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SPECIAL ARTICLE

Introducing information literacy into anesthesia curricula

L'introduction de la maîtrise de l'information dans les formations en anesthésie

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Abstract

Purpose *This review examines the topic of information literacy (IL) and its importance as a component of competency-based education in the health professions, and shares the process and outcome of a collaborative effort between The University of Manitoba Department of Anesthesia and Health Sciences Libraries to create, to introduce and integrate IL training into a new anesthesia curriculum.*

Principle findings *Nine IL modules were developed according to standards set by the Association of College and Research Libraries (ACRL) and aligned with the Royal College of Physicians and Surgeons CanMEDS competencies. Taken collectively, they explore modern tools used to approach the medical literature in an organized, efficient manner, and to locate, evaluate and use information effectively to accomplish a specific purpose. Each module forms the basis of one IL session that combines self-study and group projects with librarian-led, computer-based training, designed to build competency in information need awareness, retrieval skills and resource appraisal. Facility with the concepts taught was evaluated though examples relevant to the anesthesia practice environment. The entire collection is available at http://wiki.lib.umanitoba.ca/tiki-index.php?page=Anesthesia+Clinical+Assistants+Programme. While the original impetus for this project was to prepare Anesthesia Clinical Assistants for self-directed, life-long, active learning, what emerged was a curriculum in IL germane to medical specialties and flexible enough to be used by healthcare professions generally.*

Conclusion *An IL program, directly relevant to current expectations of competent practice, education and lifelong learning, has been created and is discussed within the larger context of curriculum-integrated IL for the health professions.*

Résumé

Objectif *Ce compte-rendu examine le thème de la maîtrise de l'information (information literacy—IL) et son importance comme composante d'un modèle de compétence attendue dans les professions de la santé, et présente le processus et les résultats d'une collaboration entre le département d'anesthésie de l'Université du Manitoba et les Bibliothèques des sciences de la santé. Cette collaboration avait pour but de créer, d'introduire et d'incorporer une formation en maîtrise de l'information dans une nouvelle formation en anesthésie.*

Constatations principales *Neuf modules de maîtrise de l'information ont été élaborés selon les normes définies par l'ACRL (Association of College and Research Libraries) et ajustées aux compétences CanMEDS du Collège royal des médecins et chirurgiens. Collectivement, ces modules explorent les outils modernes utilisés pour aborder la littérature médicale de façon organisée et efficace, ainsi que pour localiser, évaluer et utiliser l'information de manière efficace pour réaliser un objectif spécifique. Chaque module constitue la base d'une session de maîtrise de l'information qui allie auto-apprentissage et projets de groupe avec une formation sur ordinateur dirigée par un bibliothécaire, dans le but de développer les compétences*

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en matière de conscience des besoins en information, compétences de recherche documentaire et évaluation des ressources. L'aisance avec les concepts enseignés a été évaluée grâce à des exemples pertinents au contexte de la pratique de l'anesthésie. La collection complète de modules est disponible à l'adresse URL suivante : http://wiki.lib.umanitoba.ca/tiki-index.php?page=Anesthesia+Clinical+Assistants+Programme. L'objectif initial de ce projet était de préparer les assistants cliniques en anesthésie à un apprentissage auto-dirigé, permanent et actif; toutefois, le projet a généré une formation en maîtrise de l'information pertinente aux spécialisations médicales et suffisamment flexible pour être utilisée globalement par les professions médicales.

Conclusion *Un programme de maîtrise de l'information, répondant directement aux attentes en matière de pratique compétente, de formation et d'apprentissage permanent, a été créé et est présenté dans le contexte plus vaste de la maîtrise de l'information intégrée à la formation dans les métiers de la santé.*

Professional medical societies and training programs place emphasis on continuing education and lifelong learning as essential activities necessary for responsive patient care, contemporary clinical practice, and quality academic pursuits. Physicians are expected to continue their education beyond formal schooling in order to incorporate new knowledge about disease conditions, therapies, and technologies into daily practice.[1] Professional and technical knowledge that once served throughout a practitioner's career is now estimated to double every 5 years.[2] This rapid pace of change in the medical sciences and the burgeoning number of publications, coupled with the technological expertise required to navigate the information mire and access relevant health sciences literature, can be overwhelming for the busy, practicing professional. Aside from developing skill in searching the literature databases, such as PubMed, or sampling the available hits with a cursory search of Google, what other techniques and strategies are available to tackle information retrieval that will yield useful, practical results?

