Brief individual e-learning activities using information delivery and retrieval technology in a continuing medical education context:

A literature review, an environmental scan, and interviews with CME experts

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Abbreviations

- CFPC: The College of Family Physicians of Canada
- CME: Continuing Medical Education
- CMQ: Le Collège des médecins du Québec
- RCPSC: The Royal College of Physicians and Surgeons of Canada

Executive Summary

While high priority is given to the application of research-based knowledge in clinical practice, which is a component of knowledge translation, clinicians in primary care do not have the time to read and critically appraise original research. Delivering pre-appraised synopses of research articles to clinicians via email (information delivery technology or ‘push’ technology), and their retrieval by clinicians within databases (information retrieval technology or ‘pull’ technology) may help to solve this problem.

By way of illustration, members of the Canadian Medical Association (CMA) receive daily InfoPOEMs® delivered as email alerts (push). InfoPOEMs® stands for Information about Patient-Oriented Evidence that Matters. They are appraised synopses of peer-reviewed published research, selected for their validity and clinical relevance to primary care practitioners. These synopses may then be retrieved from a searchable database system, such as Essential Evidence Plus®, to assist with clinical decision-making (pull).

The present report aims to better understand the current status of individual e-learning activities that employ push and pull technology. To achieve this objective, we conducted a literature review, an environmental scan and interviews with an international panel of experts in continuing medical education (CME). Our questions were: (1) What are the information use and educational value associated with the usage of push and pull technology in accordance with the medical literature? (2) Under what conditions, can brief individual e-learning using push and pull technology be considered CME? ‘Brief’ refers to reading synopses of research papers, as opposed to conducting a structured review of the literature and performing the critical appraisal of the selected studies.

Our literature review shows push and pull technology is increasingly used in routine medical practice, and results in physicians applying research-based knowledge in clinical decision-making. We examined this application using an educational perspective, and suggest using push and pull technology may trigger individual e-learning activity.

The environmental scan indicates the following. While there are policies to recognize literature reviews as CME activities (identification and selection of relevant studies, and critical appraisal of selected studies), (1) no specific policies exist to recognize brief individual e-learning activities using push technology, and (2) no specific policies exist to recognize brief individual e-learning activities using pull technology outside the USA. For each search within approved databases (pull), physicians may complete a brief questionnaire, and claim 0.5 ‘Prescribed Credit’ from the American Academy of Family Physicians (AAFP) or 0.5 ‘AMA PRA’ credits from the American Medical Association (AMA). In Canada, physicians may claim credit for

reading research-based information on computer (push or pull), as for any reading activity (e.g., Mainpro-M2 credits issued by the College of Family Physicians of Canada - CFPC).

Interviews with experts support these findings from our literature review and environmental scan. The utilization of push and pull technology for individual e-learning CME can be part of a problem-based learning approach. For instance, retrieved information items might be used to address clinical problems encountered in clinical practice for a specific patient. Allocation of CME credits for brief individual e-learning activities could be based on self- assessment of cognitive processes (reflection), and as stated by the experts, allocation of CME credit in both the USA and Canada is also based on problem solving actions implemented in clinical practice (physicians being asked what they did with the information). The amount of time spent using technology is presently a criterion for allocating CME credit; however no consensus over the use of this criterion emerged from interviews with CME experts.

While the literature review suggests information retrieval for brief individual e-learning activities has educational value (pull), studies to document the educational value of information delivery (push) are just now emerging. Our prior research and the present review, environmental scan and expert panel interviews lead us to propose two options focusing on brief CME individual e-learning activities using push technology. We focus on push technology for two reasons: A specific policy and brief CME individual e-learning activities using pull technology are already implemented in the USA; and practice-based tools for tracking CME e-learning activities using pull technology have been developed in Canada in collaboration with major educational bodies.

Option 1: Transfer pull-related policy into a push context

Existing pull-related policy may be transferred to a push context where one hour spent on e-learning activities corresponds to one credit. Thus, the amount of time spent using push technology for e-learning activities can lead physicians to claim a fraction of CME credits. The amount of time may be tracked and reported to physicians for supporting their claim, or the average time spent to read and rate or comment on a research-based synopsis may be used as a metric for allocating credits. We propose a second option since there was no consensus on the amount of time spent using technology as a criterion for allocating CME credits.

Option 2: A new metric

When delivered on email, the number of opened, read and rated information items may be considered as an appropriate measure of brief individual e-learning CME activity (push technology). Delivered evidence-based information items can lead physicians to claim CME credits when they are read, and when reflective learning activities are documented, e.g., using the McGill 'Information Assessment Method' (relevance, cognitive impact, use for a specific patient and expected health benefits). In Canada, further CME activities can be suggested to the learner when information items are used for a specific patient, specifically via a link to one of the following tools when appropriate: Mini-Pearls® exercise (CFPC), 'Le plan d'auto-gestion du dévelopement professionnel continu' (Collège des médecins du Québec - CMQ), and 'Personal Learning Projects' (Royal College of Physicians and Surgeons of Canada - RCPSC). In other words, using push technology may reveal 'unknown information needs', and trigger the use of pull technology for patient-related problem-solving activities.

In conclusion, both of these options may act as a guide for physician self-assessment, and for CME accreditation or other CME policy development. At the time this report is written, the CFPC and the RCPSC have integrated 'option 2' into their policies and policy-making processes, respectively. Our work suggests more educational research is needed on issues concerning push and pull technology in clinical practice, individual reflective e-learning, and their potential outcomes (physician practice, organizational learning and health outcomes).

Introduction

The relationship between individual e-learning and information delivery and retrieval technology is gaining recognition for two reasons. First, information delivery technology can increase physicians' awareness of relevant and valid research-based information (scientific evidence). Second, information retrieval tools can provide physicians with such information for a specific patient at the point-of-care. In this way, physicians may learn as they practice through individual e-learning.

The synergy between information delivery and retrieval has been demonstrated by Haynes et al. (2006), but there are few studies published on their educational value, and no specific public policy in Canada concerning these modes of learning. Information delivery and retrieval are crucial tools for disseminating and exchanging research-based knowledge, which in turn constitute key components of knowledge translation as defined by the Canadian Institutes of Health Research (CIHR). In line with the Evidence-Based movement in medicine and public health, "*Knowledge translation is a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of [research-based] knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system*" (www.cihr-irsc.gc.ca). As proposed by Davis et al. (2003), knowledge translation offers a new conceptual framework for developing Continuing Medical Education (CME) and continuing professional development. For instance, while "CME and continuing professional development are primarily teacher-learner driven" (Davis et al., 2003, p. 33), information delivery and retrieval technology may contribute to develop individual learning (Hiemstra, 1994) as well as encouraging or supporting reflective practice (Schön, 1983).

The present report aims to better understand the current status of individual e-learning activities that employ information delivery and retrieval technology. To achieve this objective, we conducted a literature review, an environmental scan and interviews with an international panel of CME experts. Our questions were: (1) What are the information use and educational value associated with the usage of push and pull technology in accordance with the medical literature? (2) Under what conditions, can individual e-learning using information delivery and retrieval technology be considered CME?

This report presents (1) background and definitions, (2) the literature review on information delivery and retrieval technology, and effects of using such technology with respect to education, continuing professional development, and the use of information in clinical practice and education, (3) the environmental scan and interviews with experts on the recognition of using information delivery and retrieval technology through individual e-learning activities inside and outside Canada. Derived from our work, two options are proposed regarding brief CME individual e-learning activities using information delivery technology.

1. Background and definitions

The College of Family Physicians of Canada (CFPC) defines CME as the process of acquiring new clinical knowledge and skills by practicing physicians in which existing practice is reinforced, and new knowledge is introduced into their practices (www.cfpc.ca, 2007). In other words, high priority is given to the use of research-based knowledge in clinical practice as a form of professional development. This definition involves two types of learning. First, physicians should become adept at lifelong learning using new research-based knowledge in clinical practice as an engagement for practice renewal or transformation when needed. Second, professional development is characterized by self-regulated learning in response to the clinical environment. Physicians are responsible for their learning, and can address their learning needs by critically examining problematic situations encountered in medical practice.

As stated by Davis et al. (2003), "most physicians think of CME in terms of the traditional medical conference, with rows of tables, pitchers of ice water, green table cloths, and a lecturer at the front of the room" (p. 33). In addition, individual learning activities may consist of reading the medical literature, and reviewing the literature and appraising the quality of selected studies. However, such CME learning activities are potentially limited by heavy workloads in clinical practice. For instance, family physicians do not have time to review and appraise the literature and update their knowledge on all topics seen in daily practice. Brief individual e-learning activities may address this limitation. Research-based information may be delivered to physicians on e-mail, and retrieved as needed using search engines. For instance, rather than reading and appraising original research, a most efficient approach is the delivery and retrieval of research-based synopses. McKibbon et al. (2008) critically review the soundness, comprehensiveness and ease-of-use of different types of information delivery and retrieval technology. With respect to CME, this review suggests the format and the quality of information items vary.

While e-learning corresponds to any Internet-based training and learning processes (Depover & Marchand, 2002), we define *individual e-learning* in a CME context as physicians' learning on the job using information delivery and retrieval technology (outside a collective learning setting). Using such technology, research-based knowledge may be integrated into medical practice via cognitive processes such as higher order thinking, reflection, reflective learning, reflective practice, or self-assessment, for the achievement of intellectual rigour of professional competence (Leung, in press; Mann et al., 2007; Regehr & Eva, 2006). In line with the definition of self-directed learning proposed by Hiemstra (1994), "individual learners can become empowered to take increasingly more responsibility for various decisions associated with the learning endeavor (…), self-directed study can involve various activities and resources, such as self-guided reading, participation in study groups, internships, electronic dialogues, and reflective writing activities (…), and self-direction does not necessarily mean all learning will take place in isolation from others" (p. 347). According to previous educational literature reviews, research on reflective learning remained largely theoretical, examined only three measurement tools in terms of validity, and demonstrated repeatedly that an isolated introspective global self-evaluation of practice is not effective as compared to a specific reflective learning exercise guided by new evidence-based information for example (Leung, in press; Mann et al., 2007; Regehr & Eva, 2006).

The present report focuses on *brief individual e-learning activities* using information delivery and retrieval technology. 'Brief' refers to the delivery or retrieval of information hits, as opposed to a structured review of the literature with quality appraisal of the selected studies. For example, members of the Canadian Medical Association (CMA) receive daily InfoPOEMs® delivered as email alerts. InfoPOEMs® stands for Information about Patient-Oriented Evidence that Matters. They are synopses of peer-reviewed and published research, selected for their validity and relevance to primary care practitioners. These synopses may then be retrieved from a searchable database system for use in their clinical decision-making (e.g., Essential Evidence Plus®).

We define 'information hits' as follows. When physicians use information retrieval technology for instance, "they retrieve information items that may or may not address their search objective; In our work, when a user opens an information item, and reads its content, it becomes an information hit (…); Information hits constitutes our smallest units for data collection and analysis" (Pluye et al., 2007, p. 617). When information is delivered on email, users may or may not open their emails, and choose either to read, or ignore, their content. Thus, only opened and read emails become information hits (Grad et al., 2008).

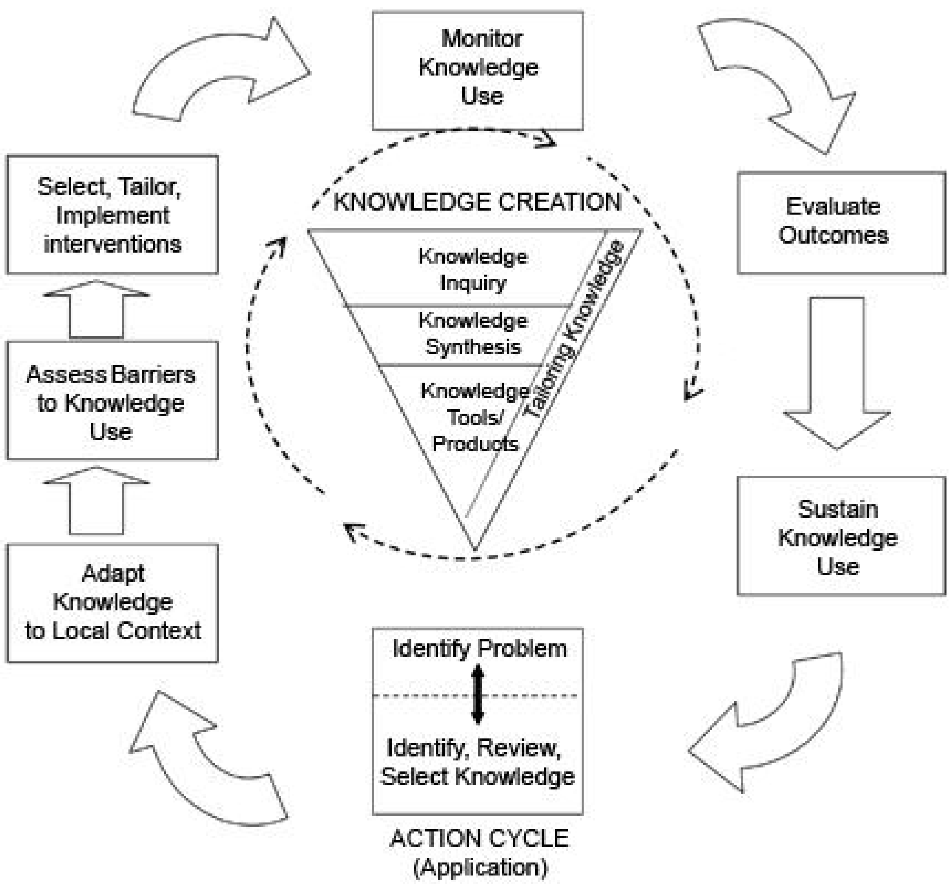
In the present report, 'information retrieval' refers to information seeking behaviours and processes (information being actively found or 'pulled' from a search), and 'information delivery' refers to computer mediated communication (information being passively received or 'pushed' through e-mail). We use three key terms:

- *Information retrieval technology (hereinafter pull technology):* Databases and search engines that clinicians can use to retrieve general information on disease prevention, health promotion, diagnosis, treatment and prognosis when needed (e.g., PubMed).
- *Information delivery technology (hereinafter push technology):* Services that send information to clinicians on a regular basis or when new information is available (e.g., email alerting services).
- *Information delivery and retrieval technology (hereinafter push and pull technology):* Combination or integration (into one blended computerized system) of information services on email and searchable databases to find information when needed (e.g., Essential Evidence Plus®).

While pull databases are not necessarily linked to push technologies, push technologies are usually associated with a pull database, permitting retrieval of a pushed information object. With respect to research-based information, push and pull technology contributes to knowledge creation, defined by Graham et al. (2006) as a combination of knowledge synthesis, informational products and educational tools for translating knowledge into action. Services vary in the criteria they use to address the relevance of the information (selection criteria), the validity of the original research, and the translational validity, i.e., how well a synopsis represents the findings of original research. They also differ in their style of presentation of information, ranging from chapters in electronic textbooks, to computerized clinical practice guidelines, to verbatim reproductions of empirical research articles or review papers, to informal summaries, and to structured synopses with a commentary (McKibbon et al., 2008).

Therefore, push and pull technology may be broadly conceived as types of 'knowledge tools and products' within a generic 'Knowledge-to-Action' conceptual framework. For instance, it is presented by the CIHR as a 'Knowledge Cycle' (Figure 1), described as follows. The "knowledge creation funnel" refers to the idea that "knowledge needs to be increasingly distilled before it is ready for application", and "the action cycle represents the activities that may be needed for knowledge application" (www.cihr-irsc.gc.ca).

Figure 1. The 'Knowledge-to-action' framework



2. Literature review: CME value of push and pull technology

The present literature review indicates that using push and pull technology has CME value since it involves the acquisition of new information, and induces physicians to update prior knowledge and to construct new knowledge for solving clinical problems. Although discussing information and sharing experience with colleagues is important in learning, the present report scrutinizes only brief individual e-learning.

