationship, and reduce health care costs.⁴ Health Informatics graduates will be prepared to envision and lead the development of health informatics solutions that support coordinated care efforts central to "patient-centered medical homes" associated with the project goals of the Centers for Medicare & Medicaid Services.⁵

C. Market Analysis—Competitor Programs

At present, the American Medical Informatics Association identifies 21 universities in the U.S. that provide master's degrees in health informatics, with an additional half dozen programs in nursing informatics only. Additionally, a number of schools, such as the University of North Carolina-Chapel Hill, University of Minnesota, and Georgia Institute of Technology, have publicly stated their intention to launch graduate programs in health informatics. There are also postdoctoral fellowship programs funded by the National Library of Medicine part of the National Institutes of Health (NIH). Schools that offer exclusively postdoctoral training include Harvard University, Columbia University, University of Washington and Vanderbilt University.

Of the existing health informatics master's programs, only 11 reside at highly ranked universities. Programs at top 20 universities such as Stanford, Columbia and Vanderbilt are well established and would provide strong competition for the best students. There are also well-established and reputable master's programs at Oregon Health and Science University, the University of Pittsburgh, and University of Washington that may attract strong students. Moreover, each of these programs also offers doctoral programs exclusively in health

⁴ <http://www2.med.umich.edu/prmc/media/newsroom/details.cfm?ID=1841>

⁵ <http://www.innovations.cms.gov/innovations/pressreleases/pr110910.shtml>

informatics. Additionally, the recently launched Master of Health Sciences Informatics program at Johns Hopkins University extends the School's previous post-doctoral fellowship training in health informatics.

Each of these well-ranked health informatics programs is located within a medical school or an academic health science center, although some have collaborations with other departments—such as schools of public health or nursing. Other than a recently launched program in Canada at the University of Toronto, the University of Michigan's program will be set apart by the key leadership roles offered by the Schools of Information and Public Health in defining its curriculum. In addition, the programs proposed at Georgia Tech and the University of North Carolina have strong human-computer interaction (HCI) and/or information science components, and thus might provide more direct competition for students with strong interests in these fields.

The proposed program should be highly attractive to strong students who prefer to study in the Midwestern region of the U.S. At present, the only Midwestern master's programs in health informatics are at the University of Missouri-Columbia and University of Illinois at Chicago, schools that are not competitive with the University of Michigan according to ranking agencies such as U.S. News & World Report. Additionally, Michigan State University offers an online graduate certificate in Public Health Informatics,⁶ and Michigan Tech University has proposed a more specialized Master of Science in Medical Informatics and Security,⁷ which is not the key focus of our proposed program. The University of Michigan—Ann Arbor will be the first Michigan public university to offer a broad program in health informatics.

The proposed program should also be highly attractive nationally to students who want to focus on human and organizational aspects of health information systems. The majority of health informatics master's degree programs have particular strength in clinical and bioinformatics. Six make specializations in public health informatics or public health dual degrees available to their students. The schools with public health strength include the University of Washington, Johns Hopkins University, Stanford University, and Columbia University. While public health informatics may include consumer health informatics, this is not currently a stated specialization of any existing health informatics program. The University of Michigan offers unusual research strength in human-computer interaction and in consumer-facing health information systems, and the proposed curriculum capitalizes on that expertise.

Completion of most health informatics master's degree programs requires two years of full-time study (or the equivalent in part-time study). All require a bachelor's degree (at minimum) for admission, with a number of programs recommending a background in a health science/profession or computer science, engineering or mathematics. These programs generally offer professional training, with the exception of programs at the University of Washington and Vanderbilt University, which have a strong research emphasis and thus require completion of a master's thesis.

Based on interest expressed by current students in the Schools of Information and Public Health in the field of health informatics, and based on the expanding job market in the field, we expect to see significant interest in the program. Depending on the flexibility of other health-related graduate and professional programs at the University, graduate certificate entering enrollments may be as high as 25 in year one with 25-50 percent growth in years two and three. Depending on the quality of applicants, entering enrollment for the master's program is projected at 12 in year one with 25-50 percent growth in years two and three.

SECTION II: PROGRAM DESCRIPTION

A. Joint Master's Degree and Graduate Certificate Programs: A New Model

The proposed health informatics program represents an innovative model for joint educational programs at the University of Michigan. As envisioned, students enrolled in the program will complete requirements for a single

⁶ <http://www.reg.msu.edu/AcademicPrograms/ProgramDetail.asp?Program=2842>

⁷ <https://cnsa-web.tech.mtu.edu/drupal/node/23>

master's degree or graduate certificate that is conferred jointly by the School of Information and the School of Public Health. This contrasts with the existing 'dual degree' model in which students enroll in two colleges or schools, complete core requirements for each school and—double-counting a subset of credits—earn two degrees conferred by two schools in approximately 75% of the time required to complete two separate degrees (e.g. the dual master's degree program in Public Health and Social Work). This model also differs from the traditional joint degree model in which students enroll in one "home" college or school and complete graduation requirements for and earn one degree conferred by the home college or school (e.g. the joint Ph.D. program in Public Policy and Economics).

There are several reasons for pursuing this innovative joint model. Health informatics is an interdisciplinary field that sits at the intersection of computer, information, social and behavioral sciences and health application domains. Because of the field's interdisciplinary nature, the proposed program will itself be aggressively interdisciplinary—thus providing expanded opportunities for intellectual and practical innovation, as well as preparing students to occupy the type of boundary-spanning leadership positions that will be needed in the future. Graduates of the program will also be well positioned to pursue job opportunities for which credentials from either or both Schools will be viewed with high regard. Additionally, because competitor programs are offering or will offer cohesive health informatics curricula, creating a single degree two-year curriculum is not only logical from a pedagogical but also from a marketing perspective. Finally, the proposed joint model will ensure the long-term commitment of both Schools to the program.

B. Master of Health Informatics: A New Degree

For students pursuing careers in health informatics, neither the existing Master of Science in Information nor Master of Public Health degree provides sufficient depth in required areas. Therefore, students completing this professional master's program will earn a new type of degree—a Master of Health Informatics. Possession of this new degree will indicate attainment of in-depth, interdisciplinary training that could not be obtained through other channels.

C. Graduate Certificate in Health Informatics

Many academic units at the University offer graduate certificate programs designed to serve students who wish to augment their basic field of study with more detailed concentration in a specific area, to gain interdisciplinary background pertinent to a professional career intention. For example, certificates are offered by the Ross School of Business, the School of Music, the School of Natural Resources, and by many units that are part of the Rackham Graduate School. University of Michigan graduate certificate programs range from 12 to 18 credit hours of additional course work, with typical programs requiring five courses for a total of 15 graduate credit hours distributed between required core courses and some number of electives from a controlled list.

With an 18 credit-hour (six course) requirement, the proposed Health Informatics Certificate is in line with the requirements of other certificate programs at the University. The certificate program will require students to take a series of courses that will develop their competencies in the same broad areas as Master of Health Informatics students, but with less depth.

D. Curriculum

The proposed program in Health Informatics combines the strengths of two professional schools at the University of Michigan that have highly successful master's programs. The primary objective is to train a cadre of experts who will bring a human-centered approach to the development and deployment of health information technologies. The program draws both on the expertise of Public Health faculty in health care institutions, policies and incentives, as well as individual health behaviors and also on the expertise of the Information faculty in the human-centered design, implementation and evaluation of information systems.

Students completing the Master of Health Informatics degree will be well prepared to enter—and become leaders in—the health informatics field. Through their elective course selections, they may shape their preparation more specifically to certain subfields, such as clinical, consumer or public health application areas.

Because there is likely to be integration and convergence among these subfields in the coming years, however, all students will be required to acquire some knowledge about each of these fields. Defining features of the program, and those which set it apart from its competitors, will be its particular strengths in consumer informatics, population health applications and system-related human and organizational issues.

The Certificate in Health Informatics will consist of a key subset of the degree program requirements. The vision of the certificate program is that it will enrich students' other career pursuits.

Roles and Competencies

Broadly, we expect graduates to be able to serve in both: 1) visionary, strategic roles, and 2) tactical, implementation roles. In order to act as visionaries, graduates will need to understand the opportunities and constraints for health informatics applications, and be able to communicate them to others. In particular, students will need to acquire a variety of competencies related to the health domain, including the behavior of individual and institutional actors. They will need to understand the state of the art in health informatics applications and must monitor the environment for new developments. They will need to understand fundamentals of human and organizational behavior, and of computing and biotechnologies. Finally, they will need to understand the capabilities of a variety of techniques, from natural language processing to personalization to data visualization, though not every student will need to know about all of the techniques. In more tactical roles, graduates will support or lead the planning and implementation of specific health informatics projects. In order to do so, they will need to use a variety of methods, tools and techniques that allow one to: analyze requirements, plan projects, manage implementation and deployment, and evaluate system usability and usefulness. As with competencies that support visionary, strategic roles, not every graduate will need to acquire the same level of competence in all the methods, tools and techniques that support tactical, implementation roles. All graduates, however, should acquire a user and use-oriented perspective on health informatics applications (as opposed to a solely system-centric perspective), and all should be prepared to occupy critical roles in the implementation and deployment of innovative health informatics applications. Specific competencies for both roles are outlined in more detail in Appendix B.

Audiences

The proposed program is likely to attract two streams of students:

- Post-undergraduate professional master's students similar to those enrolling in current two-year professional master's degree programs in the partner Schools, but whose special interest is in health informatics. Although the master's degree may occasionally be completed over a longer period of time, the usual pattern will be for students to pursue two years of full time study (fall and winter of two successive academic years), with an internship in the summer between the two academic years.
- Certificate students, who are enrolled in other degree programs at the University and who have additional interest in health informatics. Students will complete the certificate by completing up to six courses, in addition to their graduate degree requirements.

Entrance requirements

Students will be required to complete an earned bachelor's degree prior to matriculation in the master's degree program. Additional required application materials will include transcripts from all prior programs of study, GRE scores, TOEFL scores for students for whom English is not their first language, a personal statement and a statement of purpose. We expect students from a wide variety of undergraduate backgrounds to be interested in the program. There are no specific content pre-requisites for the master's degree or graduate certificate in Health Informatics, but it will be recommended that students acquire or refresh their knowledge of a relevant analytic discipline, such as basic statistics or computer programming, prior to enrollment. We expect the admissions process to be highly selective, and we will not discriminate on the basis of age, race, disability or sexual orientation.

Students enrolled in any graduate degree program at the University of Michigan—Ann Arbor will be eligible to participate in the certificate program, without any additional admissions process.

Master of Health Informatics

The master's degree program will require completion of 52 credit hours of course work concentrated in the Schools of Information and Public Health plus an internship experience. The degree requirements are divided into three categories: required core courses (37–38 credits), elective courses (14–15 credits) and the internship (0 credits). Course descriptions appear in Appendix C.

Core Courses (37–38 credit hours)

In order to develop a strategic vision for health informatics applications, students will acquire an understanding of human and organizational behavior, of technology capabilities and constraints, and of the health care context. In order to plan, develop, implement, and evaluate systems, students will learn to apply tools and techniques for design, analysis, and management. The core of the program provides students with these two key pillars of preparation.

Also included in the core is a seminar course series. Content for the course will include readings and discussion related to emerging technologies, guest speakers (e.g. members of the medical, dental, nursing and pharmacy faculty who are engaged in health informatics research, and health informatics practitioners) and student internship presentations. The course will be cross-listed in the School of Information and one or more departments in the School of Public Health.