To answer these questions, the Department of Anesthesia at the University of Manitoba partnered with the Health Sciences Libraries to design and develop information literacy (IL) learning sessions which could be integrated into the year-long modular curriculum for the Manitoba Anesthesia Clinical Assistant Program (ACAP). The development of IL abilities was seen as necessary and fundamental for practitioners to maintain both evolving clinical competence and future ability to engage in lifelong learning.

The ACAP is a newly developed training program for Anesthesia Clinical Assistants that began in January 2007. Among the unique features of the program are a 1-year training period, a modular competency-based curriculum, preceptor-led tertiary care and community clinical exposure, academic time, case-based talk rounds, and simulation scenarios.

Evaluation includes both formative and summative assessment of the academic, clinical, and behavioral performance of the ACA trainee using a portfolio of tools, including written tests, objective structured clinical examinations (OSCEs), behavioral scales, procedural log books, simulator sessions, direct observation, and comparative self-evaluation. Performance of clinical procedures is rated against benchmarks of five levels of competence for expected performance.

The program accepts applications from licensed registered Respiratory Therapists, Registered Nurses and International Medical Graduates who have recent anesthesia, emergency, and/or critical care experience. Applicants to the program must be eligible to register with the College of Physicians and Surgeons of Manitoba (CPSM). By an amendment to the Provincial Medical Act, this body licenses clinical assistants and regulates their practice under direct supervision of an attending anesthesiologist.

Information literacy

Information literacy training provides practitioners with tools to approach medical literature in an organized, efficient manner and to locate, evaluate, and use information effectively to accomplish a specific purpose.[3] Information literacy is now considered the key competency integral to all educational, professional, and scholarly pursuits that enables practitioners to deal with the aptly described "information abundant and intensive 21st century."[4] As well, IL forms the basis of lifelong learning.[5]

Information literacy and its associated terminology should not be confused with popular terms and contemporaneous phrases appearing in the literature, such as "computer literacy," "IT literacy," and "informatics." These terms refer to a specific range of skills encompassing diverse information and communication technologies, such as e-mail, desktop applications, and network environment.[6] Information literacy competency is broader in scope than skillful use of technological tools. An individual may be computer literate and skilled at working in an electronic environment but may not necessarily be information literate.[7]

The American Library Association defines IL as a set of abilities requiring individuals to "recognize when information is needed and to have the ability to locate, evaluate, and use the needed information effectively."[8] The Association of College and Research Libraries (ACRL) has developed a framework to incorporate and integrate IL

Table 1 ACRL information literacy competency standards for higher education

Standard One	The information literate student determines the nature and extent of the information needed
Standard Two	The information literate student accesses needed information effectively and efficiently
Standard Three	The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system
Standard Four	The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose
Standard Five	The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally

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competencies into curricula and has used criteria by which to assess individuals as information literate. The document, *Information Literacy Competency Standards for Higher Education*, defines five standards of IL (Table 1), outlines associated performance indicators for each standard, and includes outcomes that can guide assessment.[3]

The *Standards* are generically written in order to be universally applicable to a wide scope of higher education settings. Acknowledged within the *Standards* is the importance of developing IL strategies within the context of particular disciplines, noting that IL "manifests itself in the specific understanding of the knowledge creation, scholarly activity, and publication processes found in those disciplines."[3] The *Standards* is also explicit in the basic notion of IL for lifelong learning, a concept that has been adopted in countries, institutions, and professions worldwide, as individuals manage an abundance of information and cope with rapid technological change.[9]

Performance indicators accompany each of the five ACRL standards. These are criteria that describe the desired performance that a student should exhibit upon mastery of the IL competency. A range of identified outcomes for each indicator describes the specific activities or behaviors that students should successfully demonstrate in meeting the performance indicators. These outcomes, in turn, can be used to measure competence achievement. Following is a selected performance indicator and several identified outcomes for Competency Standard Two, Performance Indicator 2:

The information literate student constructs and implements effectively designed search strategies.