Using push and pull technology, physicians can (1) learn at their own pace and when their schedules allow, without geographical constraints, having to leave their practice setting, or incurring expenses for travelling, and (2) apply acquired knowledge to solve clinical problems for specific patients. The following section examines studies on the use of clinical evidence derived from such technology, and the effects of this use on medical practice, in terms of individual learning on the job. While the medical literature examines the effects of using push and pull technology on medical practice and patient health outcomes, there are very few studies concerning the educational value of this technology. As stated by Gagnon et al. (in press), "research on educational aspects in the healthcare field [unfortunately] neither attracts high level of funding nor has the prestige associated with the research effort in clinical sciences" (p. 16).

2.1. Using pull technology and its effects

Our review indicates that pull technology increases physicians' awareness and knowledge related to the context of the clinician's practice, confirms the effectiveness of their current practice, and may result in changes to practice.

Pull technology is defined as a computerized system to store needed information in different databases, and to retrieve this information from them. This system may consist of a computer network that provides connections with intranets and the Internet, databases and a means of performing searches so that physicians can access information at the point of care, or in their offices via hand held or desktop computers. Such databases contain organized materials that are structured specifically to support clinical practice. These materials can be presented in the form of electronic text, multimedia, or interactive media.

- Electronic text provides a wide spectrum of services in relation to information retrieval such as searchable databases that contain pre-appraised synopses providing standardized summaries of articles selected for relevance and validity (e.g., ACP Journal Club).
- Multimedia explains complex concepts, clinical diagnoses, or clinical procedures using various types of media such as animation, graphics, textual commentary, or video clips such as those found at www.mypatient.com (Lalonde, 2000; Sandrick, 2000).
- Interactive media serves similar functions to multimedia but uses three dimensional objects, attached gears such a helmet, and/or simulations that allow physicians to interact either with one another, or with the computer program in virtual reality (Abraham et al, 1999; Sandrick, 2000).

While all these formats potentially assist physicians in making effective decisions when solving clinical problems, the present report focuses on electronic text provided by pull technology. Family physicians, specialists, and other health professionals are increasingly utilizing such information retrieval technology, specifically searchable drug databases in routine practice (Magrabi et al., 2005; Westbrook et al., 2004). While observational studies suggest that nearly one third of searches using such information-retrieval technology may have a positive impact on physicians, experimental and laboratory studies do not unanimously support the greater impact of this technology compared with other sources of information, notably printed educational material (Pluye et al., 2005).

The literature review presented here focuses on brief individual e-learning activities (i.e., clinicians retrieving one or few information items such as papers or synopses of papers) outside exercises based on a structured review of the literature with quality appraisal of selected studies (Appendix A). It shows pull technology may contribute to medical practice (clinical decision-making), and knowledge construction (individual e-learning on the job). Employing information retrieval technology for decision-making is the most widely reported use (Hayne, 1990; Haynes et al., 1991; Hayward et al., 1999; Lapinsky et al. 2001; Crawley et al, 2003; Honeybourne 2006). The retrieved information affects clinical decision making by confirming or changing decisions.

As shown in Appendix A, we identified 32 studies that examine the application of retrieved information in clinical settings: Three experimental studies, nine cohort studies, one case-control study, 15 cross-sectional studies, three case series, and one qualitative study. We have grouped the findings according to the three types of ‘information use’. *(1) Instrumental use*: Patient management, patients’ or physicians’ actions, and clinical decision-making were changed and improved. *(2) Legitimating use*: Patient management, patients’ or physicians’ actions, and clinical decision-making were maintained or justified. *(3) Conceptual use*: Physicians’ knowledge awareness, thinking or understanding about a specific issue is increased, but the evidence is not convincing enough to influence action. These findings are testimony for individual e-learning on the job.

Such individual e-learning may ultimately contribute to positive patient health outcomes. Of 32 reviewed studies, three (9%) reported patient outcomes, none of which were negative. The proportion of searches linked to patient outcomes varied between 10% and 40% across studies. For example, Westbrook et al. (2007) used the Critical Incident Technique to describe 85 searches conducted by 29 health professionals using online technology. Of those, 17 searches (20%) were linked to patient outcomes: Searches saved lives (n=2), and improved health (n=13) and quality of life (n=2).

2.2. Using push technology and its effects

Our literature review indicates that the empirical evidence for the effectiveness of push technology is sparse. Push technology nevertheless results in increased use of pull technology, and so is likely to result in the same outcomes. Push technology providing synopses of clinical evidence is a subset of Clinical Computer Mediated Communication. For example, synopses such as InfoPOEMs® are delivered on email to clinician who may learn about current research evidence, and then decide which evidence can be used for a specific patient.

Literature review: As compared to studies on information retrieval, there are few studies on push technology. Indeed, research on computer-mediated communication is in its infancy (Herring, 2002). For the present literature review, a librarian searched within multiple bibliographic databases. In total, 256 relevant references were screened. Of these, only four papers reported empirical studies: two cross-sectional studies and two experimental studies. The former suggested email may benefit CME (Davies, 2004), but may also contribute to information overload (Johnson et al, 2004).

A recent Canadian trial demonstrated that information retrieval by clinicians was stimulated by email alerts (Haynes, 2006). Physicians in the intervention arm of this trial conducted more searches in the McMaster PLUS database, as compared to those who received only passive guides to evidence-based literature (0.77 more logins/month/user). One other randomized controlled trial has examined the effect of email alerts. In this trial, the attitudes of academic internists' toward evidence-based medicine, and their self-reported use of evidence in practice were not influenced by weekly synopses of clinical research (Mukohara, 2005). The authors recommended that "future interventions should include interactive components with auditing and feedback", and that "further work is needed to develop and validate more outcome measures."

2.3. CME value of using pull technology

While there are not enough studies to examine educational value of push technology in detail, our literature review permits to examine the CME value of using pull technology in accordance with the concept of 'reflection'. We define reflection as higher level cognitive functions used to ponder ideas derived from reading information items (Dewey, 1933; Schön, 1983). Dewey explained reflective thought as a form of logical reasoning, while Schön specified this reasoning to framing and reframing questions for solving a problem arising from uncertainty. In this section, we examine the 32 retained studies of our literature review to identify the educational values of using pull technology in terms of reflection. We assigned extracts of retained studies to categories derived from Bloom's taxonomy of educational objectives (Anderson and Krathwohl, 2001), and Donald's working model (2002) of higher order thinking.

Bloom's taxonomy has been widely used in education (Bloom, Englehart, Furst et al., 1956; Anderson & Krathwohl, 2001). In this taxonomy, learning for classroom teaching refers to a hierarchy of six cognitive processes (from lower order to higher order thinking skills): knowledge, comprehension, application, analysis, synthesis and evaluation (Anderson & Krathwohl, 2001; Churches, 2008). Bloom's taxonomy may not be sufficient to explain CME value in using push and pull technology since reflection involves dynamic cognitive processes that do not necessarily involve a linear hierarchical path, and also comprises thinking about thoughts. Nevertheless, the third category 'application' within the domain of knowledge is relevant to our work; it is defined as using new knowledge for problem solving, more specifically, applying acquired knowledge to new situations (Anderson & Krathwohl, 2001).

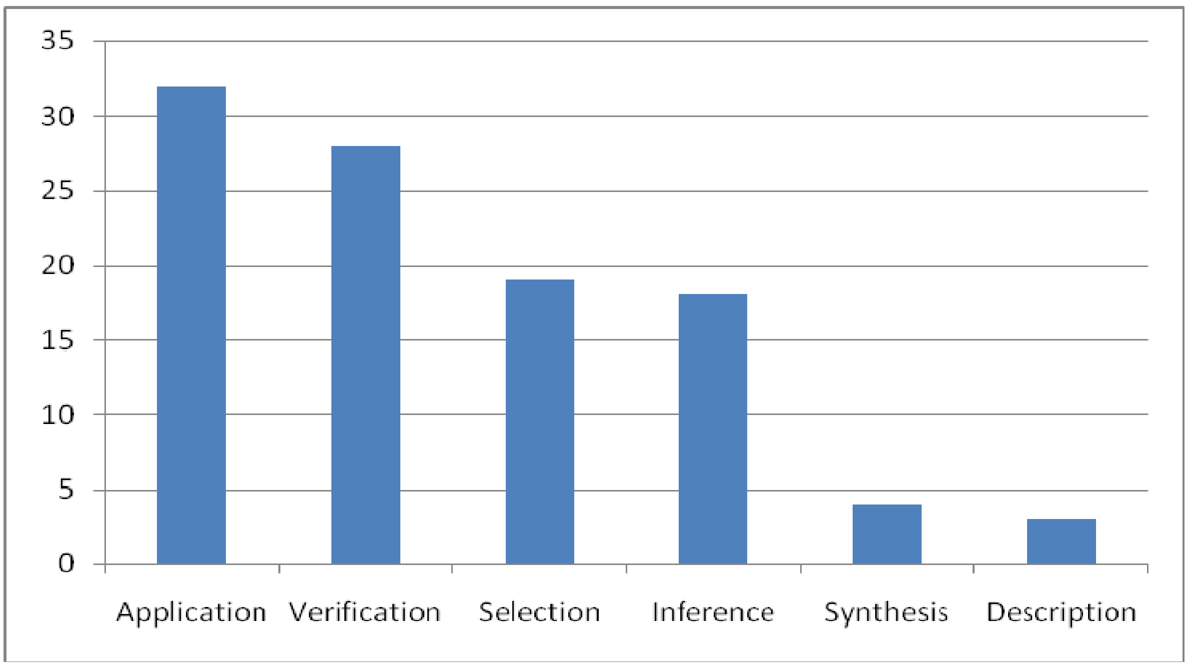
We also used Donald's working model (2002), which encompasses other Bloom processes, and can make sense of higher level cognitive functions that may relate to reflection (higher order thinking). Donald's model derives from her longitudinal cross-disciplinary study of teaching and learning, which examines cognitive processes in higher education. The following five cognitive processes derive from her study, and examples consist of family physicians' commenting on InfoPOEMs® (Leung et al., in press):

1. Description: Delineation or definition of a situation or form of a thing;
   Example: (Delineation) "Tricyclic antidepressants may not increase suicidality but we all know they are lethal compared to Selective Serotonin Reuptake Inhibitors"
2. Selection: Choice in preference to another or others;
   Example: "I started prescription of Chantix especially after the InfoPOEM® because I was not sure if it is really working or not (…), and I was a little bit more confident for prescribing Chantix to the patients."
3. Inference: Act or process of drawing conclusions from premises or evidence;
   Example: "I saw the original article in the British Medical Journal (…), and we ordered a big box of the longer needles, which I started using."
4. Verification: Confirmation of accuracy, coherence and consistency;
   Example: "The research confirms my belief that many of our prenatal interventions increase parental anxiety."
5. Synthesis: Composition of parts or elements into complex whole.
   Example: "I think long-term consequences of such treatment should be assessed before I would recommend it: fifteen years down the road are these patients going to be facing Chronic Obstructive Pulmonary Disease because of the iatrogenic damage caused by such treatment?"

In accordance with the aforementioned categories (application and five cognitive processes), the educational values mentioned in the 32 retained studies are presented in Figure 2. Since, we selected 32 studies that examine the use of retrieved information in clinical settings, application is always mentioned (100%). Verification is mentioned in 28 papers (87.5%). It is likely that the physicians determine which of the pulled information items are useful in connection to the clinical problem.

Selection is mentioned in 19 retained papers (59.4%) as physicians may then select the most relevant and valid information to address the problem at hand. The verification of the selection may involve a critical examination of the empirical evidence, physicians' prior experience and knowledge, and a comparison against clinical guidelines for instance. After a conclusion is drawn and ratified, a possible solution is confirmed or disconfirmed. Based on the ratification, the physicians may apply the confirmed information in clinical practice, or may discard the disconfirmed selections.

Figure 2. Studies reporting cognitive processes linked to the use of pull technology (N=32)



Inference is mentioned in 18 retained papers (56.3%). This inference may enable physicians to detect equality in different values presented by the information items, and to discover connections between new knowledge and experience. This discovery may lead to a change of perspective, and to making and testing hypotheses. This suggests that the use of the pull technology may be linked to conceptual change which is an important indicator of reflective learning.

Description and synthesis are respectively mentioned in four (12.5%) and three retained papers (9.4%). First, description involves the explanation and clarification of a given concept in an information item. This involves a process of contextualization of thoughts for clarification in understanding or reflection. Thus, it lays a foundation for further inference. Physicians' thoughts or understanding may not be completed in the context of the use of pull technology, and the resultant inference can be subjective or biased.

Second, synthesis of information involves a description of how different components are related, and a clarification for connecting components to form a generalization or conclusion regarding the new knowledge. In line with Donald (2002), there is a low probability of synthesis for new pulled information, and of completed thought processes through to action. While physicians understand and accept parts of an information item, it does not always lead to a definitive conclusion about practice. The description of complex relationships or connections assists physicians to reflect on their actions. Conclusions drawn may be partial. This can be a contributing factor of flawed self-assessment. Indeed, in accordance with Sibley et al. (1982), Gordon (1991) and Dunning et al. (2004), a result of the systematic literature review of Davis et al. (2006) suggests that "physicians do not appear to accurately self-assess." (p. 1100).

To increase the clarification (synthesis and selection) process of new information, group learning can be beneficial. Interactivity among physicians facilitates sharing of knowledge in which understanding is described for clarification, and feedback on the description may decrease flaws in self-assessment. The construction of consensus among physicians can provoke synthesis, and can validate results of self-assessment or disconfirm these results in the process of interactivity, e.g., group e-learning through online discussion groups.

3. Policies on brief individual e-learning activities using push and pull technology

Pull technology is integrated into CME activities in Canada, and our environmental scan showed specific CME policies recognizing brief individual e-learning activities using pull technology in the USA. It also revealed no policies and no recognition of push technology in a CME context outside our own research. Interviews with an international panel of experts nevertheless generated insight into the conditions required for such potential recognition.

3.1. Environmental scan on CME policies regarding push and pull technology

Outside the USA and Canada, our environmental scan did not reveal specific policies recognizing brief individual e-learning activities using push and pull technology as CME activities (Appendix B).

In the USA, the Accreditation Council for Continuing Medical Education (ACCME) accredits organizations to give CME credits (e.g., Tufts University). These organizations develop CME programs that comply with guidelines of the American Academy of Family Physicians (AAFP) or the American Medical Association (AMA). They may then submit requests for CME credits claimed by individual physicians to these educational bodies.

In the USA, physicians may not earn CME credits by using push technology for individual e-learning activities, while they may by using pull technology. Multiple information providers are able to track and succinctly assess physicians' brief information retrieval activities, which are recognized as CME activities. By way of illustration, the list of databases approved by the AAFP is presented in Appendix C, and the process for claiming credits via Tufts University using the mentioned database Essential Evidence Plus® is presented in Appendix D. This process can be summarized in four steps: (1) Physicians search for information within Essential Evidence Plus®; (2) They click on the 'earn CME credits' button, and complete a brief questionnaire on the potential use of retrieved information; (3) they pay (e.g., $25 to claim up to 5 credits); and (4) they receive credits. Based on such an assessment record, physicians may claim 0.5 *AMA PRA Category 1* credits per search (PRA stands for *Physician Recognition Award*).

In Canada, physicians may claim CME credits issued by the College of Family Physicians of Canada (CFPC) or the Royal College of Physicians and Surgeons of Canada (RCPSC), or via CME programs accredited by these educational bodies. When physicians are members of the 'Collège des médecins du Québec' (CMQ), they must follow 'Le plan d'auto-gestion du développement professionnel continu' (www.cmq.org) when they are not members of CFPC and RCPSC.