Course	Credits	Offered
SPH / SI 6xx Health Informatics Seminar (1 credit per term for four terms)	4	F / W
EPID 503 Strategies and Uses of Epidemiology *	3	W
HBEHED 600 Psychosocial Factors in Health-Related Behavior	3	F
HMP 602 Survey of the US Health Care System	3	W
HMP 668 / SI 542 / BIOINF 668 Introduction to Health Informatics	3	W
HMP 669 Database Systems and Internet Applications in Health Care	3	W
SI 501 Contextual Inquiry and Project Management	3	F
SI 502 Networked Computing: Storage, Communication, and Processing **	3	F / W
SI 621 / PUBPOL 720 Information, Ethics and Applied Policy	3	W
SI 622 Evaluation of Systems and Services	3	W
<i>One of the following inferential or exploratory statistics courses:</i>		
BIOSTAT 503 Introduction to Biostatistics ***	4	F
BIOSTAT 553 Applied Biostatistics	4	F
SI 544 Introduction to Statistics and Data Analysis	3	F
SI 601 Data Manipulation (1.5 credit) <i>and</i> SI 618 Exploratory Data Analysis (1.5 credit)	3	W + W
<i>One of the following management courses: ****</i>		
HMP 603 Managing Health Care Organizations	3	W
HMP 604 Understanding the Structure and Management of Nonprofit Health Orgs.	3	W
HMP 616 Understanding Organizations	3	W
HMP 643 Managing People in Health Organizations	3	F
SI 530 Principles in Management	3	W
SI 627 Managing the IT Organization	3	W

* *EPID 503 may be waived, based on passing performance on the School of Public Health's EPID 503 exemption exam. Only the course will be waived, not the credit requirement, meaning that students will be required to substitute an elective for this required course.*

** *SI 502 may be waived based on passing performance on the School of Information's SI 502 proficiency exam. Only the course will be waived, not the credit requirement, meaning that students will be required to substitute an elective for this required course.*

*** *BIOSTAT 503 may be waived, based on passing performance on the School of Public Health's BIOSTAT 503 exemption exam. Only the course will be waived, not the credit requirement, meaning that students will be required to substitute an elective for this required course.*

**** The management course requirement may be waived, based on evidence of prior learning in a graduate level management course. Only the course will be waived, not the credit requirement, meaning that students will be required to substitute an elective for this required course.

Elective Courses (14–15 credit hours)

In order to become effective participants in developing and deploying healthcare information systems, students will expand their knowledge and skills by taking five or more elective courses from the following list. The total number of core and elective credits must equal 52. *Note: Core requirements ensure that students who choose to enroll in the maximum number of available courses in one School will still complete a minimum of 19 credits that are listed or cross-listed in the other School.*

Course	Credits	Offered
BIOINF 527 Introduction to Bioinformatics	3	F
BIOSTAT 503 Introduction to Biostatistics	4	F
BIOSTAT 553 Applied Biostatistics	4	F
BIOSTAT 619 Clinical Trials	2	F
EECS 588 Computer and Network Security	4	W
EECS 598 Special Topics: Biomedical Machine Learning	1–4	F
EHS 608 / EPID 608 Environmental Epidemiology	3	W
EHS 635 / HBEHED 635 Tailored Health Communication: From Theory to Practice	3	W
EPID 514 Social Epidemiology	3	F
EPID 626 Epidemiology, Health Services and Policy	2	W
EPID 777 Geographic Information Systems	1	Su
HBEHED 530 Techniques of Survey Research	3	W
HBEHED 622 Program Evaluation in Health Education	3	F
HBEHED 624 Needs Assessment Methods for Behavioral and Educational Health Programs	3	F
HBEHED 627 Chronic Illness Interventions: Infancy to Early Adulthood	3	F
HBEHED 628 Chronic Illness Interventions: Midlife to Older Adulthood	3	W
HBEHED 630 Aging and Health Behavior	3	W
HBEHED 633 Social Networks and Social Support in Health Education	3	W
HBEHED 641 Materials and Methods in Health Education Programs	3	W
HBEHED 651 Program Development and Health Education	3	W
HBEHED 661 Designing Sticky Communications for Health Advocacy, Education & Mass Media	3	W
HBEHED 662 Risk Communication: Theory, Techniques and Applications in Health	3	F
HBEHED 668 Health Communication for Public Health	3	F
HMP 603 Managing Health Care Organizations	3	W
HMP 604 Understanding the Structure and Management of Nonprofit Health Orgs	3	W
HMP 610 Cost-Effectiveness Analysis in Health	3	F
HMP 616 Understanding Organizations	3	W
HMP 640 Program Evaluation in Public Health	3	F
HMP 643 Managing People in Health Organizations	3	F
HMP 654 Operations Research and Control Systems	3	F
HMP 696 / SI 642 / BIOINF 555 Concepts in Health Informatics	3	F
MECHENG 599-004 / ENGR 599-002 / BIOMEDE 599-011 Special Topics: Design for Global Health: Sustainable Technologies for the Developing World	1-6	Periodically
SI 508 Networks: Theory and Application	3	F
SI 529 eCommunities: Analysis and Design of Online Interaction Environments	3	F

SI 530 Principles in Management	3	W
SI 531 Human Interaction in Information Retrieval	3	F
SI 534 Theories of Social Influence	3	F
SI 544 Introduction to Statistics and Data Analysis	3	F
SI 546 Personal Privacy: Policy, Practice and Technology Issues	3	F
SI 551 Information Seeking Behavior	3	W
SI 561 / EECS 595 / LING 541 Natural Language Processing	3	Periodically
SI 583 Recommender Systems	1.5	W
SI 601 Data Manipulation	1.5	W
SI 606-001 Special Topics: Personal Informatics Design	3	W
SI 612 Pervasive Interaction Design	3	W
SI 617 Choice Architecture	3	W
SI 618 Exploratory Data Analysis	1.5	W
SI 627 Managing the IT Organization	3	W
SI 649 Information Visualization	3	F
SI 650 Information Retrieval	3	W
SI 653 / HMP 670 Evidence-Based Health Information Practice	3	W
SI 655 Management of Electronic Records	3	W
SI 663 Entrepreneurship in the Information Industry	3	F
SI 682 Interface and Interaction Design	3	F
SI 686 User-Generated Content	1.5	W
SI 689 Computer-Supported Cooperative Work	3	F

Although students are free to take any combination of electives, example sets of courses that might be taken by students with different career objectives appear below. *Note: these are examples only. Health Informatics students and their advisors may develop paths that include entirely different combinations of courses.*

A student who wants to develop social networking capabilities for disease management might take as electives:

- HBEHED 627 Chronic Illness Interventions: Infancy to Young Adulthood
- HBEHED 628 Chronic Illness Interventions: Mid-Life to Older Adulthood
- HBEHED 633 Social Networks and Social Support in Health Education
- SI 534 Theories of Social Influence
- SI 529 eCommunities: Analysis and Design of Online Interaction Environments

A student who wants to create consumer facing web-based resources might take as electives:

- EHS 635 Tailored Health Communication: From Theory to Practice
- HBHE 661 Designing Sticky Communications for Health Advocacy, Education, and Mass Media
- SI 551 Information-Seeking Behavior
- SI 682 Interface and Interaction Design

A student who wants to design novel interfaces for health IT systems might take as electives:

- SI 531 Human Interaction in Information Retrieval
- SI 649 Information Visualization
- SI 682 Interface and Interaction Design
- SI 689 Computer-Supported Cooperative Work

A student who wants to ensure the privacy and security of electronic health records might take as electives:

- SI 655 Management of Electronic Records

- SI 546 Personal Privacy: Policy, Practice and Technology Issues
- EECS 588 Computer and Network Security

A student who wants to develop data analytic tools that could be used by hospitals, clinical and translational researchers or insurance companies might take as electives:

- BIOSTAT 619 Clinical Trials
- SI 508 Networks: Theory and Application
- SI 561 / EECS 595 / LING 541 Natural Language Processing
- SI 649 Information Visualization
- EECS 598 Special Topics: Biomedical Machine Learning

Internship

A central feature of the program is its focus on developing the skills required to create health information systems and resources that are truly useful to the professionals, patients, and general citizens who interact with them. This requires a deep understanding of the context and the goals of the systems' end users, and an ability to translate their requirements into designs that are practical to implement and support, and that can accommodate the high rate of change that is characteristic of the health sector.

To perform well in this role, students need to gain experience in integrating conceptual understanding of health issues with a strong ability to recognize the unique requirements of each setting. Carefully selected field experience is essential for gaining this key capability. For that reason, all students in the program must complete 400 hours of internship work (e.g. a summer internship at 40 hours per week for 10 weeks or a part time internship spread over the summer and/or academic year). Credit will not be awarded for the internship.

Students will be required to search for, and secure, their own internships. It is expected that School of Information and School of Public Health career services staff, Health Informatics program staff, and faculty advisors will provide active support in the internship search process. Internships may be paid or unpaid, but every effort will be made to secure paid internships for all master's students.

A continuous stream of relevant projects will be identified among interested supporters of the program including the University of Michigan Health Systems, the Altarum Institute, HealthMedia Inc., and other health IT firms, community organizations and healthcare institutions in the region. Students will be matched to these internship projects based on interest, progress in the program, and project timelines.

Students will also be required to identify and secure a mentor in the internship setting. The internship mentor will be expected to: be more knowledgeable than the student in the work associated with the internship experience; contribute to completion of an Internship Agreement; offer continuing guidance and advice to the student; and complete an evaluation of the student's performance at the end of the internship.

Students—with input from their internship mentors—will be required to complete an Internship Agreement. The agreement will include:

- A description of the position
- A work plan
- A description of the knowledge acquired in health informatics that the student will take to the internship experience and how that knowledge will be applied
- A discussion of learning objectives that the student intends to fulfill through the internship (e.g. what they will take away from the internship experience and how that learning will support competencies for the program in Health Informatics)
- Student and mentor signatures confirming agreement to fulfill their responsibilities

In addition to the internship work, students will be required to:

- Complete an ePortfolio with:
 - Bi-weekly blog entries
 - Bi-weekly reports (including ongoing self-evaluation)
 - A post-internship final reflection
- Complete an internship survey
- Present a summary of their work and learning outcomes in the Seminar course

Health Informatics program staff will maintain a list of viable internship sites and assist students with securing quality internships. Staff will also review Internship Agreements to confirm that students have secured appropriate internships, engaged suitable mentors and completed all components of the Agreement. Students who have satisfactorily completed the Internship Agreement will be referred to faculty advisors for final review and approval. During the period of the internship, staff will monitor ePortfolio progress and will notify faculty advisors if progress is not being made. Staff will notify faculty advisors when ePortfolio final reflections are ready for review and notify the Seminar course director when students have completed the internship requirement and can be scheduled to present.

Following the internship experience, staff will administer a post-internship survey to students, collect and review mentor evaluations of students to determine whether or not students have fulfilled internship work expectations, and confirm that students have completed all components of the internship requirement prior to graduation.

Faculty advisors will work with students to review the Internship Agreement, recommend modifications when appropriate and approve the Internship Agreement. Additionally, they will review and provide feedback on students' ePortfolio final reflections and internship presentations.

The Seminar course director will determine the format of the internships presentations (e.g. posters, online posters, oral presentations), assign internship presentations to students who have completed the internship experience, and provide feedback on students' internship presentations.