Outcomes include:

a. Develops a research plan appropriate to the investigative method.
b. Identifies keywords, synonyms, and related terms for the information needed.
c. Selects controlled vocabulary specific to the discipline or information retrieval source.
d. Constructs a search strategy using appropriate commands for the information retrieval system selected (e.g., Boolean operators, truncation, and proximity for search engines, and internal organizers, such as indexes for books).

A companion document, *Objectives for Information Literacy Instruction: a Model Statement for Academic Librarians*,[10] was designed for use with the *Standards* to further develop objectives and outcomes in integrated IL curricula. The *Objectives* expand and define the outcomes from the *Standards* document into specific, measurable results and facilitate creating both course content and relevant assessment. For example, the enhanced outcomes for Competency Standard 2, Performance Indicator 2, include:

2.2a. Develops a research plan appropriate to the investigative method.

- Describes a general process for searching for information.
- Describes when different types of information (e.g., primary/secondary, background/specific) may be suitable for different purposes.
- Gathers and evaluates information and appropriately modifies the research plan as new insights are gained.

The outcomes, as seen in the above example, can be used as benchmarks to assess students' progress in meeting the goals of the IL curriculum, allowing for the development of assessment methods and instruments that best suit the particular learning environment. The various outcomes also reflect the different levels of thinking skills that are evidenced in competency achievement, both the basic understanding of information structure and retrieval and the higher-level integration of the skill into scholarly and professional activity. The *Standards* framework allows for flexibility in mastery of the competencies; for instance, a discipline can emphasize certain competencies giving more weight to particular outcomes in the assessment process.[3]

The ACRL *Standards* have gained wide acceptance. They form the foundation of IL competencies and programs developed by many diverse higher education institutions.[11] Also, various accrediting bodies have adopted IL principles and incorporated them into professional education and practice standards.

Embedded within the expressed competencies of medical and allied health professions are the principles of IL and lifelong learning.[12] Whether or not ACRL information literacy standards are explicitly referenced, similarly

expressed abilities or competencies are being used as performance measures that must be achievable, demonstrable, and maintained.

This incorporation of the principles of IL can be seen in the context of Canadian medical education and professional competence. In the CanMEDS roles developed by the Royal College of Physicians and Surgeons of Canada (RCPSC), the role of Scholar is most clearly related to IL. As the Scholar role is defined, the physician must demonstrate a "lifelong commitment to reflective learning, as well as the creation, dissemination, application, and translation of medical knowledge."[13] The "ability to maintain and enhance professional activities through ongoing learning" is listed as the first key competency required of the Scholar. This key competency is to be demonstrated by, among others, the ability to:

1. Recognize and reflect learning issues in practice
2. Pose an appropriate learning question
3. Access and interpret the relevant evidence
4. Integrate new learning into practice

These competencies align directly with the ACRL standards. Other key competencies of the Scholar role also rely on the core principles of IL: to critically evaluate information and its sources and apply this appropriately to practice decisions; to facilitate the learning of others; and to contribute to the creation, dissemination, application, and translation of new medical knowledge and practices.

Specific to the practice of anesthesiology, the RCPSC objectives of training and specialty training requirements in anesthesiology list the following requirements for the Scholar role: develop criteria for evaluating the anesthetic literature; critically assess the literature using these criteria; describe the principles of good research; using these principles, judge whether a research project is properly designed.[14]

Likewise, the six general competencies developed by the Accreditation Council for Graduate Medical Education (ACGME) in the United States and adopted by the American Board of Medical Specialties also contain elements of IL skills and abilities.[15] For example, in the competency of practice-based learning and improvement, residents are expected to engage in lifelong learning, to identify strengths, deficiencies, and limits in one's knowledge and expertise; to locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems; to use information technology to optimize learning; and to participate in the education of patients, families, students, residents, and other health professionals.[16]