CFPC

Canadian family physicians may claim Mainpro-M2 CME credits when they use push and pull technology for brief individual e-learning activities, like for any reading activity, or they must describe how this activity improves their clinical practice using an individual request for 'Other learning activity' (Appendix E). In other words, using push and pull technology for brief individual e-learning activity, such as finding a research-based synopsis for clinical decision-making, is not specifically recognized by the CFPC outside a research context.

By way of illustration, activities eligible for Mainpro-M2 credits and Mainpro-M1 credits issued by the CFPC are presented in Appendix F. Family physicians using pull technology may claim Mainpro-M1 credits when they complete a Mini-Pearl® exercise, and Mainpro-C credits when they review the literature to answer a clinical question and demonstrate after a two-month period that lessons learned are applied into practice (Pearls ™ & Linking Learning to Practice). For instance, the CFPC develops Mini-Pearl® in collaboration with the Centre for Health Evidence (www.cche.net). Mini-Pearl® is an online environment to facilitate evidence-based practice reflection (Appendix G). In 2007, a pilot project involved Mini-Pearl® exercises and the completion of one Audit-Pearl® exercise. Mini-Pearl® refers to semi-structured, individual learning activities designed to enhance the introduction of new knowledge into practice. These exercises are accessed using Vividesk™. Vividesk™ is an Internet desktop-management technology that facilitates integration of multiple information sources in a customized, centrally managed information environment (http://www.vividesk.com).

Furthermore, the educational value of push technology is scrutinized by the CFPC, which offers, within a research context, Mainpro-M1 CME credits to family physicians who read and rate synopses of original research on email (Appendix H). Within the context of a CIHR-funded study, over 2,500 Canadian physicians are 'reading and assessing research-based synopses on email' as a routine CME activity. One year after the implementation of the pilot project (Sept 08, 2006 - Sept 07, 2007), Grad et al. (2008) received 223,423 assessments of the aforementioned InfoPOEMs® from 2,141 CMA members, including family physicians or general practitioners, and many specialists. This level of response was obtained with only two invitation emails and advertising on www.cma.ca. Physicians rate a daily InfoPOEM® by clicking a link within their email alert. This link connects them to an assessment questionnaire developed in our previous work. For each rated InfoPOEM®, participants certified by the CFPC earned 0.1 Mainpro-M1 credit.

RCPSC

The RCPSC uses Structured Learning Projects ('Section 4') as an umbrella term for individual learning, which includes Personal Learning Projects, Traineeships, Preceptored Courses, Fellowships, Masters/PhD Programs as well as Personal Educational Development. The RCPSC has an online template to capture learning activities stimulated by practice (MAINPORT).

According to the RCPSC, Point of Care Learning is a type of Personal Learning Project initiated and completed at the point of care during the management of a patient problem (Appendix I).

CMQ

In accordance with the individual learning guidance of the CMQ (plan d'auto-gestion), using information delivery and retrieval activities as brief CME individual e-learning activities requires justification based on a self-assessment of learning needs and objectives. Then, it requires a record of such activities and corresponding reflection, which have to be integrated into a synthesis of CME activities. This justification, record and synthesis must be available upon a CME inspector's request. There are no requirements in terms of types and numbers of CME activities.

3.2. Expert panel on using push and pull technology in a CME context

Expert panel interviews are summarized in Appendix J. To better understand the current individual e-learning activities in association with information delivery and retrieval, 10 CME experts were interviewed. Four of these experts are American, and six are Canadian. In telephone interviews, these experts answered five questions. The first two questions concerned the relationships between the use of pull technology for individual e-learning activities, and the allocation of CME credits. The second two questions were about these relationships, but focused on push technology. The last question was about CME policies with respect to brief individual e-learning activities. Answers to these five questions indicated that push and pull technology are important for individual e-learning on the job.

3.2.1. Information retrieval (pull): Contributions to CME and issues

The utilization of pull technology for individual e-learning CME activities can follow a problem-based learning approach. For instance, retrieved information items might be used to address clinical problems encountered in practice regarding a specific patient. The allocation of CME credits for such brief individual e-learning activities can be based on self-reported cognitive processes (reflection), while as stated by the experts, the allocation of CME credits in both the USA and Canada is also based on problem solving actions implemented in clinical practice. The amount of time spent using push and pull technology is also a criterion for allocating CME credits; however no consensus over the use of this criterion emerged from the CME expert panel.

In the USA, physicians may claim CME credits when they search for information within a limited number of pull technologies that are approved by the AMA for instance. In an accredited CME activity at the point of care, physicians can then get *AMA PRA Category 1* credits using approved technology (example 1).

Example 1:

- Ask a clinical question (i.e., frame a specific problem),

- o Identify relevant resources (i.e., search and retrieve information items using approved databases),
- o Describe application in practice (i.e., apply retrieved items in medical practice as a solution to the problem).

This example shows that for each reported search in approved databases, systematically assessing each search-related information hit is not required to claim CME credits in the USA (Appendix D). In contrast to the USA, brief individual e-learning activity does not correspond to a specific type of CME credit or policy in Canada, and no databases are approved for such CME learning activities. However, a systematic approach is tested in one of our research projects in progress (http://kta3.activityreporter.ca). In this work, the College of Family Physicians of Canada offers 0.5 MainPro M1 CME credit for each search for information when (1) the objective of the search is reported, and (2) the relevance, cognitive impact and potential use of search-related information hits are assessed using a validated method.

As mentioned, pull technology is used in Canada for completing Mini-Pearls® exercise for example. Upon the completion of this exercise, a family physician is eligible to earn 0.5 Mainpro-M1 credits. As stated by an expert, the CFPC and the RCPSC emphasize the use and application of retrieved information items in practice (just-in-time) rather than the utilization of a specific database or retrieval tool. The use of pull technology is also integrated into learning projects that require more time and effort (Pearls™ of the CFPC, Personal Learning Project of the RCPSC, and individual learning guide of the CMQ). These projects involve reviewing and appraising the medical literature as described in the next two examples, and three Mainpro-C credits are allocated to Pearls™ by CFPC for instance.

Example 2: Pearls™ of the CFPC require family physicians to:

- Identify a question or an issue in their practice,
- Search for information in databases (search can be done by librarians),
- Come up with a viable potential solution from the findings,
- Implement these findings,
- Report the implementation and results in two months.

Example 3: Personal Learning Project of the RCPSC requires specialist physicians to document:

- A question or problem statement that the physician pursues as the focus of his/her learning,
- The stimulus for that learning arises from the professional context,
- The resources are selected based on the question defined for learning, or are derived from discussion, internet searches, reading of literature and so on,
- Conclusion or outcomes that are framed around a commitment to change framework. Physicians can select up to three outcomes from a menu of 12 outcome codes including:

- I am aware of a potential gap in my knowledge or skills,
- I am aware of a new evidence relevant to my practice,
- I am aware of a new skill relevant to my practice,
- I have confirmed my knowledge and skills are up to date,
- I have confirmed that my practice is consistent with best evidence,
- I am planning to discuss these findings with my colleagues,
- I am planning to search for further evidence,
- I am planning to complete a review of my current knowledge,
- I am planning to assess my performance in practice,
- I am committed to integrating this knowledge or skill into my practice,
- I am committed to changing my attitudes,
- I am committed to implementing a change in my practice.

As these three examples indicate, the requirements of CME in both the USA and Canada comprise lists of problem solving actions and cognitive processes in clinical practice. These tasks are steered by self-assessment of knowledge gaps. Although the Personal Learning Project and Pearl™ use information retrieval as a core activity of individual e-learning, the emphasis is on the application of retrieved information in clinical practice.

Both the RCPSC and the CFPC use Schön's reflective learning model to support all types of learning activities, including individual e-learning activities. Given that reflective learning is not yet operationalized in terms of criteria for allocation of CME credits outside research, time is used as a criterion for such allocation. CME credit is earned in accordance with the time spent in the learning process; one hour of engagement is deemed to be worth a single full credit. The rationale for this credit value was based on an unpublished evaluation of the average time for finding information using pull technology. As stated by one expert, "each credit is worth an hour." For instance, the brief learning activities such as a Mini-Pearl® exercise corresponds to 0.5 Mainpro-M1 credits (CFPC). Longer activities such as literature reviews in Pearls™ correspond to three Mainpro-C credits (CFPC).

However, no consensus over the use of time as a criterion emerged from the CME expert panel. As stated by an expert, "learning has nothing to do with time. Time is not a relevant criterion for searching. People with low computer skills are not good at searching, and can earn a lot of credits for spending time in searching." If CME credits are not given for searching or reading an information item, but for what is learned from it, the implication is that the focus of individual e-learning must be on cognitive processes of reflection, which can be observed, and a tool for assessing reflective learning is needed.

Time is also a key parameter for CME credits in a different manner. In Canada, at least a two-month period is required for completing a Pearl™ exercise for example. The rationale is that physicians can reflect on their implementation of retrieved information and the results of this implementation, and then report these results to claim Mainpro-C credits. This rationale indicates that reflective learning is the desired educational value of CME, and reflection comprises higher cognitive processes such as implementation or application. As stated by an expert panel member, “physicians have already implemented new findings into their practice, so the positive outcome is already there. This is not something that they have forgotten; certainly this is not my experience.”

In contrast, another panel expert stated that the two-month waiting time requirement for Pearl™ can be a flaw. Busy family physicians may not remember details after two months. These disagreements indicate that linking time and learning should be substantiated by research evidence and become a testimony to the needs of clarifying desired educational values, and assessable outcomes of individual e-learning activities.

3.2.2. Information delivery (push): Potential contributions to CME and issues

Currently, in the USA and Canada, research-based synopses created by physicians, such as ‘*Critique et pratique*’ (available in English and French), are pushed to subscribers via e-mail regularly. This is a time saving strategy for busy physicians to access new knowledge. Using delivered information as an individual e-learning CME activity (push) is new in comparison to using retrieved information (pull). As mentioned, claiming CME credits for assessing the impact of research-based synopses delivered via email is allowed in Canada in a research context (Grad et al, 2008).

According to three experts, reflecting on received information may lead physicians to claim CME credits since reading and critiquing information can contribute to learning. Answering a self-assessment questionnaire may structure reflection. Physicians may then decide whether this information can be put into clinical practice. For their part, two CME experts state that information delivery is passive, and that to earn CME credits, the bar should be set higher as compared to information retrieval.

Information hit within a push context can justify CME credit even when it is not relevant for a current patient. As an expert said, reading information (just-in-case) does not preclude its use in clinical practice. Besides, information hits may lead physicians to claim CME credit when they are relevant, have some cognitive impact, and may be used for a specific patient, not necessarily for changing practice, as unanimously indicated by the expert panel.

4. Discussion: Options for policy-making and issues

Our literature review, environmental scan and interviews with CME experts indicate a substantial role of the use of push and pull technology in clinical practice and individual e-learning. This role is supported by three key characteristics: (1) access to information items at the point of care; (2) rapid update of information; (3) integration of learning into clinical practice.

Push and pull technology provides fast access to new knowledge that enables physicians to solve specific patient-related problems in clinical practice. When new knowledge derived from push and pull technology is used in clinical practice, the use triggers individual e-learning in addressing a clinical problem at hand. This use may also trigger group e-learning when this new knowledge is shared, discussed, and then validated with peers.

The CME community is concerned that traditional approaches to teaching and learning may not be as effective as they should be (Ebell & Shaughnessy, 2003; Lalonde, 2000; Sandrick, 2000; Stewart, 2005). In line with Davis et al (1999), Lalonde (2000) raises a concern that physicians often experience a disconnection between what they learn via traditional CME and what they can successfully put into practice. Push and pull technology may contribute to bridge this gap by helping clinicians focus their attention on topics relevant to their practice.

Having said this, beside the speed, retrieving and receiving information with Internet also implies users' appraisals skills. These skills are important, discussing with colleagues, reading paper based journals, attending CME meetings, and for using push and pull technology as well (e.g., for selecting resources and understanding the production of appraised research-based synopses). As mentioned, information items delivered by or retrieved within push and pull technology vary in terms of soundness of evidence-based approach, comprehensiveness, and ease-of-use (McKibbon et al., 2008).

4.1. Two options for brief CME individual e-learning activities using push technology

Looking beyond cognitive process, the use of push and pull technology for brief individual e-learning CME activities can be tied to learning outcomes. As mentioned, 'brief' refers to the delivery or retrieval of few papers or synopses, as opposed to a structured review of the literature with quality appraisal of the selected studies. In turn, outcomes can be reportable by physicians. In the USA and Canada, existing computerized CME tools capture the acquisition and application of retrieved information, but there is no comprehensive or valid examination of cognitive processes that may correspond to the 'reflective learning' moment.

By way of illustration, this may be addressed using the McGill 'Information Assessment Method', which structures reflective learning, and systematically documents the relevance, cognitive impact and use of information, and information-related health outcomes in push and pull contexts (Grad et al., 2007; Grad et al., 2008; Leung, in press; Pluye et al., in press). For example, InfoPOEMs® are emailed to the members of the Canadian Medical Association by Practice Solutions (cma.ca). For each InfoPOEM® rated using IAM 2008, members of the College of Family Physicians of Canada automatically receive 0.1 MainPRO M1 credits (Appendix K).

This method is based on a generic 'Acquisition-Cognition-Application' model of information processes: (1) health professionals receive information or search for information with an intention, namely to fulfill an objective (acquisition), (2) they absorb, understand and integrate information (cognition), and (3) they may use this newly understood and cognitively processed information (application) (Pluye et al., 2007a; Pluye et al., 2007b). Selected publications on this method are presented in Appendix K.

Our previous research, and the present literature review, environmental scan and interviews with CME experts lead us to propose two options focusing on brief individual CME e-learning activities using push technology. We focus on push technology for two reasons: A specific policy and brief CME individual e-learning activities using pull technology are already implemented in the USA; and useful tools for tracking and assessing the utilization of pull technology in terms of CME activities have been developed in Canada in collaboration with several educational bodies (CMQ, CFPC, and RCPSC).