Students who are currently working in a health informatics related position either full- or part-time may seek approval from the Director of the program to count job activities as their internship provided the activities meet the same criteria applied to other students. These students will be required to complete a mentorship agreement, complete the ePortfolio requirements and present a summary of their work and learning outcomes in the Health Informatics Seminar.

Graduate Certificate in Health Informatics

The certificate program will require completion of a minimum six courses for 18 credit hours of course work concentrated in the Schools of Information and Public Health. Students will select three credits from each of six categories of Health Informatics program competencies: 1) understanding the domain of health informatics applications, 2) understanding the health domain, 3) understanding human and organizational behavior, 4) understanding technologies and the application of techniques, 5) analyzing requirements, planning applications and managing projects, and 6) evaluating systems, applications and programs.

Students will be allowed to count courses completed for the graduate degree programs in which they are enrolled toward completion of the certificate. The requirements for the Graduate Certificate are:

Course	Credits	Offered
<i>The following health informatics applications course:</i>		
HMP 668 / SI 542 Introduction to Health Informatics	3	W
<i>One of the following health domain courses:</i>		
HBEHED 641 Materials and Methods in Health Education Programs	3	W
HBEHED 668 Health Communication for Public Health	3	F
HMP 600 The Health Services System I <i>and</i> HMP 601 Control of Quality and Costs of Health Care	3 + 2	F + W
HMP 602 Survey of the US Health Care System	3	W
SI 653 / HMP 670 Evidence-Based Health Information Practice	3	W
<i>One of the following human and organizational behavior courses:</i>		
HBEHED 600 Psychosocial Factors in Health-Related Behavior	3	F
HBEHED 633 Social Networks and Social Support in Health Education	3	W
HMP 603 Managing Health Care Organizations	3	W
HMP 616 Understanding Organizations	3	W
HMP 643 Managing People in Health Organizations	3	F
<i>One of the following technologies or techniques courses:</i>		
BIOINF 527 Introduction to Bioinformatics	3	F
EPID 777 Geographic Information Systems	1	Su
HMP 669 Database Systems and Internet Applications in Health Care	3	W
SI 502 Networked Computing: Storage, Communication, and Processing	3	F / W
SI 561 / EECS 595 / LING 541 Natural Language Processing	3	Periodically
SI 649 Information Visualization	3	F
<i>One of the following requirement analysis, application planning or project management courses:</i>		
SI 501 Contextual Inquiry and Project Management	3	F
SI 627 Managing the IT Organization	3	W
SI 682 Interface and Interaction Design	3	F
<i>One of the following system, application or program evaluation courses:</i>		
EPID 626 Epidemiology, Health Services and Policy	2	W
HBEHED 622 Program Evaluation in Health Education	3	F
HMP 610 Cost-Effectiveness Analysis in Health	3	F
HMP 640 Program Evaluation in Public Health	3	F
SI 622 Evaluation of Systems and Services	3	W

New Courses

In recent years, and with a future Health Informatics curriculum in mind, new courses have been developed and offered in the Schools of Information and Public Health. For example, HMP 668/SI 542 Introduction to Health Informatics was first offered in Winter 2007, SI 653/HMP 670 Evidence-Based Health Information Practice was first offered in Fall 2009 and SI 606-001 Special Topics: Personal Informatics Design is being offered for the first time this Winter 2011. Additional health informatics courses are likely to be developed by members of the faculty who are engaged in health informatics teaching and research, and such courses will be added to the program's curriculum on an ongoing basis. Pending approval of the program, a seminar course series for the master's program will be developed and presented to the appropriate committees for review and approval. The general content of the seminar course is described in the master's degree curriculum above.

Instructors of existing project-based courses in the participating Schools (e.g., SI 501 Contextual Inquiry and Project Management) will be asked to make available special projects for students enrolled in the Health

Informatics program. As program enrollments increase, Health Informatics sections may be added to existing courses. Evaluations of these courses will be carefully reviewed to confirm Health Informatics program competencies are being met.

SECTION III: PROGRAM ADMINISTRATION AND DELIVERY

Although the proposed joint model for offering the degree and graduate certificate program will require administrative innovation, the School of Information and School of Public Health are committed to a coordinated effort for the administration and delivery of this program. The current Health Informatics Faculty Committee and Administrative Committee and leadership in the Schools of Information and Public Health will develop a structure of governance that will ensure the continuing support for the program in Health Informatics. This governance structure will provide for accountability, balanced representation of faculty from the collaborating schools, and mechanisms establishing and documenting academic policies and processes.

A. Faculty

Members of the faculty in the School of Information, the School of Public Health and other campus units pursue research and develop and teach courses related to health informatics. Examples include work on social interventions for health and wellness and health information seeking, sharing and use in communities and families conducted in the School of Information and on patient decision-making using Internet-based interventions and design and development of informatics applications for enabling clinical, translational, public health, and health services research conducted in the School of Public Health. A list of faculty who are engaged in health informatics-related teaching and research appears in Appendix D.

B. Administration

Health Informatics Program Director: Oversight of and leadership for the program will be the responsibility of a program director. The director will report to a cross-school governing board and receive support from cross-school admission and curriculum committees. Ideally, the program director will be a senior member of the faculty who is connected with health informatics research and professional practice in health informatics. The director will have an external role as a public face marketing the program, as well as internal roles managing the program and advising and mentoring students. A search is currently underway for a Senior Faculty member in the area of health informatics, and the Schools of Information and Public Health have agreed to a joint hire for this position. If the program in Health Informatics is approved, the senior faculty candidate will serve as the program director and may be invited to serve as the course director for the Health Informatics Seminar course.

Health Informatics Admission and Curriculum Committees: The Health Informatics curriculum has been developed by a group of seven faculty representatives of the partnering schools. This group designed the curriculum, and all or some portion of the group will remain actively involved through service on the Health Informatics Admission Committee and/or Curriculum Committee. Members of the Admission Committee will serve as primary reviewers of application files and make admission recommendations. The Curriculum Committee will be responsible for the future of the Health Informatics curriculum, including future modifications to the currently proposed curriculum and the addition of new courses.

Health Informatics Program Manager: A program manager and student services staff from both Schools will support all administrative and academic aspects of the program. A program manager was hired jointly by the two Schools in August of 2010, and has the primary responsibility of working with members of the faculty and administration across both Schools to coordinate the development and launch of the program. If the program is approved, the program manager will be retained and will plan for implementation of the program, including: marketing, recruitment, admission, orientation, scholarship selection, financial aid, academic advising, academic policies and procedures, academic skills enrichment, speaker series, diversity coordination, wellness coordination, internship activities, career services and graduation.

C. Key Administrative Functions

Marketing: The Health Informatics Program Manager will work with management and admission and communications staff in the participating Schools to develop a marketing strategy and marketing materials (e.g. print and online material, press releases, audio and video clips) for the program. Depending on the workload of the communications staff at both Schools, web development and some graphic design work may be developed using Michigan Marketing and Design or an external vendor.

Recruitment: We expect the program in Health Informatics will be attractive to students from a variety of academic backgrounds. The Health Informatics Program Manager will work with management and admission staff in the participating Schools to develop a recruitment strategy and system of recruitment that attracts a diverse pool of applicants. For the short term, it is expected that the program manager and admission staff from the Schools of Information and Public Health will be able to handle recruitment efforts including print and e-correspondence, social media, planning for and presence at off-campus recruitment events and planning for and hosting on-campus recruitment events. As interest in the program increases, additional staff may be needed to support recruitment efforts.

Master's Admission: The Health Informatics Program Manager will work with management and admission staff in the participating Schools and with CollegeNet (the University's application vendor) to develop an application for the master's degree program. An admission committee will be comprised of the Health Informatics Program Director and selected members of the faculty of the two Schools. As early as year one, additional temporary staff may be needed to support the admissions process.

Graduate Certificate Admissions: University of Michigan graduate students will not be required to apply to the graduate certificate program. Interested students will be encouraged to meet with a Health Informatics advisor and discuss an academic plan that outlines their ability to complete the both the requirements for their graduate program and the Graduate Certificate in Health Informatics. The program manager and members of the staff of the participating schools will manage declarations for the certificate program, monitor student progress toward certificate completion and complete academic audits for the certificate program.

Scholarships:

Members of the Health Informatics Administrative Committee and finance staff from the Schools of Information and Public Health are preparing sample budget models that represent modest and generous discounting. The Administrative Committee will make recommendations regarding discounting to the Deans of the participating schools. As interest in the program grows, and as revenues increase, discounting will be modified to meet demand. In addition to tuition generated scholarship monies, the Health Informatics Program Director and Program Manager will work with development staff in the participating Schools to secure gift monies that may be used toward named scholarships. Scholarships will not be awarded for the graduate certificate program.

Course Delivery: Nearly all of the courses in the proposed program are offered in the School of Information and the School of Public Health. Additionally, of the 30-plus courses in the proposed program, approximately half are offered in the fall and half in winter terms. Both Schools are committed to continued delivery of key courses for the program and to accommodating Health Informatics students in those courses. Historically, seats have also been available in proposed elective courses that are offered outside of the Schools of Information and Public Health.

Academic Advising: The Health Informatics Program Director, program manager and key members of the School of Information and School of Public Health faculties will share advising responsibilities for the program. The Health Informatics Administrative Committee will develop a structure of governance that will ensure faculty coverage of advising for the long term. This governance structure will provide for accountability, balanced representation of faculty from the collaborating schools and colleges, mechanisms establishing and documenting academic precedents and exceptions to established program requirements.

Academic Policies and Procedures: The Health Informatics Administrative Committee is already discussing an approach for developing academic policies and procedures. In many cases, existing policies and procedures from one or both schools will be adopted. In some cases, new policies will be developed. The governance structure described above will provide for balanced decision-making regarding academic policies and procedures.

Student Data Systems: The proposed joint program model will require modifications to University of Michigan student data systems, and preliminary feasibility conversations are underway with the Office of the Registrar. The Health Informatics Program Manager will communicate program requirements to the Office of the Registrar and other central campus units such as the Office of Financial Aid and continue to liaise with appropriate offices throughout and after the launch of the program.

Student Life: Student support services, student organizations and student activities that are available to students in the Schools of Information and Public Health will be made available to all Health Informatics students. The program manager will collaborate with academic affairs and student services staff from the participating schools to plan and implement additional events that target students interested in or enrolled in the Health Informatics program such as conversion events, new student orientation, special programs and graduation.

Career Services: Health Informatics students will have access to career services available to students in both the School of Information and the School of Public Health. The Health Informatics Program Manager will work with members of the career services staff from both schools to further develop services and job and internship opportunities that are appropriate for Health Informatics students. The Program Manger will also support and monitor students throughout the internship process (see Master of Health Informatics curriculum section).

Alumni Relations and Development: Because the academic program and student support services will be co-delivered, it is expected that the joint model will foster among students an allegiance not only to the program in Health Informatics but also to the Schools of Information and Public Health. Leadership and alumni relations and development staff from both Schools are prepared to begin working together to engage Health Informatics alumni and prospective donors. Members of the administration from the participating schools, the Program Director and the Program Manager will help shape a strategic plan for and support alumni tracking and relationship development with Health Informatics alumni.

D. Program Income and Expenses

Members of the financial planning staff from the Schools of Information and Public Health have prepared program income and expense projections for three years. Until gift funds are procured, program income will include application fees and tuition. Funds supporting the Health Informatics Program Manager position are currently split between the School of Information and the School of Public Health. Both Schools are committed to continued academic and administrative support, including but not limited to funding for faculty salaries, staff salaries, scholarships, marketing and recruitment funds, a speaker series and other related programs and events.

