Environmental Scan

Health Informatics

Prepared for: Curriculum Renewal

Undergraduate Medical Education, Dalhousie University

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Executive Summary

Medical Informatics tools and technologies have an ever-growing influence on healthcare. Multiple organizations have published Medical Informatics learning objectives or competencies for clinicians including Health Canada, AAMC, IMIA, UME-21 and the HealNET National Centre of Excellence Initiative. (1-5) Despite these efforts, the uptake of Medical Informatics into undergraduate medical education has been poor. Curriculum renewal hence presents an opportunity for Dalhousie University to continue its track record as an informatics leader and generate graduates with Medical Informatics competencies for the 21st century.

Recommendations:

1. Develop a longitudinal programme in Medical Informatics that is interwoven into the curriculum and focuses on Medical Informatics principles rather than specific applications. The programme should be facilitated by faculty with some expertise in Medical Informatics.
2. Develop a faculty development programme in Medical Informatics to engage faculty at all Dalhousie teaching sites.
3. Organize a program of research and evaluation to publish curricular initiatives and evaluate program performance.
4. Provide opportunities for hands-on experience in informatics early in the curriculum. Potential activities include:
   a. An informatics lab with a variety of vendor supplied applications such as decision support, e-prescribing programs and electronic health records.
   b. A virtual electronic health record populated with PBL and Learning Centre cases covered in the curriculum i.e. paperless PBLs and OSCEs.
   c. Integration with the Fenwick Learning Centre to ensure that patient simulations include use of electronic health records.
   d. A virtual electronic health record portal that allows students to access a variety of interfaces similar to that described as a pilot project at the University of Victoria.
Introduction

Medical Informatics represents the intersection of medicine and information science. At its most basic level, Medical Informatics deals with individual patient data and how clinicians interpret and use that data. As such, it involves the technology used to store and retrieve patient data, and the skills to use such technology both proficiently and critically.

Beyond its use in clinical care, Medical Informatics also supports research, teaching and health services administration. Medical Informatics embraces the electronic patient record, data-capturing tools, analytic tools operating on patient and population levels, clinical practice guidelines and clinical decision support, using various information resources such as MEDLINE, e-learning modalities, epidemiology and public health decision-making, communication systems, practice management tools, and other technologies.

While a number of organizations have published informatics learning objectives or competencies for clinicians little has been implemented within undergraduate medical curriculums in Canada. As this environmental scan demonstrates, medical schools in the Canadian context largely interpret “informatics” as information literacy and evaluation of evidence.
Literature review

The potential benefits of Medical Informatics tools and technologies are well documented from clinical decision support to physician order entry and e-prescribing. (6) Without basic skills in informatics, physicians are limited in their ability to be savvy users in effectively navigating available systems as well as choosing systems to match their clinical needs. Furthermore, input from skilled clinicians is essential in developing informatics tools that fit within clinical workflow and meet the needs of patients and their health care providers. (7)

The Association of American Medical Colleges (AAMC) produced a set of learning objectives as part of their Medical School Objectives Project (MSOP) and recommended the following: (5)

To support health care, life-long learning, education, research and management, medical students should be able, at the time of graduation, to utilize biomedical information for: formulating problems; arriving at strategies for solutions; collecting, critiquing and analyzing information; taking action based on findings; and communicating and documenting these processes and the results.

The International Medical Informatics Association (IMIA) has stated that “all professionals in healthcare should, during their studies, be confronted with health and medical informatics education... Every profession in healthcare even at an early stage needs some core health and medical informatics knowledge.” (8) Health informatics is one of the nine objectives in the Council on Graduate Medical Education Report from the USA and has subsequently been designated a key skill in the Undergraduate Medical Education for the 21st century (UME-21) curriculum project in the USA. (4, 9) The American Psychiatric Association has recommended that an increase in teaching about the use of technology for learning skills should come even at the cost of a decrease in general knowledge based content. (10)