Option 1: Transfer pull-related policy into a push context

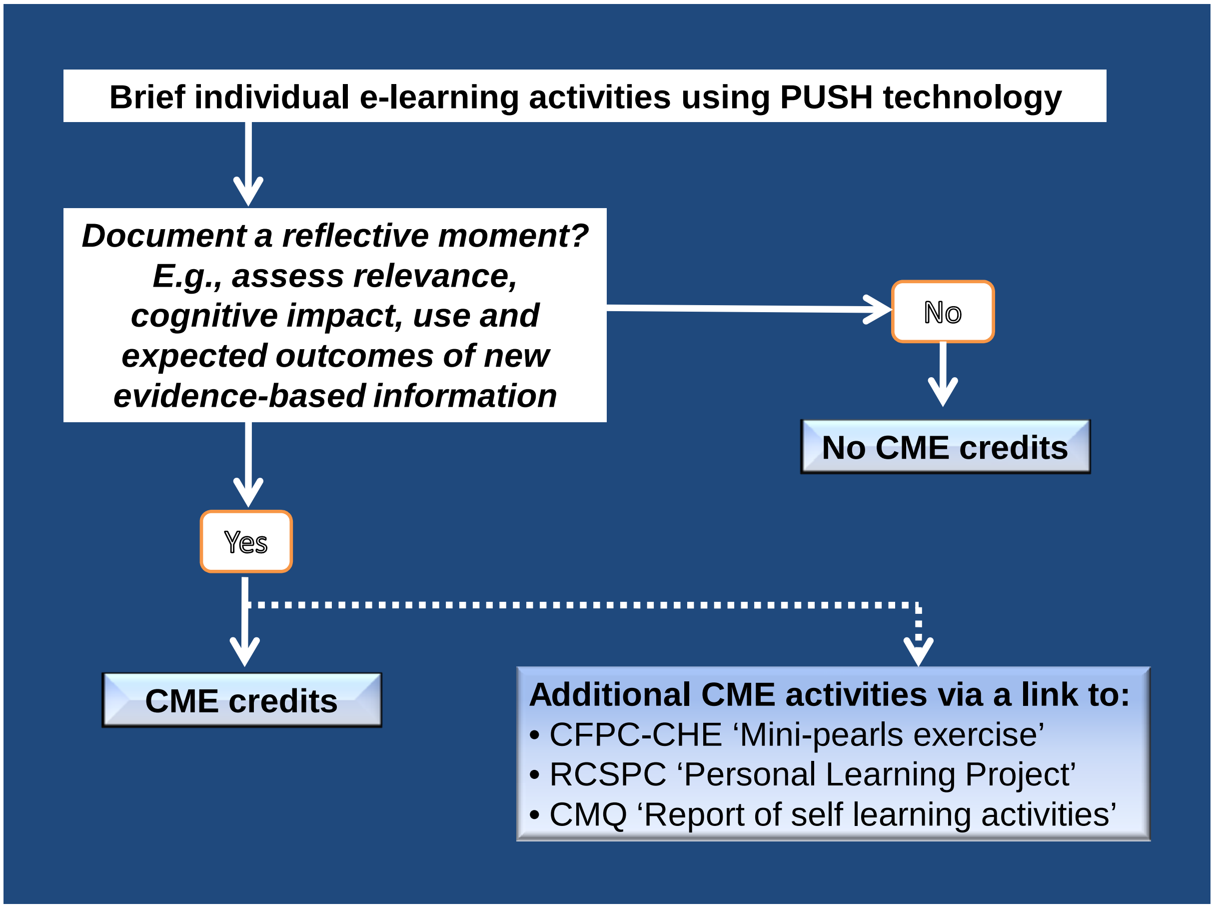
Existing pull-related policy may be transferred into a push context (one hour spent on e-learning activities corresponding to one credit), and the amount of time spent using push technology for individual e-learning activities can lead physicians to claim a fraction of one CME credit. The average time spent to read and rate or comment on a research-based synopsis may be used as a rationale for allocating credits. However, educational bodies tend to focus on the quality of the learning process rather than on time spent to complete learning activities. For example, the individual learning guide of the CMQ specifies no requirement in terms of hours to be dedicated to CME activities.

We propose a second option since there was no consensus on the amount of time spent using technology as a criterion for allocating CME credits. "New modalities of CME cannot be measured with the traditional credit hour" (Davis & Willis, 2004, p. 143). In addition, time is not well suited to measure brief individual e-learning activities in a push context for two reasons. On the one hand, time may undervalue activities when received information changes practice. On the other hand, time might over value irrelevant information that has no impact on physicians or their practice.

Option 2: A new metric

This option is illustrated by the decision tree presented in Figure 3. When delivered on email, the number of information items that are opened, read and assessed may be considered to be an appropriate measure of brief individual e-learning activities (push technology). Simply opening an information item is not a valid indicator of learning. However, reading and assessing one information item constitutes an appropriate unit to measure brief individual e-learning activities using push technology, when reading information hits can be systematically linked to a generic reflective learning exercise.

Figure 3. Brief individual e-learning activities using push technology for CME (option 2)



For instance, the McGill 'Information Assessment Method' for rating information hits can structure reflection on relevance, cognitive impact, use and expected outcomes. Ratings of information hits within a push context may then be submitted by physicians to obtain CME credit. In line with the mentioned 'Knowledge-to-action' conceptual framework (Figure 1), push and pull technology may be conceived as an educational tool for providing research-based informational products, and the McGill 'Information Assessment Method' can help to monitor and systematically evaluate the 'relevance-impact-use-outcomes' of delivered and retrieved information hits.

CFPC & CMQ & RCPSC: In Canada, when information hits can be used for a specific patient, additional learning activities may be proposed to physicians via a link from the 'Information Assessment Method' to one of the following tools: Mini-Pearls® exercise (CFPC), the 'Plan d'auto-gestion du développement professionnel continu' (CMQ), or 'Personal Learning Projects' (RCPSC). Such additional activities can permit physicians to ponder and critically examine key information hits in line with the related literature for example.

Using push technology may reveal 'unknown information needs', and stimulate the use of pull technology for patient-related problem-solving activities. In other words, delivering new evidence-based information raises physicians' awareness, and may trigger specific self-assessment with respect to an evidence-related knowledge gap, which can in turn enable a Personal Learning Project or Pearl™ for further individual e-learning using information retrieval technology (e.g., to compare new evidence-based information with other evidence and clinical practice guidelines). Therefore, the proposed options may work as a guide for physicians to do self-assessment, for CME accreditation or other CME policy development, and for guiding educational research on brief individual e-learning activities combining push and pull technology.

4.2. Issues in using push and pull technology

Our work advocates that reflective learning should be used as a criterion for measuring CME learning outcomes, and as a condition for allocating CME credits in relationship with information delivery and retrieval activities. Using push and pull technology potentially triggers reflective learning when physicians select appropriate information, validate their selection, and synthesize evidence for clinical decisions.

However, push and pull technology in a CME context raises at least three concerns. First, there are issues with the quality of the information itself. For instance, abstracts often overemphasize positive findings (Cullen, 2002), and some information items do not have enough content (Angier et al., 1990). Accrediting trustworthy sources of information is an option chosen by educational bodies in the USA to overcome this issue.

From a clinicians' perspective, the McGill 'Information Assessment Method' may document issues regarding the relevance of the information, the validity of the original research (e.g., cognitive impact type "I disagree with this information"), and its translational validity (e.g., cognitive impact "there is a problem with this information"). Then, ratings collected via this method can be used by information providers and/or by the community of readers. For example, the Canadian Pharmacists Association uses this method to collect constructive feedback from their members' and improve the content of e-Therapeutics+ (an electronic textbook with treatment recommendations for common medical conditions). As another example, Practice

Solutions uses this method to collect InfoPOEMs® ratings from members of the Canadian Medical Association, and summarizes ratings for the community of readers using a 'thumbs-up / thumbs-down' approach.

Second, the utilization of push and pull technology for individual e-learning in CME is related to technical skills. Information retrieval requires a set of computer and logic skills in order to effectively search databases using Boolean queries for example. Not all physicians have sufficient skills to proficiently search for information in databases, and not all databases are user-friendly or easy to learn. When needed information is not found within a database, resulting frustration can lead to the discontinuation of the use of this database (Schilling, et al., 2005). Inexperience and excessive time spent searching hinder the use of on-line evidence-based resources (Schwartz, et al, 2003). Training residents and physicians in using push and pull technology offering in priority preselected 'Evidence Based Medicine' resources such as those critically reviewed by McKibbon et al. (2008) may contribute to solving this problem.

Third, some physicians will not change their practice as a consequence of a new piece of information delivered on email or retrieved in a database (Grad et al., 2005; Grad et al., 2008). Practice change is complex, is influenced by multiple factors, and not the unique outcome of information and reflection. In addition, reflection is hindered by a lack of time to validate delivered or retrieved information by physician and self-confidence regarding their knowledge (Groopman, 2007; Westbrook et al., 2005; Westbrook et al., 2007). Integrating push and pull technology into group learning may contribute to address the latter.

4.3. Information delivery and retrieval and group learning in CME

Finally, an individual is a basic resource for group learning. In a community or a team, physicians discuss information used or not used (i.e., explaining knowledge and experiences that help each other as a team). Using push and pull technology to complete a task, an individual can transfer knowledge when information items are discussed on a team or community level through face-to-face meetings, electronic conferencing, and online seminars. Although group learning in CME is not a focus in this report, it is worth a brief discussion.

Both information delivery and retrieval activities can be designed to include group learning in which individuals' reflection is likely to occur. For example, when physicians share the experience of using the push and pull technologies in clinical practice, each physician explains and synthesizes his/her ideas such that feedback from one another triggers reflection. In this way, quality of the information items is examined in peer review, and inference of its use is validated using other physicians' perspectives. Feasibility and benefits of group learning have been demonstrated in multiple programs worldwide. For example, the Practice Based Small Group (PBSG) Learning Program of the Foundation for Medical Practice Education is designed to give small groups of family physicians the opportunity to facilitate change in knowledge, attitudes, and skills. “This program has successfully recruited about 8,000 members nationally and internationally, and has trained over 850 peer facilitators to lead the group process” (www.fmpe.org).

Reflective learning is an educational value CME aims to achieve. Usefulness of information delivery and retrieval depends on how physicians learn, i.e., reflect on information items and on the use of these items in clinical practice. Reflection refers to the process of describing application, explaining inferences when synthesis is made, confirming or disconfirming them in verification, and synthesizing them to communicate a conclusion. All these cognitive behaviors may occur by interaction with colleagues in which thoughts are shared and discussed.

Recommendations for policy-making and future research

We propose two options as a guide for physicians to do self-assessment, and for CME accreditation or other CME policy development. In addition, our work suggests an agenda for further research.

Policy-making

Despite the lack of sufficient research on health outcomes associated with push and pull technology, the use of this technology is found to be helpful to physicians in applying research-based information items to address clinical problems at hand, i.e., brief individual e-learning activities on the job. Given the issues we identified, it is difficult to know what the desired educational values are and how they occur. Because of this difficulty, CME policies for brief individual e-learning activities may be developed in a push context, and refined in a pull context. The present literature review, environmental scan, and interviews with CME experts attempted to contribute to such development or refinement. In a push context, the CFPC and the RCPSC have integrated the proposed ‘option 2’ into their policies and policy-making process, respectively (at the time of writing this report).

In a pull context, reading and assessing an information item can also document a reflective learning exercise and may justify CME credits. For instance, such policy is tested in research in progress (http://kta3.activityreporter.ca). In this work, the College of Family Physicians of Canada offers 0.5 MainPro M1 CME credits for each search for information when (1) the objective of the search is reported, and (2) the relevance, cognitive impact and potential use of search-related information hits are assessed using the McGill validated method. By contrast, in the USA, for each reported search in approved databases, systematically assessing search-related information hits is not required to claim 0.5 CME credit (Appendix D).

Research agenda

Educational research is needed on issues concerning push and pull technology in clinical practice, individual reflective e-learning, their potential outcomes (physician practice, organizational learning and health outcomes), and their potential contribution to group learning. More research is needed on issues regarding the synergy between push and pull technology, specifically their integration into the daily work of physicians, the difficulty in synthesizing multiple pieces of evidence into a clinically useful plan, uncertainty with respect to the completeness of information, and the integration of physician feedback into knowledge management processes at the organizational level. The desired educational values in terms of the reflective learning model of CME should be studied, so this model can be refined or improved. The components of such a model have to be specified and described in terms of observable and measurable cognitive processes.

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APPENDICES

A. Literature Review
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E. The College of Family Physicians of Canada: Three-step CME Credits
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APPENDIX A. LITERATURE REVIEW

Information retrieval technology review update

Apart from our published work, there are no reports of systematically prompted assessment of information items. As stated by Westbrook et al. (2007), "effective and tested techniques for assessing the impact [of information retrieval technology] on care delivery and patient outcomes are limited" (p. 234). While studies globally measure impacts of information retrieval technology (e.g., knowledge tests), there are no systematic evaluations of all information items derived from retrieval technology in clinical settings. We initially reviewed the literature in 2004, updated this review in 2006 and 2007, and we have retained 32 studies for the present report.

First, we systematically reviewed the literature on all types of impact of information retrieval technology when used by trainees and doctors in practice (Pluye et al., 2005). Given the paucity of experiments in this field, all research designs were sought (quantitative, qualitative and mixed methods studies). The world literature was initially reviewed up to February 2004, in collaboration with an information specialist. Using complementary strategies, two reviewers identified studies by scrutinizing 3,368 and 3,249 references from bibliographic databases. Additional studies were found by hand searches of personal files, journals and textbooks, and by searching ISI Web of Science for citations of relevant articles. Empirical results on the usage of information retrieval technology were reported in 605 articles, which were assessed using inclusion-exclusion criteria. Of 605 papers, 40 (6.6%) mentioned at least one type of impact (impact defined as any immediate or future consequence, effect, influence, outcome, change or modification). These papers were then independently appraised by two reviewers for relevance and methodological quality, only 26 (4.3%) met our criteria, and were selected.

Second, we updated this review in 2006 and 2007 with assistance of medical librarians. From these two updates, 18 additional relevant studies were selected for a total of 44 selected studies on information retrieval technology-related impacts. *In 2006*, two bibliographic databases (MEDLINE and EMBASE) were searched, and 8,146 new references (author, title, source and abstract) were screened by one principal investigator (PP). Subsequently, using ISI Web of Science Citation Index, PP searched for articles citing relevant papers. Of 67 studies on information retrieval technology, only 15 examined technology-related impacts, and were selected. *In 2007*, the parameters of our review were revised. Of 42 studies on information retrieval technology, only three examined technology-related impacts, and were selected.

Of 44 selected studies, 32 examined the application of information retrieval technology-derived information in clinical settings, and were retained for the present report (including three examining patient outcomes). The 32 retained studies are presented below: description, analysis with respect to the use of information for specific patients and its educational value, and list of references (see pp. 39-52).

They consist of three experimental studies, nine cohort studies, one case-control study, 15 cross-sectional studies, three case series, and one qualitative research. We classified their findings according to types of 'information use', and in accordance with educational concepts (cognitive tasks associated with reflective learning).

Information use

The application of information derived from information retrieval technology was classified according to three generic types of 'information use': instrumental, legitimating and conceptual (Hivon et al., 2005). Instrumental use arises when information items directly modify action. Legitimating use arises when information items justify and maintain action. Conceptual use arises when information items change awareness, thinking, or understanding of specific issues. We distinguished the legitimating use of retrieved information items from the symbolic use of the process of information retrieval, which enhances reputation and power (e.g., health professionals enhance their power and expert status by searching for health information with patients).

Using these definitions, findings of retained studies were assigned to one or more than one type of use: 32 (97%) studies reported instrumental use of information items, 26 (79%) reported legitimating use, and seven (21%) reported conceptual use. Findings that did not clearly refer to only one type of 'information use' have been assigned to two or three types. E.g., studies stating 'effect', 'impact', 'influence' and 'change or confirm' may correspond to instrumental or legitimating use. In the retained studies, 'instrumental use' refers to searches for information that changed or improved patient management, patients' or physicians' actions, and clinical decision-making. The proportion of searches linked to an instrumental use of information varied between 20% and 65% across studies. 'Legitimating use' refers to searches that confirmed patient management, patients' or physicians' actions, and clinical decision-making. 'Conceptual use' refers to situations where physicians' knowledge is increased, evidence is not convincing enough to influence action, or information does not influence action but is helpful for clarity of thought.

Educational value of information retrieval technology

Educational values detected in the 32 studies were interpreted as higher level cognitive functions using Donald's working model (2002) and a revised version of Bloom's taxonomy (Anderson et al., 2001). Donald's model was operationalized via a coding system (Table 1), and we assigned findings of retained studies to educational concepts (cognitive processes and related tasks associated with reflective learning). In line with Bloom's taxonomy of cognitive processes, information use (criterion used to retain studies) refers to the process 'application' of learned material in concrete situations, and so we added this process to our coding system. Using this system, findings were assigned to one or more than one type of cognitive process. In addition, we assigned examples, i.e., empirical illustrations, to cognitive tasks. For each study, more than one example was eventually assigned to a task. Results are presented in Table 2.

As mentioned in the text of the report, reflection is not well defined and operationalized in the literature. Thus, we used Donald's working model (2002) as a guiding principle. Donald's model derives from her longitudinal study of higher order thinking in education. This study is a cross disciplinary research that examines cognitive processes used in scientific studies. It defines five major cognitive processes as follows: (1) Description: Delineation or definition of a situation or form of a thing; (2) Inference: Act or process of drawing conclusions from premises or evidence; (3) Selection: Choice in preference to another or others; (4) Synthesis: Composition of parts or elements into complex whole; (5) Verification: Confirmation of accuracy, coherence, consistency, correspondence. For each cognitive process, Donald also proposes a list of cognitive tasks that contributed to refine our coding system.