E. Learning Resources

Library: Health Informatics students, faculty and staff will depend upon the support of professional staff in the University of Michigan libraries. Laurie Alexander, Head of Graduate Library Research and Education Services at the Harlan Hatcher Graduate Library and Jane Blumenthal, Director of the Taubman Health Sciences Library are aware of the proposed program in Health Informatics and have confirmed their ability to support library resource needs for students, faculty and staff associated with the program.

One librarian in the Hatcher Graduate Library serves as a liaison to the School of Information, and the Taubman Health Sciences Library has a Public Health Core Team of liaison librarians who meet regularly to engage in planning and monitoring progress on the library's curriculum and instruction activities with the School of Public Health. Their services include instruction on the use of library and information management resources, individual and small group research consultations and skills enrichment programming. The Taubman Health Sciences Library also has a Research and Informatics department of five librarians, including a bioinformaticist

and a clinical and translational research liaison. Members of this team have been active in a variety of informatics projects, including efforts funded by the Clinical and Translational Science Awards⁸ program. Additionally, the Taubman Health Sciences Library liaison to the School of Public Health is involved in research and instruction on the use of social media technologies by public health organizations, including a significant grant-funded project that builds off of the "23 things"⁹ Learning 2.0 model.

Academic Support Services: Currently, the School of Public Health supports tutoring in biostatistics for students who enter the program with low quantitative GRE scores. This service will also be made available to students who are admitted to Health Informatics program with low quantitative GRE scores. As needed, students will be referred to campus support services including the Sweetland Writing Center, the Office of Services for Students with Disabilities, the Language Resource Center and others. The Health Informatics Program Director and program manager will also promote skills enrichment workshops available in the Schools of Information and Public Health and will remain open to identifying additional learning needs.

F. Facilities, Equipment and Technology

All equipment, network access, computing support services and facilities available to students in the Schools of Information and Public Health will be available to Health Informatics students.

Facilities and Equipment: Health Informatics students will have the opportunity to learn and study in the School of Information's space in the newly constructed North Quad building and in the School of Public Health's space in the recently renovated School of Public Health's SPH I building and SPH Tower. In both Schools, students will have access to high tech classrooms, networked study spaces and meeting rooms and wireless connectivity. Three University maintained computer labs are also available for use in the School of Public Health.

Throughout North Quad, many spaces are available to facilitate project meetings and to exchange ideas. The School of Information offers seven project rooms with large LCD screens and WiFi that are available on a first-come, first-served basis and can be accessed using UM identification cards. Additionally, there are three collaborative workspaces available to facilitate videoconferencing and electronic media sharing and editing, and the high-tech Media Gateway is available to support students working with multimedia, network, and communication technologies. Health Informatics students will also have access to the School of Information's graduate student lounge, which includes space for collaborative work and dedicated space for quiet study. One large classroom and formal meeting with Video Conferencing is also available. Web-conferencing is also available through a system called TurboMeeting.

The School of Public Health offers ten small group meeting spaces, some equipped with monitors and projectors, and all offering WIFI connectivity. In addition, two meeting rooms are equipped with a web-conferencing system called Centra that is maintained and used extensively by the School of Public Health.

Network Access: All School of Information and School of Public Health classrooms, offices, and meeting/assembly rooms offer network access, either through wires (Ethernet) or wirelessly (WiFi). This network is part of the UM campus network, which is in turn a part of the global Internet. The network allows all School of Information and Public Health computer users to share digital information with each other; to take advantage of high-quality printers in both Schools and high-power computation servers in the form of a Hadoop cluster in the School of Information; and to communicate directly with systems used by other researchers, students, and developers at other sites around the world. The network is also accessible from UM public computing sites and over home broadband connections.

Computing Support: The School of Information computing staff provides first-rate information technology services to the entire School of Information community. The computing staff supports the high-quality research

⁸ <http://www.ctsaweb.org/index.cfm?fuseaction=home.showHome>

⁹ <http://plcmcl2-things.blogspot.com/>

and education that occurs in the School of Information with the latest in technological services and support, including the School's own servers for storage and computational services. All Health Informatics students will receive a School of Information computer account, which will provide access to additional computer resources.

G. Program Evaluation and Outcomes Assessment

Effective evaluation is an integral part of our program plan. Both the School of Information and the School of Public Health have significant experience in program evaluation and conduct a number of surveys each year. We will build on the collective experience of the participating Schools to articulate and assess specific outcomes for the Health Informatics program. At a minimum, we will evaluate learning outcomes, student satisfaction and the impact of the program on the careers of its graduates. Both Schools are new users of the Qualtrics Research Suite, a robust software package that supports effective survey development and administration and storage of and analysis of survey results. Health Informatics program evaluation will be administered using the Qualtrics Research Suite.

H. Accreditation

Every seven years, the School of Information invites the American Library Association (ALA) to conduct an assessment of the educational, teaching, and research functions of the school. Every seven years, the School of Public Health invites the Council on Education for Public Health (CEPH) to conduct an assessment of the educational, teaching and research functions of the school. The School of Information was recently re-accredited by the ALA, and the School of Public Health is currently in the self-study phase of CEPH re-accreditation. As a part of accreditation review processes, the Schools of Information and Public Health will report on developments with the program in Health Informatics. The Schools will not seek accreditation for the Health Informatics program from either accrediting body.

To date, the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM)¹⁰ is the only source of accreditation for health informatics programs. Because CAHIIM does appear to make a clear distinction between health informatics and health information management, accreditation will not be sought from this organization.

I. Timeline

During the 2009-2010 academic year, an *ad hoc* committee of faculty members from the School of Information and Public Health prepared a rationale for proposing a joint graduate program in Health Informatics. Since September of 2010, cross-school Health Informatics Faculty and Administrative Committees have been working to develop and refine curricular and administrative aspects of the program. The schedule of program review follows:

Wed, Jan 19	SI Curriculum Committee (<i>approved</i>)
Mon, Jan 24	SPH Faculty (<i>approved</i>)
Wed, Feb 16	SI Faculty (<i>approved</i>)
Wed, Feb 16	SPH Executive Committee (<i>approved</i>)
March	Office of the Provost
Thu, Apr 21	Regents of the University of Michigan
Thu, Jun 23	Presidents Council of the State Universities of Michigan

Pending approval at the University and state levels, our goal is to enroll the first graduate certificate students in Fall of 2011 and the first master's degree students in the Fall of 2012.

¹⁰ <http://www.cahiim.org/>

J. Health Informatics Program Committees

Faculty Committee

- Goncalo Abecasis, Professor, Department of Biostatistics, School of Public Health
- Meghan Genovese, Health Informatics Program Manager, School of Information & School of Public Health (*ex officio*)
- Sharon Kardia, Professor and Chair, Department of Epidemiology, School of Public Health
- Paul Resnick, Professor, School of Information (*committee co-chair*)
- Rudy Richardson, Professor, Department of Environmental Health Sciences, School of Public Health
- Vic Strecher, Professor, Department of Health Behavior and Health Education, School of Public Health (*committee co-chair*)
- Tiffany Veinot, Assistant Professor, School of Information; Department of Health Behavior and Health Education, School of Public Health
- Kai Zheng, Assistant Professor, Department of Health Management and Policy, School of Public Health; School of Information

Administrative Committee

- Kim Elliott, Director of Student Services, School of Public Health
- Tom Finholt, Professor and Senior Associate Dean for Faculty, School of Information (*committee co-chair*)
- Meghan Genovese, Health Informatics Program Manager, School of Information & School of Public Health
- Nancy Janz, Professor and Associate Dean of Academic Affairs, School of Public Health (*committee co-chair*)
- Judy Lawson, Director of Admissions and Student Affairs, School of Information

Point of Contact

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School of Public Health
1700 SPH I
University of Michigan
1415 Washington Heights
Ann Arbor, MI 48109-2029

APPENDIX A

The following list includes employers with whom existing School of Information or School of Public Health alumni work in job capacities related to health informatics and advanced degree programs in which our alumni are enrolled.

- Abbott
- Accenture
- Altarum
- Armed Forces Medical Intelligence Center
- BioMedware
- Biotronic
- Bravo Health
- Blue Cross Blue Shield
- Cerner Corporation
- Cielo Med Solutions
- Deloitte
- Digital Health
- Eli Lilly
- Epic
- Harvard University Medical School
- Henry Ford Health System
- HIV/AIDS Resource Center
- Johns Hopkins
- Kaiser Permanente
- Keane, Inc.
- National Library of Medicine
- Philips Healthcare
- Procter & Gamble
- Thomson Reuters Healthcare
- St. Jude Medical Center
- Stanford University Biomedical Informatics Program
- University of California Los Angeles Health System
- University of Michigan Health System
- University of Washington Biomedical and Health Informatics Program
- Vanderbilt University Department of Biomedical Informatics
- Veterans Medical Center
- Washtenaw Community Health Organization
- WISCO (National Cancer Institute)

APPENDIX B

Health Informatics Competencies

VISION & STRATEGY

Understand the space of health informatics applications:

- public health information systems (e.g., disease surveillance, data mining, modeling)
- clinical information systems (e.g., EHR, decision support, order entry, collaboration technologies)
- consumer health information systems (e.g., monitoring, persuasive technologies, web search, support communities)
- regulatory environment (e.g. HIPAA)

Understand the health domain:

- health behavior and decision making
- patient education and self management
- health-related care and support in informal settings (e.g., home, community)
- determinants of health (e.g. environment, behavior, genetics)
- healthcare delivery channels (e.g., payer, employer, provider, distributor, supplier)
- health research processes (e.g., patient registries, clinical trials, specimen management)
- health information sources (published public health and biomedical evidence)
- health ontologies and taxonomies
- clinical decision making and evidence-based practice

Understand human and organizational behavior:

- human and organizational learning
- information behavior (e.g., information seeking, sharing, use)
- social influence processes

Understand technologies:

- computers and networks
- telecommunications
- biotechnology
- medical devices

Understand and apply techniques:

- natural language processing
- data mining
- personalization and content tailoring
- online communities and collaboration tools
- network analysis
- data visualization

SYSTEMS PLANNING, DEVELOPMENT & IMPLEMENTATION

Analyze requirements and plan applications

- Conduct stakeholder analysis (e.g., system users, vendors, buyers)
- Assess data and system integration needs and opportunities
- Assess user needs
- Map information flows and work flows
- Design for a compelling user experience
- Plan for privacy and security
- Prepare a disaster recovery plan

Manage projects

- Deploy project management tools and techniques
- Plan and conduct a competitive system procurement process

- Plan and implement an organizational change management strategy
- Manage relations with internal and external stakeholders
- Plan and conduct user education and training

Evaluate systems, applications and programs

- Retrieve and prepare data for analysis
- Evaluate usability and use of systems
- Conduct cost-effectiveness analysis
- Assess ethical and policy implications of system configuration alternatives
- Evaluate program outcomes
- Conduct statistical analysis

APPENDIX C

Health Informatics Course Descriptions

BIOINF 527 Introduction to Bioinformatics

- Prerequisites: Upper level or graduate level Statistics or concurrent enrollment in Statistics; Calculus I and II; Biochemistry, Molecular Biology, or Cellular biology; or permission of instructor.
- Description: This course introduces students to the fundamental theories and practices of Bioinformatics and Computational Biology via a series of integrated lectures and labs. These lectures and labs will focus on the basic knowledge required in this field, methods of high-throughput data generation, accessing public genome-related information and data, and tools for data mining and analysis. The course is divided into four areas: Basics of Bioinformatics, Computational Phylogeny (includes sequence analysis), Systems Biology and Modeling.