Further, medical students appear to want and need informatics training; in one study nearly half of all trainees identified Medical Informatics as a learning need, and students in general were found to be unaware of many Medical Informatics sub-domains and issues. (11) A 2006 survey of US medical students on informatics competencies found that the lowest ranked competencies in terms of self-perceived confidence were: exposure to and ability to use clinical information systems; and competency accessing databases of clinical information. (12) Although electronic medical records are much talked about in the popular media, a 2006 review article on the use of electronic medical records found very little data on its use as an educational tool. (13)

The literature cites a number of barriers to informatics initiatives at the undergraduate medical education level. Firstly is a lack of understanding of the discipline of medical informatics among educators. (14, 15) There is a “general tendency to prioritise the teaching on IT skills (the ‘easy win’) to the neglect of health informatics... this finding would appear to be related to a lack of
staff with the skills and motivation to develop health informatics as a curriculum theme.” (15) Second is the densely packed nature of the medical curriculum. (14, 15) A national survey of clerkship and undergraduate teaching in the USA suggests that only 52% of pre-clerkship and 32% of clerkship medical students receive training in Medical Informatics prior to the clerkship stage citing cost, time, and lack of staff as significant barriers. (16)

The importance of faculty development in a distributed curriculum is underscored by at least one study that compares on-campus learners to distance education learners in a health informatics curriculum. While overall scores may be similar between these two groups, face to face instruction may provide a benefit in some individual sub-domains of health informatics teaching. (17) In particular, the domains of Health Data Structure, Content and Standards; Healthcare Statistics and Research; Information and Communication Technologies; and Data, Information and File Structure were found to be different, with the on-campus students scoring higher.
Scan of Canadian medical schools

University of British Columbia

The University of British Columbia undergraduate curriculum in Medical Informatics focuses on skills training for evidence based medicine. They adopted a modified version of the Association of American Medical Colleges’ Medical Informatics Objectives and deliver the curriculum using lectures, workshops, online courses, and evaluations. The curriculum has a designated director and is led by a collective of medical librarians who work with course directors to incorporate the Medical Informatics curriculum longitudinally over four years. Informatics skills and knowledge are assessed through exam questions, assignments and OSCE stations. Opportunities for formative feedback include: online assignments and quizzes, individualized feedback on assignments/projects and access to expert tutors. As part of the curriculum renewal process at UBC, the Medical Informatics theme is likely to merge with the Evidence-Based Practice and e-Health themes.

University of Victoria

At the American Medical Informatics Association 2009 Annual Symposium, researchers from the University of Victoria made an interesting presentation on an initiative to help medical students gain proficiency in the use of electronic health records (EHRs) as well as knowledge of its theoretical underpinnings. They have developed an education EHR portal that provides access to a range of EHRs and can be accessed remotely. They used this system with senior students to provide access to patient cases for problem-based learning (PBL). The initial qualitative assessment was positive with some suggesting that it would be a useful in PBL from first year onwards. This system has not yet moved beyond the pilot stage.

University of Alberta

The University of Alberta’s “informatics curriculum” focuses on information literacy and evaluation of evidence. Specifically the objective is to “retrieve and evaluate information from the health sciences literature, and translate it into practice.” There are several dedicated lectures and small group sessions designed to address the “information and evidence” theme longitudinally across the pre-clerkship years. In the clerkship curriculum, the theme is addressed in the MED532: Link Course. There are no designated informatics faculty per se.

University of Calgary

The undergraduate medical curriculum at the University of Calgary does not include a specific teaching unit on medical informatics. Up to 14% of their curriculum is dedicated to teaching and learning evidence-based medicine and information literacy. These themes are interwoven
throughout the curriculum but are also specifically addressed in the Healthy Populations course (year one) and Applied Evidence-Based Medicine (year two). Some relevant topics covered include searching online databases, use of software to facilitate learning and how to integrate technology into the doctor-patient relationship in an unobtrusive fashion. A Medical Informatics elective is offered.

**University of Manitoba**

The University of Manitoba online undergraduate medical curriculum guide cites delivery of health informatics sessions as part of its Population Health and Medicine course in pre-clerkship. We were not able to obtain more information as to its content or methodology.

**University of Saskatchewan**

Medical Informatics at the University of Saskatchewan is also focused on information literacy and evaluation of evidence. Librarian led sessions in the first and third year of the undergraduate medical curriculum introduce students to the skills needed to use biomedical databases and evidence-based practice tools.