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Table 1. Educational value: Coding system based on Donald's model (2002)

Cognitive processes & related tasks	[Codes]	Definitions
Description		***Delineation or definition of a situation or form of a thing.***
Identify context	[IC]	Establish surrounding environment to create a total picture.
State conditions	[SC]	State essential parts, prerequisites, or requirements.
State facts	[SF]	State known information, events that have occurred
State functions	[SFu]	State normal or proper activity of a thing or specific duties
State assumptions	[SA]	State suppositions, postulates, or propositions assumed
State goal	[SG]	State the ends, aims, objectives
Selection		***Choice in preference to another or others***
Choose relevant information	[CRI]	Select information that is pertinent to the issue in question.
Order information in importance	[OII]	Rank, arrange in important or according to significance.
Identify critical elements	[ICE]	Determine units, parts, components that are important.
Identify critical relations	[ICR]	Determine connections between things that are important.
Representation		***Depicting or portrayal through enactive, iconic, or symbolic means.***
Recognize organizing principles	[ROP]	Identify laws, methods, rules that arrange in a systemic whole.
Organize elements and relations	[OER]	Arrange parts, connections between things into a systemic whole
Illustrate elements and relations	[IER]	Make clear by examples the parts, connections between things.
Modify elements and relations	[MER]	Change, alter, or qualify the parts, connections between things.
Inference		***Act or process of drawing conclusions from premises or evidence.***
Discover new relations	[DNR]	Detect or expose connections between parts, units, components.
Discover new relations between relations	[DNRR]	Detect or expose connections between connections of things
Discover equivalences	[DE]	Detect or expose equality in value, force, or significance.
Categorize	[C]	Classify, arrange into parts.
Order	[O]	Rank, sequence, arrange methodically.
Change perspective	[CP]	Alter view, vista, interrelations, significant of facts or information.
Hypothesize	[H]	Suppose or form a proposition as a basis for reasoning.
Synthesis		***Composition of parts or elements into complex whole***
Combine parts to form a whole	[CPFW]	Join, associate elements, components into a system or pattern.
Elaborate	[E]	Work out, complete with great details, exactness, or complexity.
Generate missing links	[GML]	Produce or create what is lacking in sequence; fill in the gap.
Develop course of action	[DCA]	Work out or expand the path, route, or direction to be taken.
Verification		***Confirmation of accuracy, coherence, consistency, correspondence.***
Compare alternative outcomes	[CAO]	Examine similarities or differences of results, consequences.
Compare outcomes to standard	[COS]	Examine similarities, differences of results based on a criterion.
Judge validity	[JV]	Critically examine soundness, effectiveness, by actual fact.
Confirm results	[CR]	Establish or ratify conclusion, effects, outcomes, products.

Table 2. Educational value of information retrieval technology (pull): (a) Number of studies with findings assigned to cognitive processes (N=32), and (b) number of examples assigned to cognitive tasks (N=172)

Cognitive processes	Number of studies	*Cognitive tasks*	*Number of examples*
Application (B)	32		
Description (D)	3	*Establish surrounding environment to create a total picture.*	*2*
		State suppositions, postulates, or propositions assumed	*2*
		State normal or proper activity of a thing or specific duties	*2*
Inference (D)	18	*Alter view, vista, interrelations, significant of facts or information*	*27*
		Detect or expose equality in value, force, or significance.	*3*
		Detect or expose connections between parts, units, components.	*3*
		Suppose or form a proposition as a basis for reasoning.	*4*
Selection (D)	19	*Select information that is pertinent to the issue in question.*	*22*
		Determine units, parts, components that are important.	*21*
		Determine connections between things that are important.	*21*
Synthesis (D)	4	*Join, associate elements, components into a system or pattern.*	*1*
		Work out or expand the path, route, or direction to be taken.	*1*
		Produce or create what is lacking in sequence; fill in the gap.	*6*
Verification (D)	28	*Examine similarities or differences of results, consequences.*	*19*
		Examine similarities, differences of results based on a criterion.	*3*
		Establish or ratify conclusion, effects, outcomes, products.	*8*
		Critically examine soundness, effectiveness, by actual fact.	*27*

(B) Bloom’s revised taxonomy (2001) & (D) Donald’s working model (2002)

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APPENDIX A. LITERATURE REVIEW

Description of the 32 retained studies: Types of information use and educational value of information retrieval

First author (year) and design	**Participants and searches**	**Information use:** **A. Instrumental** **B. Legitimating** **C. Conceptual**	**Educational value:** **D. Application (Anderson, 2001)** **E. Cognitive process (Donald, 2002): Cognitive tasks [code] – see Table 1** **F. Concerns or issues**
Alper et al. (2005) Randomized trial	52 primary care clinicians were randomized (access to *Dynamed* versus information source of their choice) on a per-question basis when searching for answers to clinical questions (n=698). Using *Dynamed*, primary care clinicians answered more questions (50% of participants) and changed clinical decisions more often (54.3%) without increasing overall search time.	With *Dynamed*, more participants found answers that: (A) changed clinical decision making (54.3%), and (A or B) had better overall impact on decision making (60.9%).	(D) Use for clinical decision-making. (E) Answering questions: [CRI], [ICE], [ICR], [H], [GML]. Changed clinical decisions: [CP], [CAO]. Context: Change as a cognitive impact of reading and selecting the information. (F) Search skills critically influence the search itself that lead to the use of information retrieved.
Angier et al. (1990) Cohort study	29 health professionals affiliated to an oncological unit were invited to use a specialised database (physicians, nurses, pharmacists). Of those, 15 used the database on average 2.4 times over 31 days (36 searches).	(A) On a per-question analysis, 64.6% of searches using the database changed decision-making. (A or B) Of 15 users, 8 reported that using the database affects clinical management (53%).	(D) Use for clinical decision-making. (E) Changed clinical decisions: [CP], [CAO], [JV]. Affected clinical management: [CRI], [ICE], [ICR]. Context: Change as a cognitive impact of reading and selecting the information. (F) Not enough information in the database (e.g., only general information on drugs, their side effects, and toxicity).
Baker et al. (2001) Cohort study	190 family physicians had access to an internet diabetes guideline (13,325 patients). Of those, 55 (29%) used the guideline on average 7 times over 1 year.	(A or B) Guideline use was associated with guideline adherence.	(D) Use for clinical decision-making. (E) Used the guideline with adherence: [CRI], [ICE], [ICR], [COS]. Context: Searches for and evaluation of information involve selection and justification using the guideline. (F) The motivation underlying the use of technology influences the use of information retrieved.
Brassey et al. (2001) Cross-sectional study	40 of 50 family physicians answered a questionnaire on the responses provided to their clinical questions by an information manager who conducted the searches using information retrieval technology (mediated searches).	(A) 60% of respondents reported they changed their practice as a result of the information provided.	(D) Use for clinical decision-making. (E) Changed clinical practice: [CP], [CAO], [JV], [MER]. Context: Change as a cognitive impact of reading and selecting the information. (F) None.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Bloom, 2002) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Brilla & Wartenberg (2004) Case control study	While 10 neurology residents were given handheld computers and encouraged to access drug databases, 16 other neurology residents were also given handheld computers but not encouraged nor discouraged to use them (control group). Both groups were interviewed on their use and attitudes using a standardized questionnaire. The use of drug databases was significantly more common in the intervention group.	(A or B) 80% of the intervention group and 31% of the control group reported that handheld computers were their usual way of obtaining information about drugs (e.g., to check medication dosing, or to help prevent medical errors).	(D) Use for clinical decision-making. (E) Validating medical treatments using different sources: [CR], [JV]. Context: Validating medical treatments using a different source. (F) None.
Crowley et al. (2003) Cohort study	82 internal medicine residents formulated 625 clinical questions, and searched the internet for answers to 93% of these questions over 10 months.	(A) 43% of searches changed patient care. (B) 39% of searches confirmed patient care.	(D) Use for clinical decision-making. (E) Changed patient care: [CP], [CAO], [JV], [MER]. Confirmed patient care: [CR], [JV]. Context: Change as a cognitive impact of searching, reading and selecting the information. (F) The competence of formulating questions is important.
Cullen (2002) Cross-sectional study	294 of 363 randomly selected family physicians answered a questionnaire on their searches using the internet: 49% searched the internet in 2001, at least once, for clinical information using medical databases and popular search engines.	(A or B) 45% of respondents reported that searches changed or confirmed treatment, and 30% reported that searches changed or confirmed diagnosis.	(D) Use for clinical decision-making. (E) changed treatment or diagnosis: [CP], [CAO], [JV], [MER]. Confirmed: treatment or diagnosis: [CR], [JV]. Context: Change as a cognitive impact of searching, reading and selecting information. (F) Access to high-quality evidence-based information is needed along with access to the full text of relevant items. Abstracts may be unreliable source of information and can over-estimate positive findings.

First author (year) and design	Participants and searches	Information use (immediate-direct outcome): A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Dee et al. (2005) Cohort study	59 attending physicians and 49 physicians in training (108 participants) completed a questionnaire designed to explore the of use handheld computers in a clinical setting: 87% of the respondents reported the of use handheld computers for patient encounters (55% frequent use, and 32% occasional use).	(A) 16% of participants stated that using handheld computers helped avoid unnecessary tests, and 6% perceived that using handheld computers had shortened a patient's length of stay. (A or B) 67% of participants said using handheld computers influenced their clinical decision making (85% of the frequent users and 60% of the occasional users).	(D) Use for clinical decision-making. (E) Influenced clinical decision making: [CRI], ICE], [ICR], [CAO]. Context: Identifying and selecting critical elements in the information for clinical practice. (F) Access to information is only the beginning of evidence based practice.
Del Mar et al. (2001) Cross-sectional study	In two regions, 42 of 58 family physicians answered a questionnaire on 84 clinical questions. Searches were conducted by other family physicians, research assistants and an information specialist, using evidence-based databases and Medline (mediated searches).	(A) 49% of respondents in one region and 33% in the other region reported that answers changed the patient management.	(D) Use for clinical decision-making. (E) Changed the patient management: [CP], [CAO], [JV], [MER]. Context: Change as a cognitive impact of searching, reading and selecting the information for use. (F) None.
Gorman et al. (1994) Cross-sectional study	Of 966 family physicians, a sample of 50 asked 295 clinical questions over 2 half-days. Of those, 60 randomly selected questions were answered by librarians using online bibliographic databases. 48 physicians gave feed-back.	(A or B) 51% of searches would have had an impact on physician practice.	(D) Use for clinical decision-making. (E) Influenced physician practice [CRI], ICE], [ICR], [CAO]. Context: Identifying and selecting evidence for clinical practice. (F) The feedback to information may indicate the characteristics of the impacts that lead to decision making, but neither the feedback nor the impacts are explained.
Haynes et al. (1990) Cohort study	128 hospital affiliated physicians or medical students, and 30 clerks, searched *Medline*. 81% did on average 2.7 searches/month over 8 months. Interviews were conducted for 280 of a random sample of 300 searches.	(A or B) 41% of searches affected physicians' decision-making.	(D) Use for clinical decision-making. (E) Affected physician decision-making: [CRI], [ICE], [ICR]. Context: Identifying and selecting critical elements in the information for clinical practice. (F) Recall is not an objective tool to examine decision making, and can be biased.

First author (year) and design	Participants and searches	Information use (immediate-direct outcome): A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Haynes et al. (1991) Randomised controlled trial	Of a sample of 95 hospital affiliated physicians, 59 were randomised by pairs "pay / no pay" for their Medline searches over 6 months. They answered a computerised questionnaire after each search (n=322), and were interviewed for one-third random sample of searches. In the 'pay group', 52% of physicians searched MEDLINE (median of 2 searches) as compared to 87% in the 'no pay group' (median of 4 searches).	(A or B) 19% of searches affected physicians' decisions in the "pay group", and 28% in the "no pay group" (the difference being not significant).	(D) Use for clinical decision-making. (E) Affected physician decision-making: [CRI], [ICE], [ICR]. Context: Identifying and selecting critical elements in the information for decision making. (F) User fee may discourage the user to search for information, and cost can be a issue in CME.
Hayward et al. (1999) Cross-sectional study	Of 361 family physicians affiliated with a division, a random sample of 31 were invited to ask clinical questions. Of those, 9 mailed 45 questions referring to 20 searches that were done by librarians using multiple databases.	(A) In 4 out of 20 searches (20%), patient management was changed as a result of the answer.	(D) Use for clinical decision-making. (E) Changed the patient management: [CP], [CAO], [JV], [MER]. Context: Evidence-based practice requires doctors to select and justify evidence used to support decision making when these doctors answer questions derived from clinical problems. (F) None.
Honeybourne et al. (2006) Cross sectional study	14 clinical and librarian staff used handheld computers in clinical settings to support evidence based practice and education (multiple databases).	(A or B) Some databases significantly assisted participants in patient care/clinical practice.	(D) Use for clinical decision-making (E) Assisted patient care/clinical practice: [CRI], [ICE], [ICR] [H]. Context: Doctors identify critical elements and their relations in the information retrieved, and then, plan follow-up action such as seek specifics to address clinical problems at hand. (F) According to interviews, clinicians may need additional time to digest information before they apply it for a patient.
Jousimaa et al. (1998) Cohort study	102 of 477 health professionals searched computerised guidelines (physicians, medical students, librarians, nurses, dentists, and employees of pharmaceutical industry), and completed a questionnaire after 2,102 searches (29%). Each professional searched on average 0.6 times/day (from 0.03 to 6.5).	(A or B) 36% of searches influenced professionals' decisions.	(D) Use for clinical decision-making. (E) Influenced professionals' decisions: [CRI], [ICE], [ICR]. Context: Cases of disagreement with guidelines are justified by clinical knowledge and experience. (F) None.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Jousimaa et al. (2002) Randomised controlled trial	139 newly graduated family physicians were randomly assigned to use computerised guidelines or paper-based guidelines. Of those, 130 completed the study. External reviewers assessed outcomes using medical records. Guideline use was similar in 'computer' and 'paper' groups. For each physician, there were on average 2 searches/working day.	(A or B) Guideline adherence was similar in 'computer' and 'paper' groups. More than 3 of 4 consultation decisions were in agreement with guidelines.	(D) Use for clinical decision-making. (E) N/A (comparing media of delivery). (F) None.
Ketchell et al. (2005) Cross sectional study	A primary care web portal was created to make access to and use of information faster and easier. A user satisfaction survey was administered to clinicians using paper forms with a return rate of 32% (35/108): 74% of respondents said they use the portal.	(A) 88% of users of the portal answered that it provided information improving patient care. (A or B) While 50% reported that they use frequently the portal to answer a diagnostic or treatment question for a specific patient, 27% reported that they use it to provide patient education.	(D) Use for clinical decision-making. (E) Improved patient care: [CP], [CAO], [JV], [MER]. Answered a diagnostic or treatment question: [CRI], [ICE], [H], [ICR], [GML]. Provided patient education: [CRI], [ICE], [ICR]. Context: The use of information depends on the process of selecting, and inferring information for answering clinical questions. (F) The portal presents different types of information on different formats.
Krahn et al. (2006) Case series	Trauma surgeons (number not specified) were asked to produce EBM questions related to the treatment of current patients. An information specialist searched the literature and reported the findings on every following day: 44 questions were formulated, and 157 text items were identified as potentially relevant. Answers were found for 30 questions.	(B) 11 answers (37%) confirmed the original treatment plan (no change), and 13 (43%) answers were considered as useful and influential (no change). (C) Six (20%) answers were not considered convincing enough to influence clinical decision-making.	(D) Use for clinical decision-making. (E) Influenced a clinical decision: [CRI], ICE], [ICR], [CAO]. Confirmed the original treatment: [CR], [JV]. Not considered convincing enough to influence clinical decision-making: [CRI], ICE], [ICR]. Context: Matching evidence with surgical operation requires the identification of critical elements that indicate the workability of evidence in the context of a specific clinical problem, and then infer the relations of these elements to the possible solution. (F) The specific problem of evidence-based surgery is that operative procedures have comparably, seldom been tested for their effectiveness with experimental studies.