BIOSTAT 503 Introduction to Biostatistics

- Prerequisites: Elementary algebra
- Description: Fundamental statistical concepts related to the practice of public health: descriptive statistics; probability; sampling; statistical distributions; estimation; hypothesis testing; chi-square tests; simple and multiple linear regression; one-way ANOVA. Use of computer in statistical analysis.

BIOSTAT 553 Applied Biostatistics

- Prerequisites: Calculus
- Description: Fundamental statistical concepts related to the practice of public health: descriptive statistics; probability; sampling; statistical distributions; estimation; hypothesis testing; chi-square tests; simple and multiple linear regression; one-way ANOVA. . Taught at a more advanced mathematical level than BIOSTAT 503. Use of the computer in statistical analysis.

BIOSTAT 619 Clinical Trials

- Prerequisites: BIOSTAT 601 or equivalent or permission of instructor; one introductory statistics course
- Description: This course is designed for individuals with a strong quantitative background that are interested in the scientific, policy, design and management aspects of clinical trials. Topics include types of clinical research, bias and random error, study design, ethics, treatment allocation, randomization and stratification quality control, power and sample size, group sequential monitoring, crossover designs and meta-analysis.

EECS 588 Computer and Network Security

- Prerequisites: EECS 482 or 489; or graduate standing
- Description: Survey of advanced topics and research issues in computer and network security. Topics will be drawn from a variety of areas of such as mandatory and discretionary security policies, secure storage, security darnings, trust management, preventing software vulnerabilities, applied cryptography, network security.

EECS 598 Special Topics: Biomedical Machine Learning

- Prerequisites: STATS 412 or IOE 265; MATH 216; experience with MATLAB; or graduate standing
- Description: Explores modern machine learning in the context of real-world medical applications. Introduces students to different learning and feature extraction techniques for physiological data, and develops intuition on how these methods can be used to solve hard clinical problems in disease diagnosis, prevention and management. Topics covered include time-frequency analysis, non-linear dynamics, supervised and unsupervised learning, and symbolic analysis; with clinical applications from cardiology, neuroscience, obstetrics, oncology, surgery and intensive care monitoring. Focus on extensive hands-on experience with actual clinical data. Students expected to complete a final project using the methods learned in the course. Target audience: Graduate students or advanced engineering undergraduates interested in healthcare applications. No prior experience in either machine learning or medicine is required, but basic knowledge of probability and statistics is assumed.

EHS 608 / EPID 608 Environmental Epidemiology

- Prerequisites: EPID 600 or EPID 503; BIOSTAT 553 or 503
- Description: This course will serve as an introduction to topics in environmental epidemiology, covering major areas of current inquiry in this field. It will convey the basic tools required to critically read the literature and to develop appropriate study designs in light of intended applications. The class meeting will include lectures and student-led discussions. This course will review epidemiologic methods used in evaluating the health effects of physical and

chemical agents in the environment and the available evidence on the health effects of such exposures. We will also consider policy and public health applications of the scientific evidence. Topics include lectures on methodology and major environmental exposures, discussions based on review and critiques of current literature, and presentations by outside experts on specific environmental epidemiology issues of current interest, followed by primary instructor-led discussion on the paper. After taking this course, students should have a better understanding of the scope, limitations, applications and future of environmental epidemiology.

EHS 635 / HBEHED 635 Tailored Health Communication: From Theory to Practice

- Prerequisites: HBEHED 600
- Description: This course provides students with hands-on experience in creating tailored health intervention materials. The course focuses on interventions designed to promote dietary behaviors; however, students are welcome to propose other health behaviors and environmental health topics for their class projects. This course pays particular attention to cultural tailoring, which considers the role of cultural factors in personalized health programming. The course first reviews the mechanisms behind tailored health behavior change, tailoring research to date, and the selection of target populations and health outcomes. During this time, each student will select a population and health outcome that he/she will focus on for all graded course assignments. Next, the course guides participants through the steps involved in creating a foundational survey for a tailored intervention. In the last part of the course, students will design tailored intervention materials using the Michigan Tailoring System (MTS) software, which is a free, open-source software program published by the University of Michigan Center for Health Communications Research.

EPID 503 Strategies and Uses of Epidemiology

- Prerequisites: BIOSTAT 503, graduate status
- Description: This course offers an introduction to the principles, concepts, and methods of population-based epidemiologic research. It is intended to be the introductory course for students who are NOT majoring in Epidemiology. The course will be divided into three primary sections. The first section will serve as an introduction to the basic principles of epidemiology and the measures used in epidemiology. The second section will discuss epidemiologic study design (including case-control, cohort studies) and analysis (including bias, confounding, effect modification). The third section will cover special topics that are important to an introductory understanding of epidemiology (including outbreak investigations, screening, and the role of epidemiology in public health).

EPID 514 Social Epidemiology

- Prerequisites: EPID 503 (or equivalent), BIOSTAT 503 (or equivalent)
- Description: Considers the uses of epidemiology with emphasis on the social determinants of chronic diseases and premature mortality. Theoretical as well as methodological issues in conducting social epidemiology research are emphasized. Designed for graduate students who have prior familiarity with the basic principles and methods of epidemiologic research.

EPID 626 Epidemiology, Health Services and Policy

- Prerequisites: n/a
- Description: This course deals with selected applications of epidemiologic methods and findings to public-health and clinical practice. Class topics include utilization and quality of medical care, health needs assessment, health impact estimation, evaluation and economic analysis of interventions, systematic reviews and meta analysis, risk assessment and health policy. The major objective is to provide a framework for integrating causal inference and decision making, thereby bridging the gap between science and practice. Emphasis is given to conceptual and methodologic issues that confront researchers, health planners, policy analysts, and decision makers.

EPID 777 Geographic Information Systems

- Prerequisites: n/a
- Description: Geographic Information Systems (GIS) are used for analyzing and displaying spatial data. Data from a variety of sources may be compared with overlay analysis and spatial statistics. Modern tools permit novice GIS users to perform advanced spatial analysis without extensive training. This course will introduce students to ArcView, the world's leading GIS analysis package. Examples of epidemiological applications will give students the opportunity to see and use this powerful tool. Some of the topics to be covered are data import/export, layering, table management, classification, labeling, spatial and attribute queries, buffering, and address geocoding. No prerequisite.

HBEHED 530 Techniques of Survey Research

- Prerequisites: n/a
- Description: Techniques of sample interview surveys developed through lecture, research literature, discussion, and experience in design, including sampling considerations; questionnaire construction and interviewing; coding; processing, including adaptation to machine methods; and application, presentation, and evaluation of results. Emphasis on health surveys. A research project is developed as part of the course.

HBEHED 600 Psychosocial Factors in Health-Related Behavior

- Prerequisites: n/a
- Description: Psychological and social determinants of health, illness, and sick role behavior, emphasizing the decisional bases for health-related actions. Critical review of models of health behavior. Role of social communication and influence processes in health decisions. Application of concepts from behavioral science to a variety of health problem areas.

HBEHED 622 Program Evaluation in Health Education

- Prerequisites: BIOSTAT 503 or equivalent and a course dealing with health education program development
- Description: Examination and application, through a series of exercises, of several program evaluation models relevant for health education, including the goal attainment, goal-free, systems responsive, and decision-theoretic models, with emphasis on both process and impact analysis. Design options for measuring program effect, with the associated threats and external validity, are discussed, and several basic statistical techniques are reviewed and examined in terms of their applicability to program evaluation, including sampling and sample size determination for both surveys and experiments.

HBEHED 624 Needs Assessment Methods for Behavioral and Educational Health Programs

- Prerequisites: n/a
- Description: This course is for the student who is interested in gaining knowledge and skills about different methodological approaches to conducting public health needs assessment. The course reviews the use of both methods of primary data collection (e.g., structured surveys, focus groups, and key informant in-depth interviews) supplemented by the use of secondary data (e.g., agency, state or national statistics, archival, and census data). The course emphasizes feasible, practical and inexpensive methods for assessing community needs and assets. The Public Health Needs Assessment will be conceptualized as a research methodology and process for development and prioritizing behavioral and educational health programs. The major emphasis of the class is placed upon "real-world" needs assessment projects conducted by students (working in groups) for local community-based and public health organizations and community residents in the Southeast Michigan area. This course includes an in-field lab component: five-sessions will be conducted working on primary and secondary data collection projects at community organization sites.

HBEHED 627 Chronic Illness Interventions: Infancy to Early Adulthood

- Prerequisites: Permission of instructor
- Description: This course examines intervention efforts aimed at the self-management of chronic illness from a lifespan perspective with a focus on infancy, childhood, adolescence, and young adulthood. Theoretical and conceptual frameworks for viewing chronic illness in the context of individual and family development will be discussed. Specific examples of health education interventions for selected chronic illnesses and school-based approaches to cardiovascular risk reduction will be examined. The appropriate developmental tasks and psychosocial and cognitive stages for individuals and their implications for the self-management of chronic illness will be described. The format of the course will rely heavily on structured and informed discussion. A brief overview will be provided each week, followed by exchange generated by discussion questions for each week's reading assignments as well as small group exercises. Student presentations based on a wide variety of chronic illnesses will be scheduled throughout the course.

HBEHED 628 Chronic Illness Interventions: Midlife to Older Adulthood

- Prerequisites: Graduate standing
- Description: This course provides an overview of trends in aging and health with a particular focus on health behaviors and health promotion. Age-related changes in health and health behavior and the impact of societal and personal attitudes toward aging on health behaviors will be discussed. Successful aging, an emerging paradigm for gerontology, will frame discussion of strategies for facilitating optimal health behaviors among older adults. Current recommendations and practices and multi-level interventions will be presented for physical activity, smoking, obesity, weight management, nutrition education, immunizations, and cancer screenings. Recent evidence of the impact of health behaviors on brain health and the prevention of cognitive decline will be discussed.

HBEHED 633 Social Networks and Social Support in Health Education

- Prerequisites: Permission of instructor and graduate status
- Description: Review and analysis of theory and empirical evidence concerning social networks and social support and their relationship to health status and health behavior. Examines utilization of social networks in health education programs, e.g., family network interventions, self-help groups, "natural helpers", community organizing.

HBEHED 641 Materials and Methods in Health Education Programs

- Prerequisites: Permission of instructor
- Description: The goal of this course is to enable participants to select and use learning materials and methods in health education programs. The course consists of in-class sessions where various materials and media are demonstrated and their utility as enhancements to learning discussed. Technical and production aspects of materials and media are considered in several lab sessions. Students are required to produce health education materials or develop learning activities through fieldwork in addition to in-class and lab sessions.

HBEHED 651 Program Development and Health Education

- Prerequisites: Permission of instructor
- Description: Focuses on design of effective learning programs: specification of objectives, selection and organization of learning activities, and program assessment. Moves between theoretical bases for program development and examination of applications. Initial sessions focus on framework for development of health education. Subsequent sessions center on specific components of program design and particular applications.