**McMaster University**

McMaster University’s problem-based learning curriculum is founded on the principles of a reflective practice model. Through this process students are expected to develop skills in information seeking, retrieval and evaluation. Each small group is assigned a librarian preceptor who provides an orientation and ongoing assistance with respect to educational and clinical resources. A series of Professional Competency sessions throughout the curriculum provide further opportunity for students to develop their vocabulary and skill set with respect to evidence-based medicine and life-long learning.

**Queen’s University**

The undergraduate curriculum in Medical Informatics at Queen’s University focuses on information literacy and evaluation of evidence. The curriculum is delivered by medical librarians within the Critical Appraisal Research and Learning Course. The content is taught using a variety of methods including: didactic, case-based small group sessions, demonstrations and hands-on exercises in the e-laboratory. Students complete two assignments in their first year designed to practice literature searches and information retrieval. As part of the second year research project, students must also submit their literature search for evaluation and feedback purposes.
The Queen’s University School of Medicine Educational subcommittee considers their “informatics unit” (MEdTech) to be an area of excellence in their institution. This unit manages online course resources, shareable electronic tools and learning modules which, as a whole, align more closely with e-learning than medical informatics.

**University of Western Ontario**

The University of Western Ontario teaches some informatics content to its undergraduate students through the Community Health Course. However, the focus is one of information literacy, evidence-based medicine and health care systems, rather than informatics as we have defined it. Librarians play a significant role in the leadership and delivery of this curricular content. The University of Western Ontario boasts a well-organized Medical Informatics elective for students in their 4th year of study covering topics such as information literacy, computer literacy, electronic medical records and web-based information for patients.

**University of Toronto**

The undergraduate medical curriculum at the University of Toronto does not include informatics content as we have defined it. They do have specific content on information literacy and evaluation of evidence that is delivered longitudinally throughout the undergraduate program. These aspects of the curriculum are shared by librarians and faculty for the Determinants of Community Health course. Students are required to complete a search assignment as well as a Critically Appraised Topic. Like Dalhousie, the University of Toronto has a Health Informatics Program at the Master's level ([http://www.hpme.utoronto.ca/about/gradprograms/mhi.htm](http://www.hpme.utoronto.ca/about/gradprograms/mhi.htm)) but there has been no collaboration with UGME to date. A qualitative study examining the barriers to initiating an informatics curriculum cited an already “packed” curriculum as well as an unclear understanding of the principles of Medical Informatics by faculty and students alike. (14)

**University of Ottawa**

The University of Ottawa does not have a Medical Informatics curriculum. They do have specific curricular components focusing on information literacy (led by librarians) and evaluation of evidence. Medical Technology Services provides some sessions on using laptops and software.

**Northern Ontario School of Medicine**

The Northern Ontario School of Medicine has an Informatics Unit with administrative support. One of the goals of this unit is to enable execution of informatics-enhanced education, research and clinical programs. Despite this, there is no formal informatics undergraduate curriculum. As is true in other academic environments, many students learn specific informatics applications
through clinical experiences with electronic health record systems in both outpatient and inpatient settings.

**McGill University**

McGill University does not identify a Medical Informatics theme in its undergraduate curriculum. The McGill Molson Medical Informatics Project focuses on the use of informatics to support pedagogy. Since this project began in 1997, their goal has been to accomplish an integrated *e-curriculum*. McGill has a structured information literacy program for first year students called "Mastering Medical Information." McGill’s medical school is also engaging in strategic planning and curriculum review. The following informatics-related learning outcomes may be implemented in the future:

1. Demonstrate the use of the computer for appropriate data retrieval and function.
2. Use information technology to locate existing data sources.
3. Select an appropriate computer database tool for collecting and organizing data.
4. Use information systems.
5. Identify how data sources at one's own institution (including medical records, claims and reimbursement information and online data) might be used to address a specific clinical question posed as research.