Competency-based education in the health professions

The requirement by accrediting bodies for demonstrated competence in professional practice is being translated into the curricula of professional education. The impetus for competency-based education has been driven by public accountability and societal demands for assurance that health care professionals are competent in their practice.[17–19] A call for competency-based education for all health professions was made in the 2003 Institute of Medicine report, *Health Professions Education: a Bridge to Quality*.[13] The report identifies a core list of five competencies that all clinicians, regardless of their discipline, should attain:

1. Provide patient-centered care
2. Work in multidisciplinary teams
3. Employ evidence-based practice
4. Apply quality improvement
5. Utilize informatics.

Internationally, other countries have also developed competency-based frameworks for medical and other health professions.[17] The competency-based educational model has been recognized in anesthesia education, both in primary training and continuing medical education and professional development.[20–22]

Competency-based education is a paradigm shift from the teacher-centered, passive delivery of training and education toward an active, learner-centered education reflective of adult learning theory. The desired outcome of training drives the educational process and, in turn, focuses on performance-based assessment of skills, knowledge, and understanding.[17,20] The learner-centered environment of competency-based education incorporates problem-based learning and critical thinking, both of which require the competencies of IL.

One of the earliest competency-based medical programs at Brown University School of Medicine specifies active learning as a core feature of the program, which includes lifelong learning and problem solving as two of the nine identified abilities forming the base of the curriculum.[23] The Dundee curriculum model specifies 12 outcomes that need to be demonstrated by the medical graduate. The outcomes that are directly related to IL include use of critical thinking, problem solving, decision making, clinical reasoning and judgment, and application of appropriate information retrieval and handling skills.[24]

Along with the competency-based movement in professional health education, a similar significant change is underway in the manner health professions regard continuing education and professional development. The focus has changed from the traditional continuing medical education (CME) approach of accumulating credit hours through lecture or conference attendance toward self-identification of learning objectives or knowledge deficits and self-directed learning plans.[25] Again, the emphasis is on active learning where the individual seeks appropriate

learning opportunities and applies them to practice.[22] Competency-based education carries over from initial training to lifelong learning throughout the course of a career. The RCPSC has built its Continuing Professional Development program according to the principles of lifelong learning based on the roles and competencies outlined in the CanMEDS framework. Renewal of a physician's Fellowship with the Royal College is now based on a 5-year cycle of demonstrated continuing professional development.[26] The American Board of Medical Specialties has adopted a similar process for maintaining certification.[25] Indeed, for maintenance of licensure, credentialling bodies may, at some point, require demonstration of continuous, competency-based learning.[27,28]

Curriculum-integrated information literacy

At the same time that medical credentialling bodies are incorporating principles of IL into the core competencies of the profession, IL is being integrated into the health profession's educational curricula. Successful examples of curriculum-integrated IL are well-established in medical and allied health education.[29–34] Information literacy is not a stand-alone skill existing outside of the curriculum but is central to the development of competent professionals practicing within an information literate society. As discussed in the *Standards*, the delivery of IL competency training can best be achieved through an integration of IL proficiencies and skills into a curriculum's content, structure, and sequences. Such a framework lends itself especially well to problem-based or evidence-based learning, where a learner-centered approach is emphasized requiring students to search for and appraise information sources applicable to the course content. A curriculum-integrated IL program requires collaboration of faculty, librarians, and administrators.[3] Unlike stand-alone library training or bibliographic instruction sessions occurring independent of courses, integrated IL ties the expected proficiencies, outcomes, and assessment directly to the objectives and content of the curriculum. To be successful, IL training cannot be generic in nature.[35] Rather, there exists a "critical" relationship between IL competency training and discipline content. By integrating IL within a course, knowledge development and skills acquisition develop progressively as part of the learning process.[36]

Introducing information literacy into anesthesia curricula

The integration of IL training into the Manitoba ACAP curriculum builds on the examples of successful curriculum-integrated IL programs. The impetus for developing the program arose from recognizing the changing information environment of health care professionals and from acknowledging the requirement both for competency-based practice and for ongoing participation in professional development activities in accordance with professional standards.[37]

The framework created by the *Information Literacy Competency Standards for Higher Education* for incorporating and integrating IL competencies into curricula was ideal for the development of IL program learning modules (Table 2) for the anesthesia environment. The framework allowed for both the specifics of IL competency achievement and for the flexibility to adapt to the content and structure of the discipline and the curriculum.