HBEHED 661 Designing Sticky Communications for Health Advocacy, Education and Mass Media

- Prerequisites: n/a
- **Description:** This class will identify and discuss a set of broadly applicable message design principles that distinguish between health education and promotion messages that are likely to "stick" in recipients' minds and potentially be persuasive versus those which may fail to have long-term impact. We will draw on literatures from social marketing, decision psychology, and education to deconstruct at the most basic level what made some of the most memorable health campaigns (and other messages) so powerful, using frameworks and examples from the bestselling and well researched books *Made to Stick: Why Some Ideas Survive and Others Die* and *Influence: Science and Practice*. Multiple exercises will build students' competency in the practical application of these message design skills in mass media relations and advocacy (e.g., public service announcements, news releases, interviews). The course use a variety of targeted examples and case studies, which will examine topics such as celebrity effects (e.g., Katie Couric's colonoscopy), efforts to change professional behavior (e.g., handwashing), and translating health statistics into compelling meanings. We will pay particular attention to the potential uses (and misuses) of first-person narratives.

HBEHED 662 Risk Communication: Theory, Techniques and Applications in Health

- Prerequisites: n/a
- Description: This course will draw upon economic, psychological, and scientific / medical concepts of risk to provide students with both a theoretical and practical understanding of when and why people feel their health is "at risk." The course will then focus on skill building, especially as related to three practical applications: (i) the use of evidence-based techniques to increase comprehension and understanding of epidemiological data and other numerical risk statistics in reports to the public, patient decision aids, and health interventions, (ii) the identification and use of expert and lay-person mental models of health risks for public health intervention design and (iii) the communication of risk information to communities, the media, and policy makers during public health crises. It will also survey a broad range of risk communication research, covering topics as varied as (a) various ways that providing or withholding contextual risk information can alter message recipients' risk perceptions, (b) the relationship between individual risk perceptions and willingness to undertake preventive health behaviors, and (c) some of the unique issues which arise in communications of genetic risk. The course is designed for Masters' level students but may be taken by PhD students

HBEHED 668 Health Communication for Public Health

- Prerequisites: HBEHED 600
- Description: From one-on-one health counseling to broad-based social marketing campaigns, a vast body of research over the past twenty years has demonstrated that numerous dimensions of health communications, including message format, receiver characteristics, and delivery channel can affect program impact. This course will address key considerations for constructing effective health communications including the application of behavior change theories and general marketing principles. Selected prior and current health promotion campaigns will be critically reviewed and students will

be asked to develop a health communication intervention or social marketing campaign. Occasional guest lecturers, actively involved in development of health communication interventions will be integrated into the syllabus.

HMP 600 The Health Services System I

- Prerequisites: Enrollment in Health Management and Policy (HMP) or permission of instructor
- Description: First part of two-course sequence focusing on major issues in the organization of a health services system: role of values; assessment of health status; analysis of need, access and use of services; current supply and distribution of health resources; analysis of health care costs and expenditures. Students enrolling in HMP 600 are expected to also complete HMP 601.

HMP 601 Control of Quality and Costs of Health Care

- Prerequisites: HMP 600
- Description: HMP 601, building on the material in HMP 600, focuses on: the definition and assessment of quality of care; control of quality and costs of care through market-oriented strategies, professional self-regulation, intra-organizational process improvement approaches, third-party strategies, and government regulation; and system reform.

HMP 602 Survey of the US Health Care System

- Prerequisites: Graduate status
- Description: Analysis of current organizational arrangements and patterns for provision and financing of medical care services in the United States. Topics include the medical care process and factors which affect need, access and use of services; factors affecting supply and distribution of health professionals and health facilities, and current issues pertinent to these health care services; factors related to health care costs; quality assessment and assurance; and financing of care through health insurance and governmental programs.

HMP 603 Managing Health Care Organizations

- Prerequisites: HMP 600
- Description: HMP 601, building on the material in HMP 600, focuses on: the definition and assessment of quality of care; control of quality and costs of care through market-oriented strategies, professional self-regulation, intra-organizational process improvement approaches, third-party strategies, and government regulation; and system reform.

HMP 604 Understanding the Structure and Management of Nonprofit Health Organizations

- Prerequisites: Graduate standing or permission of instructor
- Description: Nonprofit organizations face unique challenges because of their ownership, including greater needs to motivate employees through culture, to manage volunteer workforces and complex stakeholder relations within communities. This course will focus on the analysis of the goals, environmental conditions and organizational structures of specifically nonprofit health organizations, including a variety of smaller (and largely, non-health services) community-based nonprofits. This course is explicitly targeted to meet the needs of those interested in policy and those who may manage non-health services organizations.

HMP 610 Cost-Effectiveness Analysis in Health

- Prerequisites: Permission of instructor
- Description: HMP 610 focuses on the use of cost effectiveness analysis to inform decisions about improving health. The course also covers a number of related analytical tools such as cost benefit analysis, decision analysis, and sensitivity analysis. Students will learn theoretical justifications for these tools as well as their limitations. The main goal is for students to understand when cost effectiveness analysis and related tools are appropriate and how to apply them in practice to a broad range of health issues.

HMP 616 Understanding Organizations

- Prerequisites: MHSA Candidate, MPH Candidate in Health Management and Policy (HMP), or permission of instructor
- Description: This course provides an overview of key issues confronting modern organizations, with an emphasis on healthcare organizations but attention to supplier, customer, and other partnering organizations. The issues will be studied from several perspectives to familiarize students preparing for work in health care organizations with a working understanding of both organizational dynamics and approaches to understanding them. Students completing the course should understand fundamentals of how organizations are formed, governed, designed, and improved. They will also learn how workers and organizations related to each other, and how organizations relate to their environment and other organizations.

HMP 640 Program Evaluation in Public Health

- Prerequisites: Graduate status
- Description: The Purpose of this course is to provide students with an understanding of the fundamentals of evaluation and research as applied to public health programs, policies and other types of interventions. The course covers impact, outcomes, process and participatory evaluation, and a number of research designs common in public health evaluation research. Students will gain skills in framing evaluation questions. In addition, students will gain skills needed to understand and critique published evaluation literature, and skills in measurement/data collection strategies. Class format includes lecture, discussion articles, and small group exercises. For final project, students will design and write and evaluation plan in the format of a proposal for funding.

HMP 643 Managing People in Health Organizations

- Prerequisites: Graduate status
- Description: This course provides the knowledge and skills for understanding and effectively managing individuals and groups within health care organizations. We consider a wide variety of motivations that draw individuals to their jobs and keep them productive. We also consider why organizations form small groups and the dynamics of these groups over time. Students learn techniques for persuasive communication and conflict management, develop strategies for dealing with interpersonal problems in an organizational setting, and processes for handling work teams. Common organizational problems that students solve include choosing the right person through the hiring process, evaluating employee performance, and negotiating contracts.

HMP 654 Operations Research and Control Systems

- Prerequisites: BIostat 503 or BIostat 553 or equivalent and graduate status
- Description: Provides rational framework for decision making for both operating and control systems in the hospital environment. Emphasizes basic modeling techniques and examples of actual hospital applications. Aims at thorough understanding of concepts of total value analysis, objective function formation, and exception reporting. Students become familiar with operations research techniques of inventory modeling, queuing, computer simulation, PERT/CPM, mathematical programming, and quality control. Presentation emphasizes objectives, constraints, and required assumptions of each of these techniques as applied to specific hospital examples.

HMP 668 / SI 542 / BIOINF 668 Introduction to Health Informatics

- Prerequisites: Graduate status
- Description: This course introduces students to the concepts and practices of health informatics. Topics include: a) an introduction to the health informatics field; b) major applications and commercial vendors; c) decision support methods and technologies; d) analysis, design, implementation, and evaluation of healthcare information systems; and e) new opportunities and emerging trends. A semester-long group project provides students with hands-on experience in planning and building healthcare information systems; associated ethical and legal topics, software engineering and human-computer interaction issues, and user adoption and outcome evaluation methodologies will also be addressed.

HMP 669 Database Systems and Internet Applications in Health Care

- Prerequisites: Graduate status
- Description: This course covers relation database theory and database-web systems with applications to health care. The students are expected to develop a working knowledge of design, implementation, administration and maintenance of small to medium relational database systems. The students will also be exposed to current technology for deployment, use and administration of relational databases through the Internet.

HMP 696 / SI 642 / BIOINF 555 Concepts in Health Informatics

- Prerequisites: Graduate status
- Description: This course provides students a formal framework in which to discuss contemporary topics in health informatics. Topics include: architecture, interoperability, usability, public policy, outreach and patient-centric care and technology-enhanced computation.

MECHENG 599-004 / ENGR 599-002 / BIOMEDE 599-011 Special Topics: Design for Global Health: Sustainable Technologies for the Developing World

SI 501 Contextual Inquiry and Project Management

- Prerequisites: n/a
- Description: This course addresses a fundamental need of information professionals: how to examine an organization's current information use in the context of work practice and discover and recommend improved ways of working. This is a projects based course. All projects are scoped to allow students to examine how information influences actions in some process or service within an organization and to develop and practice relevant skills.

SI 502 Networked Computing: Storage, Communication, and Processing

- Prerequisites: n/a
- Description: In order to appreciate the opportunities, and make wise choices about the use of technology, information professionals need to understand the architectures of modern information systems. In alternative system architectures, storage, communication, and processing substitute for the complement each other in different ways. This course introduces students, at several different levels of abstraction, to sets of functional components and alternative ways of combining those components to form systems. It also introduces a set of desirable system properties and a core set of techniques that are useful in building systems that have those properties.

SI 508 Networks: Theory and Application

- Prerequisites: n/a
- Description: This course will cover topics in network analysis, from social networks to applications in information networks such as the internet. We will introduce basic concepts in network theory, discuss metric and models, use software analysis tools to experiment with a wide variety of real-world network data, and study applications to areas such as information retrieval. For their final project, the students will apply the concepts learned in class to networks of interest to them.

SI 529 eCommunities: Analysis and Design of Online Interaction Environments

- Prerequisites: n/a
- Description: This course is intended to give students a background in theory and practice surrounding online interaction environments. For the purpose of the course, a community is defined as a group of people who sustain interaction over time. The group may be held together by a common identity, a collective purpose, or merely by the individual utility gained from the interactions. An online interaction environment is an electronic forum, accessed through computers or other electronic devices, in which community members can conduct some or all of their interactions. We will use the term eCommunity as shorthand, both for communities that conduct all of their interactions online and for communities that use online interaction to supplement face-to-face interactions. There will be two main threads that weave through the course, based on the two main texts. One thread will be concerned with the practical issues of design and use of online tools to support communities, and how choices that must be made in design can impact the function and style of the resulting community. The second thread will focus on the sociological theory that provides a frame to better understand communities in general. These theoretical pieces will provide a lens for better understanding the implications of choices made on the more practical level.

SI 530 Principles in Management

- Prerequisites: n/a
- Description: This course provides a foundation in management for information professionals interested in working in for-profit or non-profit organizations. In this course students will learn about management principles (e.g. planning, organizing, leading, controlling). Having a firm grasp of the principles is the first step. This is a skills based course, so students are expected to apply what they learn in class by reading and analyzing case studies. At all times students will be required to take on various roles (e.g. manager, employee, supplier, customer, competitor) to outline the issues managers face, evaluate managers' responses, and provide alternative courses of action.

SI 531 Human Interaction in Information Retrieval

- Prerequisites: n/a
- Description: This course explores interactive retrieval systems from users' perspectives. The purpose of this course is to introduce theory, research, and practice related to current information retrieval systems in which humans control search processes and interact with information on various levels from interfaces to functionalities. Students are encouraged to consider the nature of interaction with information in various information retrieval systems, etc. Students also learn about user studies in information retrieval in terms of experimental evaluations and measures and criteria for system performance.