**Université de Sherbrooke**

The undergraduate medical curriculum at the Université de Sherbrooke does not include specific teaching in medical informatics. Students learn some information literacy through teaching in epidemiology and health services evaluation. The university offers two specialized “professional microprogrammes” at the graduate level in health informatics (French only) and standards in health informatics (French and English). These programs are directed toward health care professionals ([http://www.cred.ca/isa_en.asp](http://www.cred.ca/isa_en.asp)).

**Université de Montreal**

The undergraduate medical curriculum at the Université de Montreal does not include specific teaching in medical informatics. The medical school has clinicians and researchers in the area of the medical informatics. Université de Montreal also offers a Bachelor's in Health Informatics. They have a "Comité inter-hospitalier et universitaire dinformatique medicale" that coordinates Medical Informatics issues between the medical school and the teaching hospitals.

**Université Laval**

There are no specific undergraduate medical curricular objectives in informatics at Université Laval. There is a strong research group in the Department of Family Medicine. They have
created an informatics portal for clinicians (http://infoclinique.fmed.ulaval.ca/Default.aspx) to assist in the location and retrieval of clinical evidence and guidelines.

Memorial University of Newfoundland

The Undergraduate Medical Education Committee at Memorial University of Newfoundland struck an Informatics Sub-committee in 2007. Informatics tools have been used to support pedagogy at Memorial but no informatics content has been explicitly included in the curriculum to date. The sub-committee still describes its work as being in the “development stages.” For the purposes of scope, they have defined informatics as follows:

Health/biomedical informatics is the science of disseminating knowledge and skills about the intersection of information technology, information in health care and information about population health. It deals with the resources, devices and methods required to optimize the acquisition, storage, retrieval and use of information in health, biomedicine and population health. Health informatics tools include not only computers but also clinical guidelines, formal medical terminologies, and information and communication systems.
Scan of international medical schools

We gleaned international examples of Medical Informatics curricular initiatives from published literature.

The University of Arizona College of Medicine (Phoenix track) has partnered with the Department of Biomedical Informatics at Arizona State University to launch an integrated informatics curriculum that spans the four years of undergraduate medicine and includes 90 hours of instruction. The curriculum includes information literacy, mobile computing skills, decision analysis and decision support. (http://www.medicine.arizona.edu/education/Phoenix_Track/index.cfm) Further, a 5th year of study is available to students who wish to obtain a certificate in health informatics.

An international partnership amongst six medical schools (University of Amsterdam, the Universities of Heidelberg and Heilbronn, the University of Health Sciences, Medical Informatics and Technology at Innsbruck, the University of Minnesota and the University of Utah) led to the formation of a Medical Informatics summer school in 2004. (19) The content followed the guidelines laid out by the International Medical Informatics Association and spanned 10 working days. Nineteen students from 14 countries participated in the program. Overall the curriculum was well received, although some topics were felt to be “too difficult” at the level presented.

A recent survey of five medical schools in Bosnia and Herzegovina revealed significant challenges in teaching medical informatics. (20) For example, lack of multimedia equipment, high-speed internet and computer access interfere with students’ ability to utilize electronic resources. However, the University of Sarajevo emerged as a leader having introduced Medical Informatics to the curriculum in 1992-93. We were unable to ascertain the curricular content and objectives.

In the early 1990’s the Facultad de Ciencias Médicas in Córdoba, Argentina wrote a proposal to form an informatics unit. (21) Although we were not able to obtain follow-up with this program, they planned to teach the following “basic principles” to undergraduate and graduate students:

1. Medical terminology
2. Medical linguistics
3. International classification of diseases (ICD)
4. Hospital information systems
5. Practical application of computing in medicine

Medical schools in Rennes and Rouen have used problem-based learning as a methodology for teaching information and communication technologies. (22) The case cited in this study was designed to cover information literacy as well as consumer health information. They report that 70% of students responded positively – students who participated voluntarily responded more enthusiastically.
Specific informatics objectives included:

1. List and categorize the informatics tools that are available: search engines, portals, etc.
2. Describe and explain how these tools work (data vs. metadata, automatic vs. manual indexing, thesaurus vs. natural language)
3. Define precision and recall in information retrieval and apply it
4. Explore and test accessible decision support systems
The following table lists some activities within eight American medical schools participating in the UME-21 (Undergraduate Medical Education for the 21st Century) curriculum project. (4)