First author (year) and design	**Participants and searches**	**Information use :** **A. Instrumental** **B. Legitimating** **C. Conceptual**	**Educational value:** **D. Application (Anderson, 2001)** **E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1** **F. Concerns or issues**
Lindberg et al. (1993) Cross-sectional study	Of 1,160 health professionals (physicians, researchers, nurses, dentists and other professionals), 552 described their recent searches in Medline according to the Critical Incident Technique.	(A) 421 of 1,158 searches (36%) modified physicians' action. (A or B) 55 searches (5%) affected physician-patient relationship, patients' health behaviours, responsibilities with respect to patient and third-party payers.	(D) Use for clinical decision-making. (E) Modified physicians' action: [CP], [CAO], [MER]. Context: Doctors identify critical elements and their relations in the retrieved information, and then, synthesise information for solving clinical problems at hand. (F) None.
Magrabi et al. (2005) Prospective cohort study	227 clinicians participated in a 4-week clinical trial of an online evidence system. Use and usefulness of the system were examined using computer logs and survey analysis: 193 family physicians used the system to conduct on average 8.7 searches per month. In 73% of queries with clinicians' feedback, participants reported that they were able to find clinically useful information during their routine work.	(A) 83% of clinicians believed that the system had the potential to improve patient care, and one in four users reported direct experience of improvements in care.	(D) Use for clinical decision-making. (E) Believed improvement can be made: [SA], [SFu]. Improve patient care: [CP], [CAO], [JV], [MER]. Context: Doctors identify critical elements and their relations in the retrieved information, and then, synthesise information for solving clinical problems at hand. (F) None.
Pluye & Grad (2004) Qualitative research	6 family physicians from one teaching practice described recent searches in multiple databases on a handheld computer according to the Critical Incident Technique (N=14 critical searches)	(A) Three searches: Prescribing radiological tests, adjusting drug dosage, avoiding drug interactions. (B) Three searches: Supporting treatment options. (C) Three searches: Recalling treatment options, finding Canadian equivalent of US drug.	(D) Use for clinical decision-making. (E) Improve patient care (adjusting drug dosage, avoiding drug interactions): [CP], [CAO], [MER], [JV]. Confirmed treatment: [CR], [JV]. Recalled needed information: [CRI]. Context: Doctors identify critical elements of a problem for a search. Then, they select and synthesize information that includes potential solutions, and match these solutions with the problem at hand. (F) When needed information is not found, frustration resulted can lead to not using the databases again though information may make a contribution to clinical practice.

First author (year) and design	**Participants and searches**	**Information use :** **A. Instrumental** **B. Legitimating** **C. Conceptual**	**Educational value:** **D. Application (Anderson, 2001)** **E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1** **F. Concerns or issues**
Podichetty et al. (2006) Cross-sectional study	Surveys were distributed randomly to healthcare professionals to assess and correlate the extent of internet use, and to examine its effect on clinical practice: 285 questionnaires were completed. Results show that internet use and web based medical information retrieval is popular among healthcare professionals.	(A or B) 51% of respondents answered yes to the following question "does information from web sites influence your healthcare decisions?"	(D) Use for clinical decision-making. (E) Influence your healthcare decisions: [CRI], [ICE], [ICR], [JV]. Context: The use of information depends on the process of selecting, and validating information for solving clinical problems. (F) None.
Rothschild et al. (2002) Cross-sectional study	946 of 3,000 randomly selected physicians and medical students (various specialties) answered a questionnaire on their searches of a handheld pharmaceutical database. 25% searched the database more than 5 times/day, 57% between 1 and 5 times, and 18% less than 1 time.	(A) 86% reported that outpatient practice efficiency was improved (87% for in patient practice). 83% found that patients were better informed. 54% reported that patients were more satisfied. (C) 79% of respondents reported that using the database increased their drug knowledge.	(D) Use for clinical decision-making. (E) improved clinical practice: [CP], [CAO], [JV], [MER]. Increased doctors' drug knowledge: [GML], [DNR], [DE]. Context: Change or improvement as a cognitive impact of searching, reading and selecting the information for use. (F) New databases on handheld computers can make a contribution to clinical practice.
Rothschild et al. (2006), cross sectional study	1,501 users of a handheld pharmaceutical database completed a survey. Usage data were tracked during 4 weeks prior to survey completion: 39% of participants reported that they use the software in more than half of patient encounters. Users searched the database on average 6.3 times/day.	(A) Participants reported that some alerts improved patient care. (A or B) Most participants (61%) reported that the database prevents adverse drug events or medication errors.	(D) Use for clinical decision-making. (E) Believed improvement can be made: [SA], [SFu]. Prevented clinical errors: [CRI], [ICR], [ICE], [JV]. Context: Decision making includes searching, reading, selecting, and synthesizing information. (F) One of the greatest challenges in medicine is keeping up to date with the growing medical knowledge.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Schilling et al. (2005) Cohort study	43 internal medicine residents asked then tried to answer 158 clinical questions, mostly using *Medline* and *UpToDate*. They completed a questionnaire after the exercise. Residents found answers to 141 (89%) questions. They rated the impact of the retrieved information on a 5-point scale.	(A or B) Regarding 110 (78%) questions, the retrieved information affected clinical decision making.	(D) Use for clinical decision-making. (E) Affected clinical decision making: [CRI], [ICE], [ICR], [JV]. Context: Synthesis of information involves (a) making inference of data about specific patient case, and (b) identifying the unknown, i.e., the knowledge gap for formulating a problem. By identifying the critical elements of this problem, these elements are used for searching potential answers. Then, retrieved information is synthesized for formulating answers. (F) The discipline of EBM, by focusing on literature searches and critical appraisal skills, may have set standards that are untenable for practicing physicians. The completeness of information retrieval includes 5 steps: • Identify a knowledge gap specific to the care of a patient, • Articulate a well-constructed clinical question, • Effectively use information resources to locate answers, • Formulate an answer, • Apply the retrieved information.
Schwartz et al. (2003) Cohort study	Three family physicians searched online databases for answers to 92 clinical questions. They searched *TRIP*, *InfoRetriever* and other online search engines respectively 81, 35 and 27 times over 3 months.	(A or B) 56% of searches influenced current patient care.	(D) Use for clinical decision-making. (E) Influenced current patient care: [CRI], [ICE], [ICR], [JV]. Context: Formulating a clinical question, and searching for information to formulate answer to this question requires selection, identification of critical elements, and inference of the relations of these elements for the formulations. (F) Inexperience and wasting time for searching hinder the use of on-line evidence-based resources.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Swinglehurst et al. (2001) Case series	20 family physicians and two primary care nurses asked 60 clinical questions. Searches were conducted by a family physician using evidence-based databases and Medline: 57 searches provided answers over 10 months (mediated searches).	(A) 7% of searches provided more information to the current patient (22% to any other patient). 20% promoted discussion/reflection or led to a better understanding of information services. (B or C) 39% of searches increased understanding or knowledge, or provided reassurance.	(D) Use for clinical decision-making. (E) Increased understanding or knowledge: [GML], [DNR], [DE]. Provided reassurance: [CR], [JV]. Promoted discussion/reflection: [CAO]..[CRI], ICE], [ICR], [CAO]. Context: Formulating a clinical question, and answering to this question requires selection, identification of critical elements, and inference of the relations between these elements. (F) Family physicians did not often use information retrieval to answer clinical questions.
Veenstra (1992) Cross-sectional study	30 of 45 medical residents completed a questionnaire on literature searches mediated by a librarian (261 searches). Senior, transitional, junior residents and interns sought on average respectively 3.2, 1.8, 1.4 and 2.6 librarian searches over 11 months.	(A or B) 93% of respondents said that searches affected patient care. Senior, transitional, junior residents and interns reported respectively that a mean of 46%, 43%, 40% and 59% of searches impacted on patients' care	(D) Use for clinical decision-making. (E) Affected patient care: [CRI], [ICE], [ICR], [JV]. Context: Doctors require answers to their questions, i.e., identify knowledge gap, formulate and articulate questions. The requirement involves selection, identification of critical elements, and inference of the relations between these elements in the information retrieved by the librarian. (F) None.
Westbrook et al. (2004) Cross-sectional study	5,511 of 21,712 hospital-affiliated physicians, nurses and allied professionals (various specialties) answered a questionnaire about their searches in a website (providing access to multiple databases): 63% had heard of the website, and 47% had used it.	(A) 54% of physicians reported direct experience of website searches resulting in improved patient care.	(D) Use for clinical decision-making. (E) Improved patient care: [CP], [CAO], [MER], [JV]. Context: Doctors identify critical elements of a problem for a search. Then, they select and synthesize information that includes potential solutions, and match these solutions with the problem at hand. (F) None.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Westbrook et al. (2005) Cross sectional study	392 junior medical staff and 684 senior medical staff from 65 randomly selected hospitals were surveyed on their knowledge and use of an online evidence retrieval system: 1,128 surveys were completed, and 1,076 retained. 93.5% of system users believed it had the potential to improve patient care and 55.2% had directly experienced this.	Reasons given to use the system include: (A) to develop a treatment plan (31.3% of users), (B) to confirm a clinical decision (37.7% of users).	(D) Use for clinical decision-making. (E) Developed a treatment plan: [IC], [H], [CPFW], [GML]. [DCA], [JV]. Confirmed a clinical decision: [CR], [JV]. Context: Doctors identify critical elements of a problem for a search. Then, they select and synthesize information that includes potential solutions, and match these solutions with the problem at hand. (F) Clinicians might have the right answer to a clinical question from their knowledge, but may place confidence in information that led them to an incorrect answer. This instance may be an outcome of (a) overconfidence in the retrieved information, thus validation of this information is not performed, (b) stopping the search prematurely, and drawing conclusion based on some clues taking from retrieved information rather than a full analysis, and (c) answers are not validated either due to overconfidence.
Westbrook et al. (2007) Cross sectional study	29 health professionals (16 nurse specialists and 13 specialist physicians) described their experience with the Internet portal Clinical Information Access Program (Critical Incident and Journey Mapping techniques): 85 searches were reported (critical incidents).	Three main types of impacts of searches were identified: (1) impact on clinical practice, (2) impact on individual clinicians, and (c) indirect impact on colleagues through dissemination of information. (A) 25% of the first type of impact improved patient care. (B) 45% of the second type of impact improved clinicians' confidence in decision-making. (C) 69% of the third type of impact increased clinicians' knowledge.	(D) Use for clinical decision-making. (E) Improve patient care: [CP], [CAO], [MER], [JV]. Improved clinicians' confidence in decision-making: [CR], [JV]. Increased knowledge: [GML], [DNR], [DE]. Context: Decision making includes searching, reading, selecting, and synthesizing information. (F) Using information system to support clinical practice does not merely relate to searching skills. The more search is done, the more information is retrieved. Doctors need to differentiate incorrect or inappropriate information from the good ones. The differentiation can be biased by the doctors' confidence level, and prior knowledge. Considering the shortage of time, in a busy clinical practice, validation of information before use may not be done. This likely lead to clinical errors. Disseminating incorrect information can be harmful.

First author (year) and design	Participants and searches	Information use : A. Instrumental B. Legitimating C. Conceptual	Educational value: D. Application (Anderson, 2001) E. Cognitive process (Donald, 2002): Cognitive tasks [code] - see Table 1 F. Concerns or issues
Williams et al. (2004) Case series (interrupted multiple time series)	Three local guidelines were made available online to a hospital's medical staff after 12 guidelines were distributed on paper. Patient notes (n = 470) were evaluated, and medical staff interviewed.	(A or B) There was a significant increase in adherence to one of the three online guidelines.	(D) Use for clinical decision-making. (E) Increase in the adherence to the guideline: [CRI], [ICE], [ICR], [COS]. Context: Searches for and evaluation of information involve selection and justification using the guideline. (F) Making clinical practice guidelines available in an electronic format may improve adherence to these guidelines.

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APPENDIX B. ENVIRONMENTAL SCAN

Policies and research in continuing medical education (CME) or continuing professional development (CPD) for physicians, specifically with regard to information delivery and/or information retrieval.

Official Policy (as of 2007)

USA

ACCME / AMA	AMA PRA Category 1 Credits (requires documentation; obtained through accredited provider activities or AMA direct credit activities) Internet PoC Learning **Structured online/internet searches** on clinical topics (.5 credits) Learning for this activity is driven by a reflective process in which physicians must document their clinical question, the sources consulted and the application to practice. AMA PRA Category 2 Credits (doesn't require documentation; not through providers) **Unstructured online searching and learning** http://www.ama-assn.org/ama1/pub/upload/mm/455/pra2006.pdf
AAFP	Growing list of "Online CME" – mostly online videos and quizzes Growing list of "Self-study CME" – a lot of overlap with "Online CME" http://www.aafp.org/online/en/home/cme/onlinecme.html

EU

European Union of Medical Specialists	50 credits minimum per year – 25 from External, up to 10 from Personal (External, Internal, Personal categories and can be either Clinical or Non-Clinical) -Have distance learning, but no reference to individual learning activities -Electronic Diary system is used to track activities
2005: The EUMS provides a co-ordinated system for Europe for awarding credits, but does not encroach on national organizations in member states. Many countries have CPD/CME (many have a formal accreditation system), but participation is only on a voluntary basis in several cases. ***Germany has a mandatory system administered by each of its 16 states. There is a category for self-study. One state, the Bavarian Medical Chamber is running in co-operation with the RCPSC for e-learning purposes. http://www.emn.net/faq_cme.php	

UK

Royal College of Physicians / Royal College of General Practitioners	50 credits minimum per year – 25 from External, up to 10 from Personal (External, Internal, Personal categories and can be either Clinical or Non-Clinical) -Have distance learning, but no reference to individual learning activities -Electronic Diary system is used to track activities

Australia

Royal Australian College of Physicians / Surgeons / General Practitioners	Physicians: Runs a individual learning program, but activities appear to be meetings/workshops http://www.racp.edu.au/index.cfm?objectid=9E377DCC-E5EF-BD5D-E93ECF008AE4562A Surgeons : Appears to prefer interactive, small-group events with evaluation http://www.surgeons.org General Practitioners: advertises "individual learning plans" and "self education" "active learning module" for Category 1 Activities http://www.racgp.org.au

Hong Kong

College of Surgeons of Hong Kong	Credit given for: development of materials for self-study or e-learning; development of a new technology http://www.cshk.org/cmesp.htm
Hong Kong Medical Assoc.	Can login and complete online CME through their website: photo & short quiz, case studies, etc http://www.hkma.com.hk/english/cme/cme.htm

Singapore

College of FPs of Singapore	Self-study – looks like readings, online education programs (without assessment) http://www.cfps.org.sg/

Research Groups to Watch

Dina Demner-Fushman, PhD, MD (Computer Science – U of Maryland)

- Information retrieval in biomedical domain, clinical questions answering, clinical decision support
  http://www.cs.umd.edu/~demner/
- MD on Tap (with Susan Hauser, PhD) - patient outcome oriented summaries of MEDLINE search results
  http://lhncbc.nlm.nih.gov/lhc/docs/reports/2005/tr2005004.pdf

Joshua Jacobs, MD (University of Hawaii -Manoa)

- Primary care physician, clinical and educational applications of information technology, effective methods of teaching healthcare professionals how to use

medical informatics effectively as a tool to help their research and patient care activities http://ome.hawaii.edu/bio.jacobs.htm
- MARP (Mobile Access Resource Project) – ending Sept 2007 - Med students' access to NLM databases for context-specific learning objectives via PDA

Primary Care Informatics Group (UK) http://www.gpinformatics.org/
Projects include:

Dr's Desk – web portal to key medical information sites (also linked access to mail, educational/telemedicine applications)
PCEL (Primary Care Electronic Library) – searchable directory of abstracted and indexed resources
WONCA Presentation – Family Medicine and Internet-based resources for CPD www.gpinformatics.org/download/meetings/wonca.ppt

Center for Information Mastery (Family Medicine) - University of Virginia
http://www.healthsystem.virginia.edu/internet/familymed/docs/info_mastery.cfm

ClinicalResource@Ovid, which was SkolarMD, which was SHINE (Stanford Health Information Network for Education)

- Quick Answers to Clinical Questions at the Point-of-Care
- SHINE developed to allow answering of clinical questions and receive CME credit for doing it.