SI 534 Theories of Social Influence

- Prerequisites: n/a
- Description: This course introduces the major theories of social influence in psychology and economics so that you may become a better decision architect and an effective leader. In this course we will learn why and under the conditions in individual's thoughts and actions can be influenced by those around them. We will touch on related theoretical ground in economics and in psychology but focus heavily on the empirical findings and how they can be applied. The primary goal of this course is to realize a detailed picture of the traditional and contemporary thinking on this topic as it is addressed in economics and in social psychology and to have you applying the tools of influence from day one.

SI 544 Introduction to Statistics and Data Analysis

- Prerequisites: n/a
- Description: The purpose of this class will be to provide students with a basic understanding of statistics, that is the ability to describe various populations and draw inferences about them. It should also sharpen individual intuition about how to read data, interpret data, and judge others' claims about data. It should be useful to a wide variety of students both as preparation for more advanced courses and as a means to professional advancement. Specifically, skills to be developed are: 1. Abilities to characterize population data intuitively for oneself and others. 2. Ability to draw conclusions and novel inferences from population data. 3. Ability to check assumptions of others' claims and debug their putative "facts". 4. Ability to look for correlations while controlling for confounding effects. 5. Overall, the chief objective is to demystify the process of inquiry into what isn't known.

SI 546 Personal Privacy: Policy, Practice and Technology Issues

- Prerequisites: n/a
- Description: This course explores personal privacy issues in the context of: 1) traditional American concepts related to privacy, as well as government protections that have developed over time; 2) technology and systems that affect the availability of information, the ability of the private sector to gather and publish data and monitor activities, and the ability of individuals to protect their privacy; and 3) business and lifestyle changes, resulting from the Internet and other developments, that have created new behavioral and privacy issues and vulnerabilities, and altered the balance concerning existing ones. These developments range from online storage of traditional documents, such as medical information and property records, to new areas of potential concern, such as social networking and data mining. The course examines theory, history, law, policy, and technology -- as well as approaches taken by other nations -- in its study of contemporary privacy issues, the questions and potential problems that they raise, and the consideration that must be part of addressing them in meaningful ways. While issues related to security will, of necessity, appear periodically, the focus of the course is on privacy matters and considerations related to the individual.

SI 551 Information Seeking Behavior

- Prerequisites: n/a
- Description: Information seeking is a complex information and communication activity requiring access to diverse information systems and resources in order to deal with work-related, personal, and social information problems. This course provides students an introduction to the human aspects of systems and technology in various information contexts including work settings, schools, health care, and everyday life. This course critically examines concepts, models and frameworks relevant to human information behavior across LIS, IR, and HCI. Understanding human information seeking behavior tends to be qualitative and inductive in nature. Therefore, students will have opportunities to learn various ethnographic research techniques including designing ethnographic interviews, conducting non-participant observation, and taking field notes.

SI 561 / EECS 595 / LING 541 Natural Language Processing

- Prerequisites: n/a
- Description: This course is an introduction to computational and linguistic concepts and techniques for modeling and analyzing natural language. Topics include finite-state machines, part of speech tagging, context-free grammars, syntax and parsing, unification grammars and unification-based parsing, language and complexity, semantics, discourse and dialogue modeling, natural language generation, and machine translation.

SI 583 Recommender Systems

- Prerequisites: n/a
- Description: Recommender systems guide people to interesting materials based on information from other people. There is a large design space of alternative ways to organize such systems. The information that other people provided may come from explicit rating, tags or reviews or implicitly from how they spend their time or money. The information can be

aggregated and used to select, filter, sort and highlight items. The recommendations may be personalized to the preferences of different users.

SI 601 Data Manipulation

- Prerequisites: n/a
- Description: This course aims to help students get started with their own data harvesting, processing, and aggregation. Data analysis is crucial to evaluating and designing solutions and applications, as well as understanding user's information needs and use. In many cases the data we need to access is distributed online among many webpages, stored in a database, or available in a large text file. Often these data (e.g. web server logs) are too large to obtain and/or process manually. Instead, we need an automated way of gathering the data, parsing it, and summarizing it, before we can do more advanced analysis. In this course students will learn to use Perl and its modules to accomplish these tasks in a 'quick and easy' yet useful and repeatable way. The companion half semester course on Exploratory Data Analysis will then teach the students how to further glean insights from the data through analysis and visualization.

SI 606 Special Topics: Personal Informatics Design

- Prerequisites: SI 502
- Description: Personal informatics refers to the technologies and data that help individuals measure and make sense of aspects of their own lives. New personal sensing technologies are revolutionizing the abilities of individuals to collect and process data about their lives -- ranging from alarm clocks that track brain waves during sleep to tiny devices that keep track of physical mobility during the day to homes that provide detailed reports of real time power use. This course introduces students to the social and technical issues that designers of these personal informatics technologies face in helping users understand and improve their lives through the use of data. We will examine the roles that measurement theory, information visualization, motivation, game design, ethics and computing all play in making aspects of life more quantifiable and in using this information to promote behavior change. We will look at the application of these technologies in the context of productivity, environmental sustainability and health. This course will be studio-based, with a focus on a semester-long group project to design a personal informatics application. Class meeting will consist of brief lectures, discussion of readings and design exercises.

SI 612 Pervasive Interaction Design

- Prerequisites: SI 682 and SI 543 or programming waiver
- Description: Pervasive Interaction Design (PIxD) will be an advanced interaction design course that focuses on designing interactive applications for emerging mobile and context-aware technologies. It will follow a similar format to 682 (Interaction Design) in that the course will be studio-based, consist largely of a semester-long group project with multiple milestones, and will be supplemented by readings and discussion relevant to the topic. Class meetings will consist of a mixture of brief lectures to introduce and frame course concepts, design methods, and technical tools; discussion of readings; in-class design exercises; and group work/lab time. Light programming will be required in order to complete prototyping activities, though programming will not be taught in the course. Depending on the platform selected for the class (most likely Android or Arduino), which may change from year to year, the projects will be carried out in either Java or Processing. Thus, students must at a minimum have experience programming in an object oriented language (e.g., Java, C++, Processing). Extracurricular tutorials will be offered for specific technologies that are used in the class such as IDEs, specific APIs, and particular hardware platforms.

SI 617 Choice Architecture

- Prerequisites: SI 562 or SI 563
- Description: Designing a system or organization for humans requires understanding not just choice and behavior motivations (good in most cases, we hope), but also learning about the reasons we blunder and make mistakes. Thus, even when incentives are "aligned" with overall system goals, there are many instances where we make poor choices because as human beings, we are all susceptible to a wide array of routine biases that can lead to an equally wide array of unwanted and unintended outcomes and decisions. Our errors are what make us human, but up until now, they have been largely ignored by systems designers, whether these designers make complex public policy, manage a team or design an information system. But knowing how people think, we can become choice architects who design environments that both yield better decision making on the part of users, and achieve behavior that is consistent with overall system goals while gaining a competitive design-edge. The first goal of this course is to inform future information system professionals, designers and managers about human decision rules and their associated biases so that these insights can be incorporated into their design, business or management strategies. Knowledge of these issues can be a significant source of competitive advantage because they are unknown to most information systems professionals and they are not taught in most I-schools. The second goal of this course is to clarify how these results can be leveraged to create original and more effective systems and institutions that meet the designer's goals.

SI 618 Exploratory Data Analysis

- Prerequisites: SI 601 or permission of instructor
- Description: This course aims to help students get started with their own data acquisition and analysis. Data analysis is crucial to evaluating and designing solutions and applications, as well as understanding information needs and use. Students in this course, who will have just completed part 1: Data Manipulation, will learn techniques of exploratory data analysis, using scripting, text parsing, structured query language, regular expressions, graphing, and clustering methods to explore data. Students will be able to make sense of and see patterns in otherwise intractable quantities of data.

SI 621 / PUBPOL 720 Information, Ethics and Applied Policy

- Prerequisites: SI 500
- Description: The "information" revolution and the pervasive use of information technology within all organizations, profit and not-for-profit, public and private, has created an environment in which electronic access to massive quantities of information is now possible at startling speeds. The technologies themselves, and the new software applications, are changing so rapidly that it is not unusual for new applications to be put into place without the users, and sometimes even the system administrators, fully understanding the way in which an application works. The extent to which a given application exposes the organization's proprietary data, the personal information of its employees or constituencies, or the entire organization to liabilities is generally not fully understood. Within this environment, policy makers, managers, indeed all individual users of the technology, must make decisions about how they want to use technology and software and, even, whether they will use the technology in a particular way. This changing environment requires that all individuals and managers of organizations clarify their organizational values, understand ethical and unethical responses to issues that arise, and actively process information to make informed decisions, develop effective policies, and institute best practices.

SI 622 Evaluation of Systems and Services

- Prerequisites: SI 501 or instructor permission
- Description: Covers the key concepts of evaluation and a variety of methods used to determine the goals of a system or service, performs organizational analysis, assesses task/technology or service fit, determines ease of learning of new or existing services or systems, determines ease of use, assesses aspects of performance (including information retrieval), and evaluates the success in accomplishing the user/organizational goals. Methods include observation, survey, interviews, performance analysis, evaluation in the design/iteration cycle, usability tests, and assessment of systems in use.

SI 627 Managing the IT Organization

- Prerequisites: SI 502 or permission of instructor
- Description: In this course, students will develop skills and techniques in the areas of strategic planning, budgeting and finance, human resources administration, vendor relationships, and leadership. The course also explores alignment of IT initiatives with business objectives, simultaneous management of operational and development environments, and the impact of virtual and nodal organizations on IT infrastructure and services. This course is designed to be cross-disciplinary, with examples and activities drawn from information services, manufacturing, health care, public administration, higher education and other areas. A variety of instructional methods are used to engage students and help identify similarities and differences between IT applications in various professional fields.

SI 649 Information Visualization

- Prerequisites: SI 622, SI 682, SI 539 or permission of instructor
- Description: The rise of the Information Age and the ascendancy of computer graphics come together in the area of information visualization, where interactive graphical interfaces reveal structure, extract meaning, and navigate large and complex information worlds. Provides an in-depth introduction to the state-of-the-art in information visualization. Through a series of readings, videotapes, and discussions, students look at various strategies that have been developed, including their static, dynamic, and interactive aspects, and understand when, where, and why they work. In addition, there is an effort to place information Visualization in the more general contexts of visualization as used in statistics and physics) information work.

SI 650 Information Retrieval

- Prerequisites: SI 502
- Description: Information is everywhere. We encounter it in our everyday lives in the form of E-mail, newspapers, television, the Web, and even in conversations with each other. Information is hidden in a variety of media: text, images, sounds, videos. While casual information consumers can simply enjoy its abundance and appreciate the existence of search engines that can help them find what they want, information professionals are responsible for building the

underlying technology that search engines use. Building a search engine involves a lot more than indexing some documents -- information retrieval is the study of the interaction between users and large information environments. It covers concepts such as information need, documents and queries, indexing and searching, retrieval evaluation, multimedia and hypertext search, Web search, as well as bibliographical databases. In this course, students go over some classic concepts of information retrieval and then quickly jump to the current state of the art in the field, where crawlers, spiders, and hard-of-hearing personal butlers roam.

SI 653 / HMP 670 Evidence-Based Health Information Practice

- Prerequisites: n/a
- Description: Health care organizations and industries have a growing need for information professionals who are capable of leading efforts to integrate health sciences research into clinical decision making. Health professional training programs also have an expanded interest in training students and practitioners in evidence based health care practice. In this course, students learn how their professional work can support evidence based health care and knowledge translation initiatives in diverse settings such as academic health science libraries, teaching hospitals, government agencies and health care industries.