<table>
<thead>
<tr>
<th>Medical School</th>
<th>Learning Objectives</th>
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</thead>
<tbody>
<tr>
<td>Dartmouth Medical School</td>
<td>• Use PDAs to document patient encounters</td>
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<tr>
<td></td>
<td>• Access MEDLINE</td>
</tr>
<tr>
<td>University of Massachusetts</td>
<td>• Describe patient care, medical education, and health care communications technologies</td>
</tr>
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<td></td>
<td>• Use computers and software effectively</td>
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<td></td>
<td>• Fourth-year “mini-selective” in Medical Informatics</td>
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<tr>
<td>University of Miami</td>
<td>• Effectively search the MEDLINE database</td>
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<tr>
<td></td>
<td>• Effectively use the internet and informatics technology to find and use information</td>
</tr>
<tr>
<td>University of Nebraska</td>
<td>• Locate and evaluate information for patient care in an electronic environment (online library, bibliographic databases, and drug information)</td>
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<tr>
<td></td>
<td>• Use EBM principles, computer informatics, and patient data to complete a population-based study</td>
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<tr>
<td>University of Pennsylvania</td>
<td>• Access Internet resources</td>
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<tr>
<td></td>
<td>• Utilize EBM in self-directed learning and patient care</td>
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<tr>
<td></td>
<td>• Complete a health policy project (data gathering, synthesis, presentation, and written report)</td>
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<tr>
<td>University of Pittsburgh</td>
<td>• Use a variety of medical information systems</td>
</tr>
<tr>
<td></td>
<td>• Describe informatics applications that impact community-based ambulatory care</td>
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<tr>
<td></td>
<td>• Use information, including on-line full-text articles and electronic text citations</td>
</tr>
<tr>
<td>University of Wisconsin</td>
<td>• Use the internet to retrieve information</td>
</tr>
<tr>
<td></td>
<td>• Use handheld computers (PDAs)</td>
</tr>
<tr>
<td></td>
<td>• Use clinical practice guidelines</td>
</tr>
<tr>
<td>Wayne State University</td>
<td>• Create electronic database of patient-oriented questions and answers</td>
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<tr>
<td></td>
<td>• Log clinical learning exercises and patient encounters using PDAs</td>
</tr>
<tr>
<td></td>
<td>• Access patient education materials and resources</td>
</tr>
<tr>
<td></td>
<td>• Access Internet resources</td>
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Recommendations

1. Develop a longitudinal programme in Medical Informatics that is interwoven into the curriculum and focuses on Medical Informatics principles rather than specific applications. The programme should be facilitated by faculty with some expertise in Medical Informatics.
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Listing of members:

Group Leader: Katrina Hurley (kfhurley@dal.ca)
Raza Abidi (sraza@cs.dal.ca)
Sarah Armstrong (saraharmstronglea@gmail.com)
Calvino Cheng (Calvino.Cheng@cdha.nshealth.ca)
Adam Harris (ad630101@dal.ca)
Ajantha Jayabaranthan (ajantha@eastlink.ca)
Grace Paterson (gpaterso@dal.ca)
Kevork Peltekian (KPeltekian@dal.ca)
Paul Postuma (Dr.Paul.Postuma@r2.rha-rrs.ca)
Steven Soroka (steven.soroka@cdha.nshealth.ca)
Brett Taylor (bwtaylor@ns.sympatico.ca)
David Zitner (david.zitner@dal.ca)
Listing of several significant contacts

Dr. Angela Towle  
Associate Dean, MD Undergraduate Education  
University of British Columbia  
Tel: (604) 875-5153  
Fax: (604) 875-5411  
atowle@interchange.ubc.ca

Dr. Kent Stobart  
Associate Dean, Undergraduate Medical Education  
University of Alberta  
Tel: (780) 492-9523  
kentstobart@med.ualberta.ca

Dr. Robert Hayward  
Assistant Dean, Health Informatics  
University of Alberta  
Tel: (780) 492-8583  
Fax: (780) 492-1748  
robert.hayward@ualberta.ca