Cincinnati Children's Hospital Medical Center

- offering "**Internet Point of Care Credit**" (IPCC)
- 0.5 *AMA PRA Category 1 Credit*™ for each search conducted. Document the clinical question, the source consulted (from the approved list), and the application to practice by completing the IPCC form and evaluation. http://www.cincinnatichildrens.org/ed/cme/cme/ipcc.htm

Articles & presentations

Puech M et al. Local implementation of national guidelines: What do general practitioners suggest will work? Int J Qual Health Care 1998;10(4):339-43.

F. Braido, T. Popov, I. J. Ansotegui, J. Gayraud, K. L. Nekam, J. L. Delgado, H. J. Malling, S. Olson, M. Larchè, A. Negri, G. W. Canonica, EAACI CME Accreditation Committee. Continuing Medical Education: an international reality. Allergy 2005:60(6):739–742.

Hubbs PR, Tsai M, Dev P, Godin P, Olyarchuk JG, Nag D, Linder G, Rindfleisch TC, Melmon KL "The Stanford Health Information Network for Education: integrated information for decision making and learning." *Proc AMIA Annu Fall Symp.* 1997; 505-8. http://www.amia.org/pubs/symposia/D004411.PDF

Medical e-CPD
www.zen34802.zen.co.**uk**/Medical_e**CPD**_-_**CPD**_Forum_Oct2003.pdf

APPENDIX C. USA: POINT OF CARE CME
THE AMERICAN ACADEMY OF FAMILY PHYSICIANS

Retrieved from **http://www.aafp.org**

Overview
AAFP recognizes Point of Care CME as practice-based learning that takes place in support of specific patient care. The physician uses a computer-based clinical decision-making support tool at the point of care to ask a clinical question, search evidence-based sources for practice recommendations and then apply a recommendation appropriately to the patient. Even in cases when the evidence-based recommendation is not appropriate for the patient, the physician still learns something in the process.

Because this is relevant, evidence-based continuing medical education that meets a physician's specific learning needs, it is appropriate to award AAFP Prescribed credit for documented point of care learning activities.

AAFP will approve .5 Prescribed credits for every point of care learning activity that utilizes an AAFP-approved Point of Care CME source and is delivered by an ACCME-accredited CME provider. There must be a mechanism, either from the approved source or from the CME provider, to document the following activity elements:

1. The learner's question
2. The search of an AAFP-approved source
3. Implementation of new knowledge in practice

It is not necessary for all three of these elements to be documented at the point of care. For example, if the point of care source captures the clinical question and the search, the physician may document implementation at a different time (e.g., at the end of the clinic day), or the point of care CME provider may capture implementation data from the physician as a part of documentation of earned credit.

It is the ACCME-accredited provider's responsibility to ensure that the three parts of the point of care learning experience are properly documented. The AAFP allows members to claim up to 20 credits (40 documented point of care CME "inquiries" or "questions" awarded .5 Prescribed credits each) per year toward membership re-election.

Review Fee
The review fee for an original application with two year accreditation is $350. For a renewal application, the review fee is $250 with two year accreditation. These fees are for review services rendered and are not refundable. Payment and supporting materials must accompany the application whether submitted by mail or by fax.

AAFP-Approved Point of Care Sources

DynaMed

InfoRetriever
PEPID
Physicians' Information and Education Resource (PIER)
UptoDate

(as of Sept. 2006)

Approval of Point of Care CME Activities
Any ACCME-accredited CME provider is eligible to use AAFP-approved Point of Care sources to provide point of care CME activities and award CME credit for family physicians. The CME provider needs to complete the Application for Approval of Point of Care CME Activities and submit it to the AAFP CME Accreditation Department. Applications will be reviewed by AAFP Commission on Continuing Professional Development (COCPD) and approved if the provider meets the criteria for producing point of care learning activities utilizing AAFP-approved Point of Care sources.

AAFP CME accreditation is awarded for two years. CME providers have the option to submit a renewal application for additional two year accreditation when the original two year accreditation ends.

It is the responsibility of the CME provider to:

1. Be an ACCME-accredited provider.
2. Plan the educational activity in collaboration with and utilizing an AAFP-approved Point of Care source.
3. Ensure that the CME activity properly documents the three required elements of the point of care learning activity (i.e., the clinical question, the search history and the implementation in practice).
4. Involve an AAFP Active or Life member in the planning/review of the overall CME activity.
5. Award learners .5 Prescribed credits per completed point of care learning activity.
6. Evaluate the activity.
7. Maintain participation records for six years.

Application for Approval of Point of Care CME Activities
Application for CME Approval of Point of Care Activities
(Microsoft Word file: 2 Pages/76 KB. **More information on downloading files.**)
For more information about the Point of Care CME approval process, please contact Nicole Lillard at 1-800-274-2237, ext. 6549 (**nlillard@aafp.org**).
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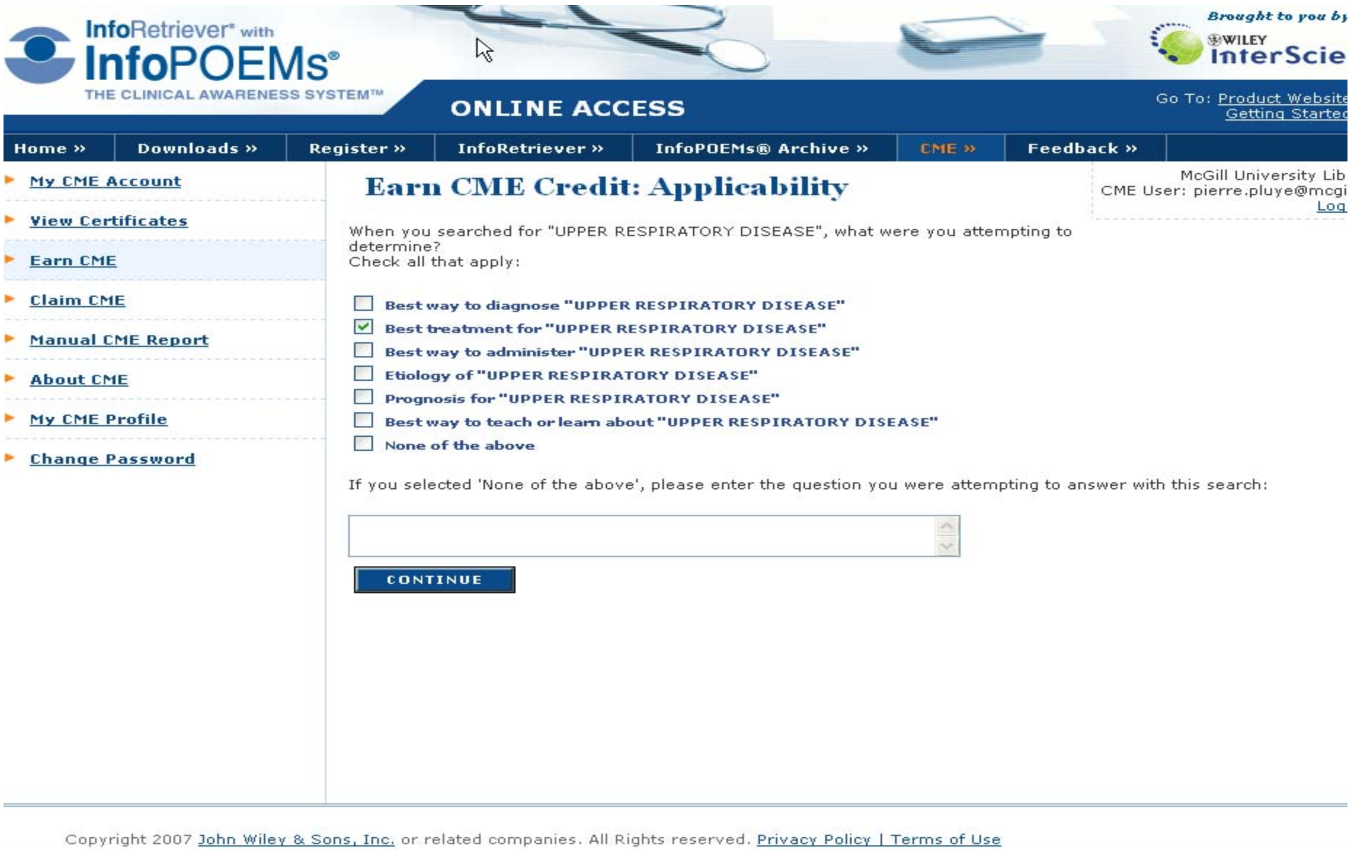
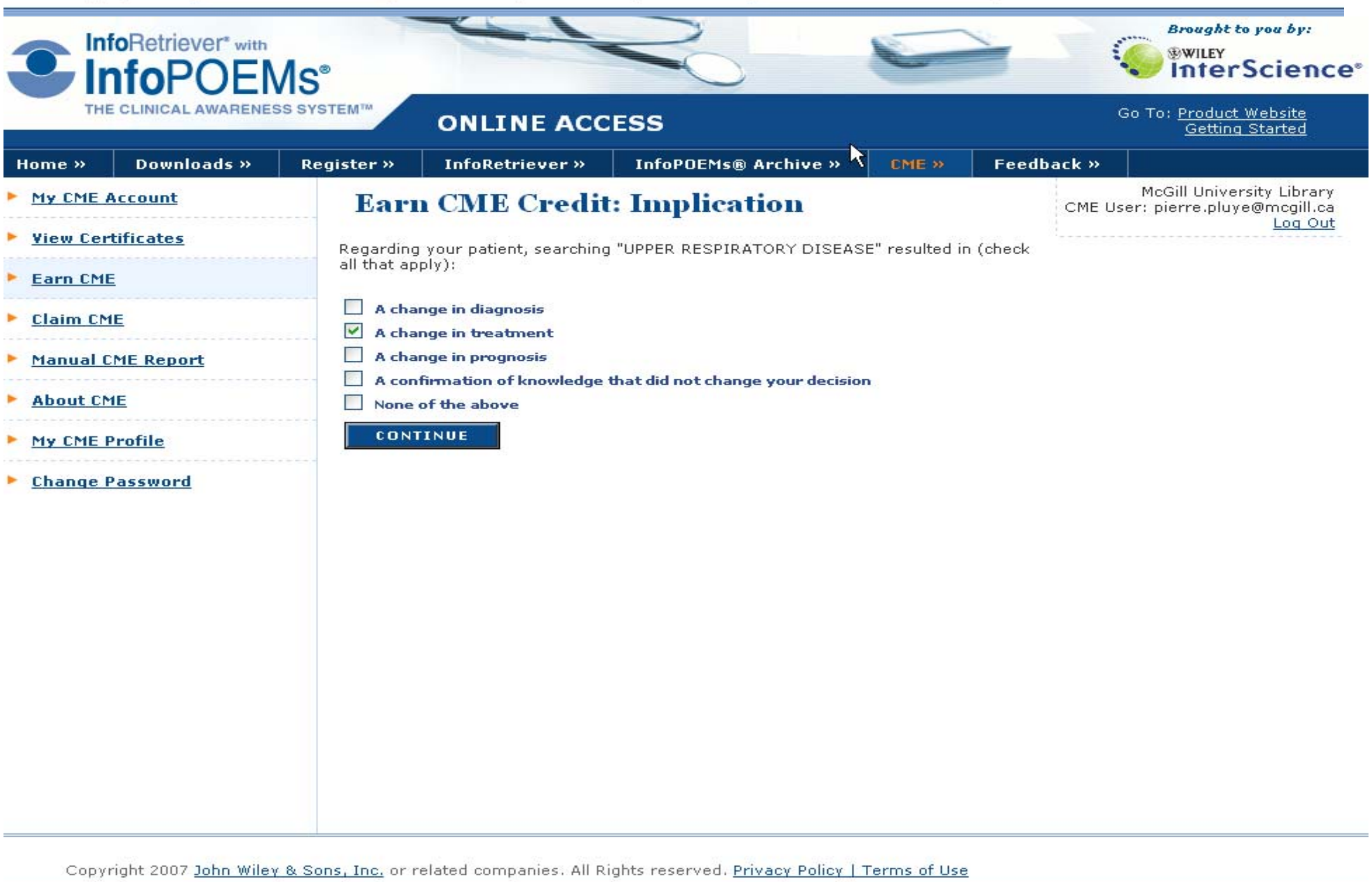
APPENDIX D. USA: USING PULL TECHNOLOGY & CLAIMING CME CREDITS EXAMPLE: INFOPOEMs® & TUFTS UNIVERSITY

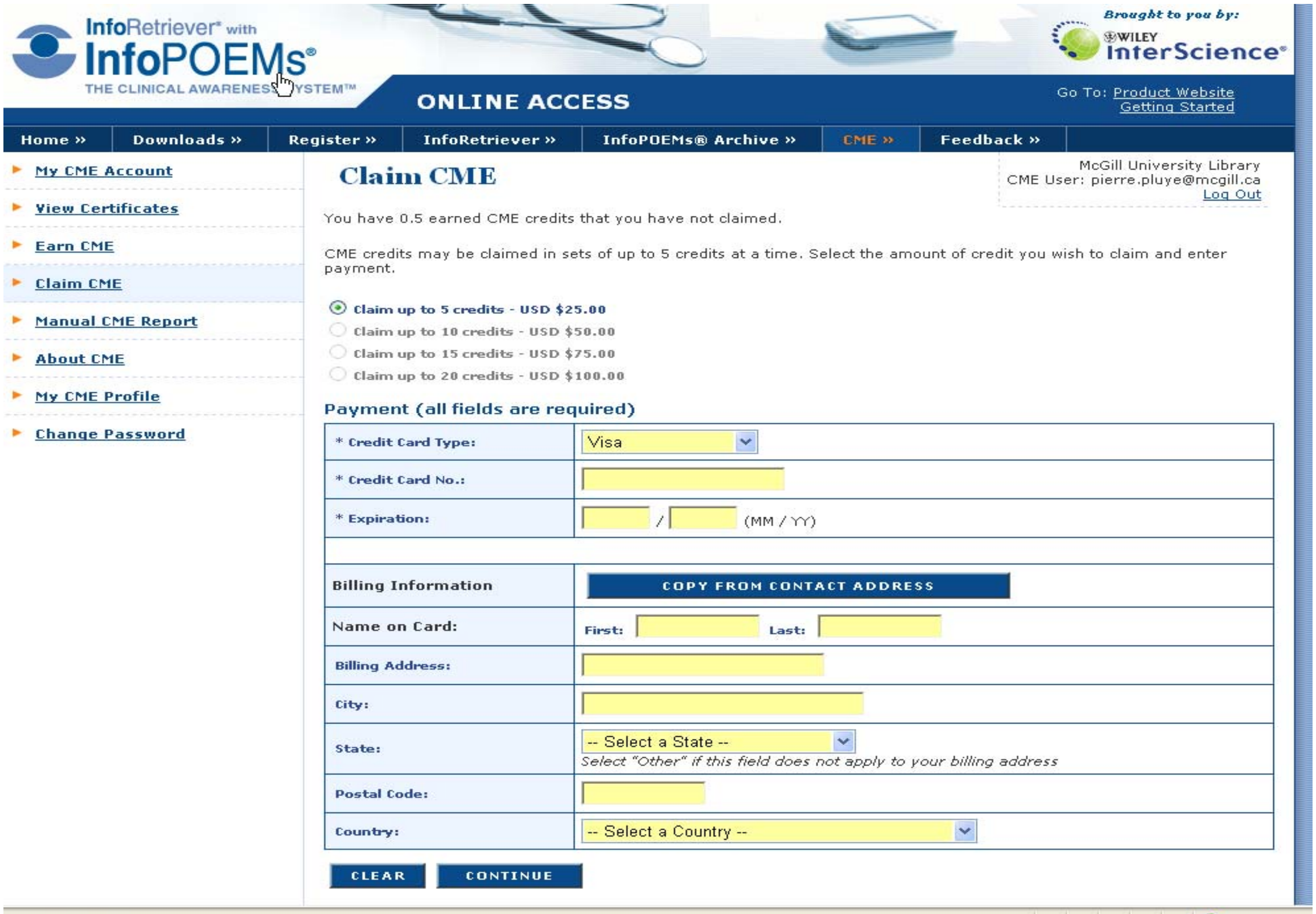
Appendix D. USA: Using pull technology & claiming CME credits