The modules were designed with objectives and measurable competencies that were geared to assist the ACA trainees to develop a set of skills permitting them to:

- Access information from a variety of sources
- Evaluate those sources
- Improve their approach to formulating questions and finding answers
- Arrange for timely drug and device alerts
- Create an individual archiving process for articles of interest tailored to personal needs
- Assist Department members with their academic and research mandates.

In addition, the process of creating and integrating IL modules into the ACA curriculum revealed the direct relevance of this approach to our anesthesia residency program, to our fellowship programs, and to the practice of anesthesia in general. As a result, we focused on creating and designing a stepwise modular approach to IL that would appeal to all levels of anesthesia practitioners and could be taught in conjunction with the information services available at a university medical library.

The nine IL modules are integrated into the first 9 months of ACA training. The format of the modules was modeled after those in the broader ACA program. The

Table 2 Anesthesia clinical assistant program information literacy modules

Module 1	Orientation to research services & support
Module 2	Formulating a clinical question, Pubmed Searching
Module 3	Introduction to Information Management (Refworks)
Module 4	Advanced Pubmed & Scopus searching
Module 5	Drug information, anesthesiology E-books
Module 6	Web research & evaluation
Module 7	Keeping current, RSS feeds, my NCBI
Module 8	Investigating anesthesia materials and devices
Module 9	Evaluating evidence, summative assessment

objectives for each topic are identified, followed by a list of pre-requisite knowledge items, supporting references from the literature, and competencies to be achieved by the student. The competencies are specific behaviors the students should exhibit or achieve that are directly related to the expressed objectives of the IL modules. The corresponding competencies from both the ACRL Standards and Objectives and the CanMEDS 2005 Physician Competency Framework are also listed. Aligning the program competencies of the ACAP IL program with those of the ACRL and CanMEDS illustrates the strength and relevance of their affiliation.

The IL modules were collaboratively designed by librarians of the University of Manitoba Health Sciences Libraries and the Manitoba ACAP Medical Director, with input and feedback, in the fall of 2007, from the anesthesia clinical assistant students. The IL program was initially presented in the spring of 2008 and again in the fall of 2008. The infrastructure and resources to deliver the program were already in place. The University of Manitoba Health Sciences Libraries are equipped with two computer labs, each with 15 workstations, and a complement of 10 librarians who regularly provide instructional sessions. There is access to an abundance of electronic resources, including databases, bibliographic management software, and electronic books and journals.

The instruction examples, associated readings, and student outcomes were explicitly tied to the anesthesia curriculum, although the modules also reflect core IL competencies in the health sciences in general. The modules can be tailored to the purposes of any health professional education program or professional development curriculum. Each module builds on skills and competencies acquired in previous modules. For instance, the skills developed in searching the PubMed database in Module 2 are again used in Module 4, Advanced PubMed and Scopus Searching; Module 7, Keeping Current, RSS Feeds and My NCBI; and Module 8, Investigating Anesthesia Materials and Medical Devices, allowing students to develop competence over time and achieve a higher level of understanding of the concepts and skills.

Each module is held in the library computer lab and is comprised of a 2-h hands-on training session led by a professional librarian. The sessions are based on active learning principles and take place in a small-group, interactive, seminar environment. With one student at each computer, access, in real-time, is available to an array of health sciences literature databases, online information resources, websites, information management tools, and web-based current awareness applications. The instructor demonstrates the features of each resource and the principles of an effective search, navigation, and evaluation. Students duplicate the instructor's directives and engage in learning activities throughout the training session that not only require the use of knowledge and skill gained during the sessions, but also pertain to their work in the anesthesia setting and result in measurable competency behaviors.