Dr. Steve Edworthy  
Associate Professor, Division of Rheumatology  
University of Calgary  
Tel: (403) 220-7740  
seword@ucalgary.ca

Dr. Pamela Veale  
Undergraduate Medical Education  
University of Calgary  
Tel: (403) 210-8620  
pamela.veale@albertahealthservices.ca

Dr. Sheila Rutledge Harding  
Associate Dean, Medical Education  
University of Saskatchewan  
Tel: (306) 966-4030  
sheila.harding@usask.ca

Dr. Alan Neville  
Assistant Dean of Undergraduate Medical Education  
Tel: (905) 525-9140 Ext. 22141  
Fax: (905) 546-0349  
neville@mcmaster.ca
Suzanne Maranda  
Head, Bracken Health Sciences Library  
Queen's University  
Tel: (613) 533-6000/74522  
Fax: (613) 533-6892  
marandas@queensu.ca

Laura Sarnovsky  
Curriculum Specialist  
Schulich School of Medicine & Dentistry  
University of Western Ontario  
Tel: (519) 661-2111 x 87914  
laura.sarnovsky@schulich.uwo.ca

Dr. Candace J. Gibson  
Associate Professor, Department of Pathology  
University of Western Ontario  
Tel: (519) 661-3849  
Fax: (519) 661-3370  
candaceg@uwo.ca

Elena Springall  
Instruction & Faculty Liaison Librarian (Medicine & Nursing)  
University of Toronto  
Tel: (416) 946-5759  
elena.springall@utoronto.ca

Dr. Pierre Fortier  
Preclerkship Co-director  
University of Ottawa  
pfortier@uottawa.ca

Dr. Rachel Ellaway  
Assistant Dean, Informatics  
Northern Ontario School of Medicine  
Tel: (705) 662-7196  
Fax: (705) 675-4858  
rachel.ellaway@normed.ca

Maryse Grignon  
Administrator – Curriculum Management  
McGill University  
Tel: (514) 398-8777  
Fax: (514) 398-3595  
maryse.grignon@mcgill.ca
Nancy Posel  
McGill Molson Medical Informatics Project  
Tel: (514) 398-2077  
nancy.posel@mcgill.ca

Dr. Andrew Grant  
Director Collaborative Research for Effective Diagnostics (CRED)  
Université de Sherbrooke  
Andrew.grant@usherbrooke.ca

Dr. Yvan Leduc  
Département de médecine familiale et de médecine d’urgence (DMFMU)  
Université Laval  
Yvan.Leduc@fmed.ulaval.ca

George Beckett  
Health Sciences Library  
Memorial University of Newfoundland  
Tel: (709) 777-6670  
Fax: (709) 777-6866  
georger@mun.ca
Appendix A

Supplementary Materials from Canadian Medical Schools
available on request from kfhurley@dal.ca

University of Saskatchewan

The Medical Informatics curriculum was initiated in 2001-02 and revised in 2008. The curriculum content is outlined below.

First year Medical Informatics instruction: 7 hours in the Professional Skills course (MED 105.8)

- introduction to Medical Informatics and information literacy and answering a clinical question
- introduction to Medline (MeSH and subheadings)
- searching Medline and Embase (explode, focus, combining and limiting searches)
- an overview of other biomedical databases (e.g. AMED, Natural Standard, Natural Medicines Comprehensive Database, PsycInfo, SportDiscus, CINAHL)
- evaluating information
- finding good quality information on the Internet
- optional RefWorks and PowerPoint sessions

Third year Medical Informatics instruction: 5 hours in the Community Health & Epidemiology course

- PubMed and review of OVID Medline and Embase
- RefWorks (optional)
- evidence-based practice tools (including Cochrane, Dynamed, BMJ Clinical Evidence, FirstConsult)
- a review of the Library Catalogue
- keeping up to date with RSS feeds and Faculty of 1000
- PDA's

University of British Columbia

Informatics Theme Director

Informatics Grid
University of Western Ontario

Informatics Elective

Memorial University of Newfoundland

Informatics Sub-committee Terms of Reference