SI 655 Management of Electronic Records

- Prerequisites: SI 502 or permission of instructor
- Description: Records are the corporate and cultural memory that provide proof of actions and decisions, build a knowledge-base for reflection and learning, and form a perspective on today's society that we will pass on to future generations. As organizations create and maintain more of their records electronically, they are struggling to develop effective policies, systems, and practices to capture, maintain and preserve electronic records.

SI 663 Entrepreneurship in the Information Industry

- Prerequisites: n/a
- Description: Prepares students to start businesses in the information industry or to work effectively in new start-up businesses. Discusses aspects of creating a business and expects students to develop an idea into a business plan that could be used to either guide the creation of the business or secure funding for a new business.

SI 682 Interface and Interaction Design

- Prerequisites: SI 501 or taken concurrent.
- Description: Provides an introduction to user-interface design from a design principles perspective. The course covers such topics as accessibility, design ethics, psychological principles, interaction principles, requirements analysis, project management, I/O devices, standards and style guides, and visual design principles. The perspective is a pragmatic, applied view of design, with frequent practical design exercises. The format of most classes is roughly half lecture and discussion and half in-class exercises.

SI 686 User-Generated Content

- Prerequisites: SI 563 or permission of instructor
- Description: This half-semester course analyzes the motivation and incentives for user-generated content. We use social science theories as guidance to study the current incentive structures of online Q&A, microfinance, P2P file sharing, open source, social bookmarking and health information exchange sites, as well as potential new design features that could improve the quantity and quality of the contents. After completing this course you will be able to: (1) have a broad understanding of situations where it may be valuable to explicitly consider individual incentives when engineering systems; (2) recognize the class of mechanism that would be appropriate to particular real-world settings involving user-generated content; and (3) identify the key design considerations in adapting such mechanisms to particular online communities.

SI 689 Computer-Supported Cooperative Work

- Prerequisites: SI 500 and SI 501 or permission of instructor
- Description: This is an advanced course that explores the social, organizational, and technical issues involved in designing, developing and deploying computational and communication tools to support the activities of groups and organizations. The course will review a variety of research methods and conceptual frameworks that have guided CSCW work. Both classic and contemporary material will be read and discussed. Students will gain first hand experience with a variety of tools through class demos and through a semester-long group project that evaluates an instance of a tool.

Appendix D

The following list includes members of the University of Michigan—Ann Arbor faculty who are engaged in health informatics-related teaching and research.

School of Information

- **Mark Ackerman**
Professor, School of Information
Professor, Electrical Engineering and Computer Science, College of Engineering
- **Michael Cohen**
William D. Hamilton Professor of Complex Systems, Information & Public Policy, School of Information and School of Public Policy
- **Thomas A Finholt**
Professor, School of Information
Senior Associate Dean, Faculty, School of Information
- **Qiaozhu Mei**
Assistant Professor, Information, School of Information
Assistant Professor, Electrical Engineering and Computer Science, College of Engineering
- **Mark W. Newman**
Assistant Professor, School of Information
- **Dragomir Radev**
Professor, Information, School of Information
Associate Professor, Electrical Engineering and Computer Science, College of Engineering
Associate Professor, Linguistics, College of Literature, Science and the Arts
- **Paul Resnick**
Professor, Information, School of Information
- **Tiffany Veinot**
Assistant Professor, Information, School of Information
Assistant Professor, Health Behavior and Health Education, School of Public Health
- **Elizabeth Yakel**
Associate Professor, Information, School of Information

School of Public Health

- **Mousumi Banerjee**
Research Professor, Biostatistics, School of Public Health
Adjunct Associate Professor, Biostatistics, School of Public Health
- **Steve Gruber**
H. Marvin Pollard Professor, Internal Medicine, Medical School
Professor, Human Genetics, Medical School
Professor, Epidemiology, School of Public Health

- **Michele Heisler**
Associate Professor, Internal Medicine, Medical School
Associate Professor, Health Behavior and Health Education, School of Public Health
- **Steven Katz**
Professor, Internal Medicine, Medical School
Professor, Health Management and Policy, School of Public Health
- **Rod Little**
Richard D. Remington Collegiate Professor, Biostatistics, School of Public Health
Professor, Statistics, College of Literature, Science and the Arts
Research Professor, Institute for Social Research
Associate Director for Research and Methodology and Chief Scientist, U.S. Bureau of the Census, Suitland, MD (Inter-Personnel Agreement with the University of Michigan)
- **David Mendez**
Associate Professor, Health Management and Policy, School of Public Health
- **Gilbert S Omenn**
Director, Center for Computational Medicine and Bioinformatics, Medical School
Research Professor, Computational Medicine and Bioinformatics, Medical School
Professor, Molecular Medicine and Genetics, Internal Medicine, Medical School
Professor, Human Genetics, Medical School
Professor, Public Health, School of Public Health
Senior Scientific Director, National Center for Integrative Biomedical Informatics
- **John Piette**
Associate Director for Global Communication Technology, Center for Global Health,
Professor, Center for Managing Chronic Disease, School of Public Health
Professor, Internal Medicine, Medical School
- **Ken Resnicow**
Professor, Health Behavior and Health Education, School of Public Health
- **Kerby Shedden**
Associate Professor, Statistics, College of Literature, Science and the Arts
Associate Professor, Biostatistics, School of Public Health
- **Peter Song**
Professor, Biostatistics, School of Public Health
- **Victor Strecher**
Professor, Health Behavior and Health Education, School of Public Health
Professor, Family Medicine, Medical School
Associate Director, Cancer Center
- **Jeremy Taylor**
Pharmacia Research Professor, Biostatistics, School of Public Health
Professor, Biostatistics, School of Public Health
Professor, Radiation Oncology, Medical School
Research Professor, Comprehensive Medicine & Bioinformatics, Medical School
Director, Biostatistics Unit, Cancer Center

- **Melissa A. Valerio**
Assistant Professor, Health Behavior and Health Education, School of Public Health
- **Kai Zheng**
Assistant Professor, Health Management and Policy, School of Public Health
Assistant Professor, Information, School of Information

Other Units

- **Yvonne Marie Abdo**
Assistant Professor, Nursing, School of Nursing
- **Lawrence C An**
Associate Professor, Internal Medicine, Medical School
- **Brian David Athey**
Chair Designate, University of Michigan Computational Medicine and Bioinformatics
Director, Academic Informatics, Medical School
Professor, Biomedical Informatics, Michigan Institute for Clinical & Health Research
Professor, Psychiatry, Medical School
Professor, Internal Medicine, Medical School
Associate Director, Michigan Institute for Clinical Health Research
- **Ulysses J Balis**
Associate Professor, Pathology, Medical School
Director, Division of Pathology Informatics, University of Michigan Health System
- **Fred Blow**
Professor, Psychiatry, Medical School
Research Associate Professor, Psychiatry, Medical School
Research Associate Professor, UM Transportation Research Institute
Adjunct Associate Professor of Psychology, College of Literature, Science and the Arts
- **Daniel M Burns Jr.**
Professor of Mathematics, College of Literature, Science and the Arts
Co-Director, Bioinformatics Program
- **Bruce Chaffee**
Clinical Associate Professor, College of Pharmacy
Clinical Pharmacist, Informatics and Outcomes
- **Stephen Chermack**
Assistant Professor, Psychiatry Department
- **Vineet Chopra**
Assistant Professor of Internal Medicine, Medical School

- **Angela Fagerlin**
Associate Professor, Internal Medicine - General Medicine, Medical School
Adjunct Professor, Psychology, College of Literature, Science and the Arts
Co-Director, Center for Bioethics and Social Sciences in Medicine
Research Scientist, VA Health Services Research and Development
- **Lee Albert Green**
Associate Chair for Information Management
Professor, Family Medicine, Medical School
- **David Alan Hanauer**
Assistant Director, Comprehensive Cancer Center Bioinformatics Core
Clinical Assistant Professor, Pediatrics and Communicable Diseases, Medical School
- **Sarah Hawley**
Associate Professor, Internal Medicine, Medical School
- **Richard Evan Hughes**
Associate Professor, Orthopaedic Surgery, Medical School
Associate Professor, Biomedical Engineering, College of Engineering
Associate Professor, Industrial & Operations Engineering, College of Engineering
- **Theodore J. Iwashyna**
Assistant Professor, Internal Medicine
- **Masahito Jimbo**
Associate Professor, Family Medicine, Medical School
Associate Professor, Urology, Medical School
- **Sachin Kheterpal**
Assistant Professor, Anesthesiology, Medical School
- **Cheryl King**
Professor of Psychiatry, Medical School
Professor, Psychology, College of Literature, Science and the Arts
Research Professor, Institute for Human Adjustment
- **Kristen R Lefevre**
Assistant Professor, Electrical Engineering and Computer Science, College of Engineering
- **Susan Murphy**
H.E. Robbins Professor, Statistics, College of Literature, Science and the Arts
Professor, Psychiatry, Medical School
Research Professor, Survey Research Center
- **Vijay Nair**
Donald A. Darling Professor, Statistics, College of Literature, Science and the Arts
Professor, Industrial & Operations Engineering, College of Engineering
- **Donald Nease**
Associate Professor, Family Medicine, Medical School

- **Long Nguyen**
Assistant Professor, Statistics, LSA
Assistant Professor, Electrical Engineering and Computer Science, College of Engineering
- **Thad Polk**
Arthur F Thurnau Professor, Psychology, College of Literature, Science and the Arts
Associate Professor, Electrical Engineering and Computer Science, College of Engineering
- **Caroline Richardson**
Associate Professor, Family Medicine, Medical School
Research Scientist, VA Health Services Research and Development
- **Hilbrand E Romeijn**
Professor, Industrial and Operations Engineering, College of Engineering
- **Andrew Rosenberg**
Associate Professor, Anesthesiology, Medical School
Associate Professor, Internal Medicine, Medical School
- **Mack Ruffin**
Professor, Family Medicine, Medical School
Assistant Chair, Family Medicine, Medical School
Assistant Research Scientist, Epidemiology, School of Public Health
- **Rajiv Saran**
Associate Professor, Internal Medicine, Medical School
Associate Director, UM-Kidney Epidemiology and Cost Center
- **Maria Silveira**
Assistant Professor, Internal Medicine, Medical School
Clinician Scientist, VA Health Services Research and Development, Division of General Medicine
- **Joshua D Stein**
Assistant Professor, Ophthalmology and Visual Sciences, Medical School
Staff Physician, VA Ann Arbor Healthcare System
- **Zeeshan Syed**
Assistant Professor, Electrical Engineering and Computer Science, College of Engineering
- **AkkeNeel Talsma**
Assistant Professor, Surgery, Medical School
Assistant Professor, Nursing, School of Nursing
Director, Peri-operative Outcomes Initiative
- **Jeffrey E Terrell**
Professor, Otorhinolaryngology, Medical School
Associate Chief Medical Information Officer, University of Michigan Health System
- **Dana Tschannen**
Assistant Clinical Professor, Nursing, School of Nursing

- **K P Unnikrishnan**
Research Assistant Professor, Bioinformatics, Computational Medicine and Bioinformatics, Medical School
- **Ji Zhu**
Associate Professor, Department of Statistics, College of Literature, Science and the Arts
Associate Professor, Department of Electrical Engineering and Computer Science, College of Engineering