For example, a learning activity related to an aspect of spinal anesthesia was developed as part of the training in advanced PubMed search skills. Repeating similar searches (using the terms spinal, spinal anesthesia, subarachnoid, intrathecal, regional anesthesia, and central and neuraxial anesthesia) and then comparing the results demonstrated the value of creating search strategies that combine the use of both database thesaurus terms and descriptive key words in a search string. Another learning activity compared the characteristics of available fluid warmers. Students were asked to select two devices, one that met the particular needs for a community setting, the other a trauma setting. This required both the knowledge where reliable sources of information on anesthesia equipment can be found and the ability to develop an effective search of PubMed and the Internet for published comparative studies and relevant specialized websites. An exercise in the value of targeted current awareness of the journal literature was undertaken by determining the most useful journals for anesthesia practice and establishing individual alerts to those journals via PubMed.

Between group sessions, the librarians were available to assist students on an individual basis. To supplement both the IL experience and the group sessions, students were encouraged to access online tutorials at times convenient for them. Examples of such tutorials include the interactive My NCBI tutorials available on the PubMed website (they demonstrate the steps for saving search strategies and for creating regular alerts for specific topics and journal contents)[38] or the general research online tutorial available from the University Library at California State Polytechnic University, Pomona.[39]

Students are given homework assignments relevant to the practice of anesthesia that are designed to solidify their skills in locating and accessing appropriate resources, in searching for specific information, and in evaluating the information retrieved. For example, the ACA trainees completed a group exercise to construct an online anesthesia resources toolkit.[40] The toolkit compiles web-based resources identified as germane to clinical anesthesia practice and lifelong learning within the specialty. The resources include primary databases for locating published articles and relevant professional websites, citation management tools, listservs, and alerting services. The toolkit format, developed by the University of Manitoba Health Sciences librarians and hosted on the library's website[41] has demonstrated its adaptability to a wide range of health professions' resources. The ACAs also constructed a

RefWorks citation database of all readings and references that support their entire ACAP curriculum.

The entire nine module series developed in a wiki format that allows users to create and edit Web page content is available for viewing online.[42] One of the modules, Formulating a Clinical Question and Basic PubMed Searching, is illustrated in Tables 3–6.

ACA trainee feedback on the IL competencies has been very positive. Suggestions such as, "shorten the timeframe for delivery of the IL modules from 9 to 4 months," "deliver the modules earlier in the year-long curriculum," and "reorder the modules, specifically the timing of the module on evaluating evidence and offer it sooner within the schedule," have been adopted and the curriculum modified. Ongoing feedback about the IL modules is encouraged. As the true value of the course content being taught and learned becomes apparent based on practical application in the working environment, ongoing evaluation of the IL program is planned. Any changes incorporated on completion of a program will be reflected in the subsequent scheduled delivery; in this case, changes will be reflected in the ACAP curriculum beginning in February 2009.

The concept of IL was presented at the Department of Anesthesia Grand Rounds in December 2008. There is general interest in adopting the IL curriculum into the residency program, and faculty members are looking at ways to incorporate IL into their practice.

The objectives and competencies can be adapted to other practices and other settings, such as internal medicine, critical care, or family practice. As such, the competencies of IL are germane to training and education across the RCPSC medical and surgical specialties. They are also relevant to the competency-based education of professionals from allied health care disciplines that assist in anesthesia, including nursing and respiratory therapy. The health sciences librarians at the University of Manitoba have successfully incorporated IL competencies into

Table 3 Module 2: formulating a clinical question and basic PubMed searching: objectives

Objectives
• Identify and differentiate whether primary or secondary resources should be used to answer a question
• Describe the elements of the PICO[a] and formulate clinical questions using the model
• Identify PubMed as a key resource in anesthesiology for searching by subject for primary resources (i.e., journal articles) to find evidence and to answer clinical queries
• Identify the main concepts of a search question and develop search strategy using Boolean operators
• Perform a keyword search in PubMed to find relevant journal articles and save, email, or print a list of the relevant citations to the articles
• Access relevant journal articles held online by the HSL[b] or request copies of articles not electronically available from the HSL

[a] PICO (Patient Intervention Comparison Outcome) is a model used to formulate a clinical question for database searching

[b] HSL (Health Sciences Libraries) refers to the health sciences libraries of the University of Manitoba

Table 4 Module 2: formulating a clinical question and basic PubMed searching: pre-requisite knowledge

Pre-requisite knowledge
• Experience with accessing websites using Internet Explorer or another website browser
• Keyboarding skills and familiarity with using a mouse
• Prior attendance at Module 1, Orientation to Research Services and Support

Table 5 Module 2: formulating a clinical question and basic PubMed searching: competencies

Competencies
• Determine whether a question is a background or foreground question and consider whether primary or secondary resources should be used to answer the question
• Gather background information from textbooks, handbooks, dictionaries, or other secondary or tertiary resources in order to understand the key concepts of a question
• Create a clear and answerable clinical question using the PICO[a] model
• Locate and access PubMed from the HSL[b] homepage or the Anesthesiology Toolkit
• Explain the mechanisms of a keyword search
• Discuss the advantages and disadvantages of keyword searching in Pubmed
• Identify the main concepts of a search question and synonyms/alternate spellings for each concept
• Combine search concepts using the Boolean operators AND and OR
• Perform phrase searching using quotations in PubMed
• Use Limits feature in PubMed to narrow search results by publication date, language, etc.
• Identify articles of interest from search results and put them into the Clipboard
• Search for journal titles indexed by Pubmed or for journal abbreviations using the Journals Database in PubMed
• Find articles using Single Citation Matcher in PubMed
• Link to the full text of journal articles located in PubMed using UM Links,[c] the UM Libraries electronic journal linking tool
• Request articles not available electronically through the Document Delivery form available in UM Links

[a] PICO (Patient Intervention Comparison Outcome) is a model used to formulate a clinical question for database searching

[b] HSL (Health Sciences Libraries) refers to the health sciences libraries of the University of Manitoba

[c] UM Links is the external link resolver used by the University of Manitoba Libraries to facilitate online access to articles from electronic journals

Table 6 Module 2: formulating a clinical question and basic PubMed searching: supporting ACRL objectives and CanMEDS competencies

The competencies for the University of Manitoba, Department of Anesthesia are supported by the following:
ACRL Objectives for Information Literacy Instruction
2.2.a. Develops a research plan appropriate to the investigative method
2.2.b. Identifies keywords, synonyms, and related terms for the information needed
2.2.d. Constructs a search strategy using appropriate commands for the information retrieval system selected (e.g., Boolean operators, truncation, and proximity for search engines; internal organizers such as indexes for books)
2.2.e. Implements the search strategy in various information retrieval systems using different user interfaces and search engines, with different command languages, protocols, and search parameters
The competencies for the University of Manitoba, Department of Anesthesia are supported by the following:
The CanMEDS 2005 Physician Competency Framework
• Scholar—1.6 Access and interpret the relevant evidence
• Medical Expert—2.1 Apply knowledge of the clinical, socio-behavioral, and fundamental biomedical sciences relevant to the physician's specialty
• Scholar—4.4 Conduct a systematic search for evidence
• Scholar—4.5 Select and apply appropriate methods to address the question

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other Faculty of Medicine programs, such as the Critical Care Fellowship and the new Physician Assistant program.

Conclusion

The University of Manitoba Anesthesia Department and Health Sciences Libraries collaborated to create and integrate IL sessions into the anesthesia clinical assistant curriculum. Modules were designed for ACAs to develop competencies in determining the information needed, in effectively and efficiently retrieving the information, and in critically evaluating the information resources. The nine IL modules are directly applicable to other anesthesia education programs, are relevant for practicing anesthesiologists, and, on the whole, are flexible enough to be used by other health care professions. Since the competencies are aligned with the IL standards developed by the Association of College and Research Libraries and the standards for professional competence from the RCPSC, they are directly relevant to the current expectations of competent practice, education, and lifelong learning embraced by the health professions.

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