Appendix D. USA: Using pull technology & claiming CME credits





Appendix D. USA: Using pull technology & claiming CME credits


InfoRetriever with InfoPOEMs
THE CLINICAL AWARENESS SYSTEM™
Brought to you by: WILEY InterScience
ONLINE ACCESS
Go To: Product Website
Getting Started
Home » Downloads » Register » InfoRetriever » InfoPOEMs® Archive » CME » Feedback »
My CME Account
View Certificates
Earn CME
Claim CME
Manual CME Report
About CME
My CME Profile
Change Password
Claim CME
McGill University Library
CME User: pierre.pluye@mcgill.ca
Log Out
You have 0.5 earned CME credits that you have not claimed.
CME credits may be claimed in sets of up to 5 credits at a time. Select the amount of credit you wish to claim and enter payment.
Claim up to 5 credits - USD $25.00
Claim up to 10 credits - USD $50.00
Claim up to 15 credits - USD $75.00
Claim up to 20 credits - USD $100.00
Payment (all fields are required)
* Credit Card Type: Visa
* Credit Card No.:
* Expiration: / (MM / YY)
Billing Information
COPY FROM CONTACT ADDRESS
Name on Card: First: Last:
Billing Address:
City:
State: -- Select a State --
Select "Other" if this field does not apply to your billing address
Postal Code:
Country: -- Select a Country --
CLEAR
CONTINUE

APPENDIX E. THE COLLEGE OF FAMILY PHYSICIANS OF CANADA: PROCEDURE FOR CLAIMING CME CREDITS

Step 1 = Login

Step 2 = Choose from a list of CME activities

Add To CME Record

Select the type of CME Activity that you would like to add to your record.

AAFP Home Study Self-Assessment / Core Content Review (Ohio and Connecticut Chapters of the AAFP)
Accredited conferences, courses and workshops
Advanced Cardiac Life Support (ACLS)
Advanced Life Support in Obstetrics (ALSO)
Advanced Neurological Life Support (ANLS)
Advanced Pediatric Life Support (APLS)
Advanced Trauma Life Support (ATLS)
Advances in Labour and Risk Management (ALARM)
Annual Scientific Assembly (ASA)
Audio and video tapes
CD-ROM
Clinical Traineeships
Examiner - family medicine certification and licensing examinations
Faculty development
Family medicine and emergency medicine examinations
Family Medicine Forum (FMF)
FMOQ Self-study modules
Hospital and Clinical Rounds
Individual consideration
Internet based CME
Journal Clubs
Linking learning to practice
Managing Obstetrical Risks Effectively (MORE)
Member - medical committees
Neonatal Resuscitation Program (NRP)
Other self-learning activities
Pearls

Appendix E. CFPC: A 3-step procedures of claiming CME credits

Pediatric Advanced Life Support (PALS)
Peer reviewer - medical journals
Practice audits
Practice-based small group learning (PBSGL)
Presentations and speaking
Provincial practice review and enhancement programs
Publications
Reading
Research
Reviewer - endorsement of CFPC products
Self Learning
Self Learning Committee and Question Writers
Teaching
Unaccredited conferences, courses, or workshops
University degree or diploma program

STEP 3 =Filling in the details — “Other learning activities” is selected as an example.

Add To CME Record

Top of Form

{94F39D16-90B5

Other self-learning activities

Mainpro-M2 credits can be claimed for most self-learning activities. But there are some exceptions which can be claimed for Mainpro-M1 credits. Each of these is developed by the CFPC or another family medicine organization.

- Activity Title   Other learning activities
- Dates
- Description of activity

Credits Requested: Mainpro-M2

Bottom of Form

APPENDIX F. THE COLLEGE OF FAMILY PHYSICIANS OF CANADA: CME ACTIVITIES

Mainpro® - Activities eligible for Mainpro-M2 credits

Any CME activity not approved for Mainpro-M1 or Mainpro-C credits can be claimed by members for Mainpro-M2 credits if they believe it was pertinent to their practice. Examples of these include:

- Conferences, courses, and workshops not accredited for Mainpro-M1 or Mainpro-C credits
- Conferences, courses, and workshops in the United States which are not accredited by the American Academy of Family Physicians for their Prescribed Credits
- Teaching (undergraduate, postgraduate, or CME)
- Presentations and speaking
- Preparation of papers for publication
- *Self-learning activities*
- Reading (books, journals, monographs)
- Audio and video tapes
- CD-ROM and other computer-based programs
- Accessing most CME available on the Internet

Mainpro® - Activities eligible for Mainpro-M1 credits

- Group learning activities
- Conferences, courses and workshops
- Advanced life support programs
- Hospital and clinical rounds
- Journal clubs
- CME on the Internet
- Academic activities
- Faculty development activities
- Research
- Publications
- Contributing to the medical community
- Participation on medical committees
- Being an examiner for family medicine and emergency medicine examinations
- Being a peer reviewer for medical journals
- Being a Pearls™ facilitator or a Pearls. ce tutor
- Self-learning activities
- Self Learning Program
- *Other self-learning activities*
- Practice audits
- Individual consideration

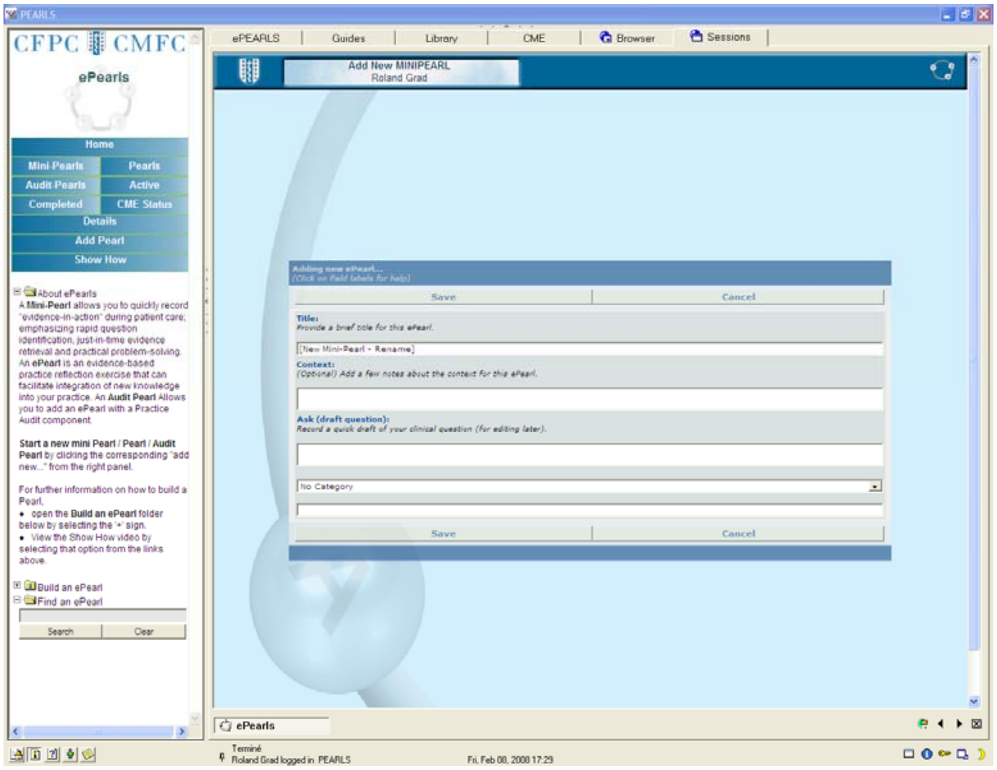
Criteria for the "other self-learning activity" to be eligible for MainPro M1 (According to CFPC):

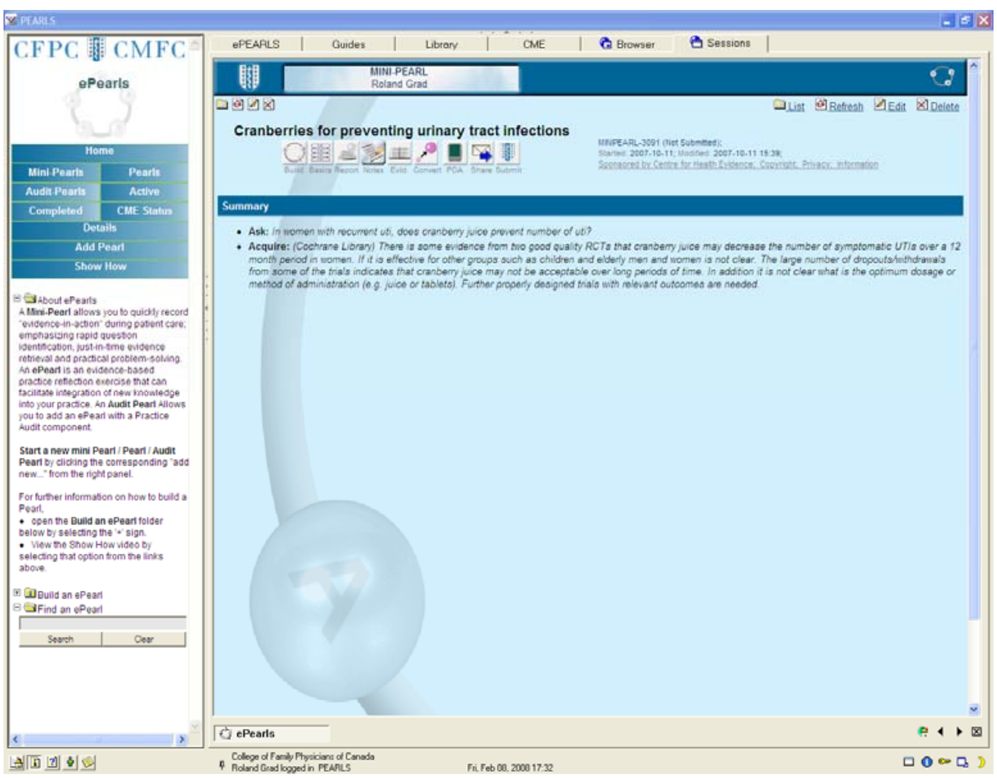
- Must be relevant for clinical practice
- Must improve clinical practice
- Individual request: doctors must write a letter explaining how this activity (e.g. reading and rating InfoPOEMs) improves their clinical practice.

Example:

- Attending a 2 day workshop may correspond to 12 Mainpro-M1 credits.
- Mainpro-C credits are offered when learning activities contain pre-assessment and follow-up (e.g. 6-month post-evaluation).

APPENDIX G. CENTER FOR HEALTH EVIDENCE & COLLEGE OF FAMILY PHYSICIANS OF CANADA: MINI-PEARL®

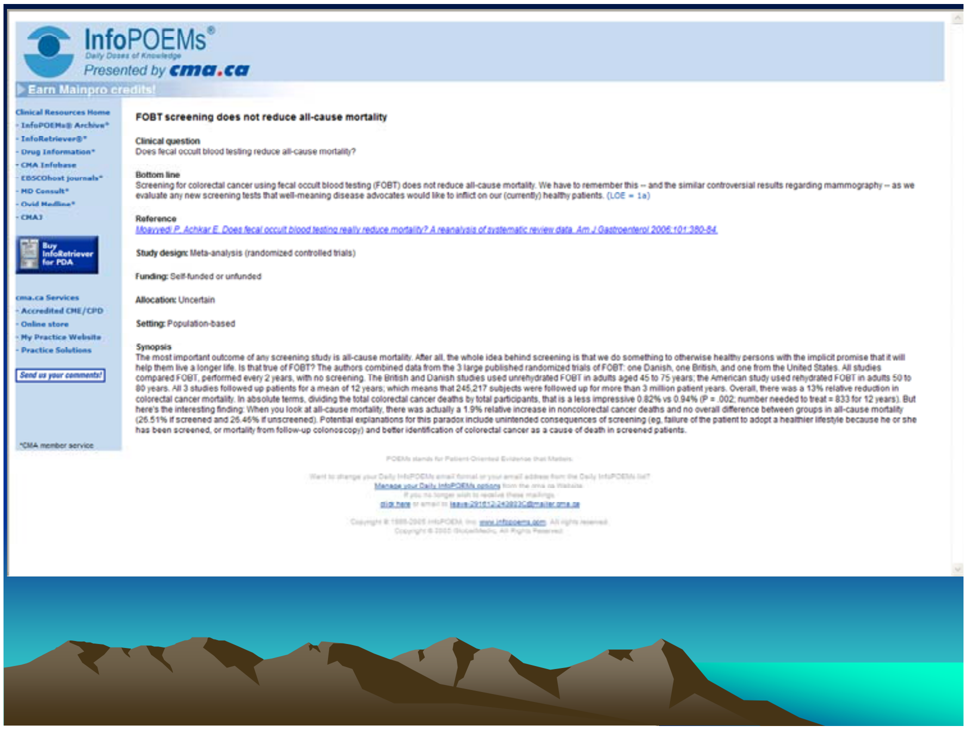




Reproduced with authorization

APPENDIX H. THE MCGILL 'INFORMATION ASSESSMENT METHOD' IAM 2005 FOR PUSH TECHNOLOGY

Example of Synopsis sent by daily email to physicians (CIHR-funded study).



InfoPOEMs®
Daily Doses of Knowledge
Presented by cma.ca
Earn Mainpro credits!

Clinical Resources Home
- InfoPOEMs® Archive*
- InfoRetriever®*
- Drug Information*
- CMA Infobase
- EBSCOhost journals*
- MD Consult*
- Ovid Medline*
- CMAJ

Buy InfoRetriever for PDA

cma.ca Services
- Accredited CME/CPD
- Online store
- My Practice Website
- Practice Solutions

Send us your comments!

*CMA member service

FOBT screening does not reduce all-cause mortality

Clinical question
Does fecal occult blood testing reduce all-cause mortality?

Bottom line
Screening for colorectal cancer using fecal occult blood testing (FOBT) does not reduce all-cause mortality. We have to remember this -- and the similar controversial results regarding mammography -- as we evaluate any new screening tests that well-meaning disease advocates would like to inflict on our (currently) healthy patients. (LOE = 1a)

Reference
Moayyedi P, Achkar E. Does fecal occult blood testing really reduce mortality? A reanalysis of systematic review data. Am J Gastroenterol 2006;101:380-84.

Study design: Meta-analysis (randomized controlled trials)

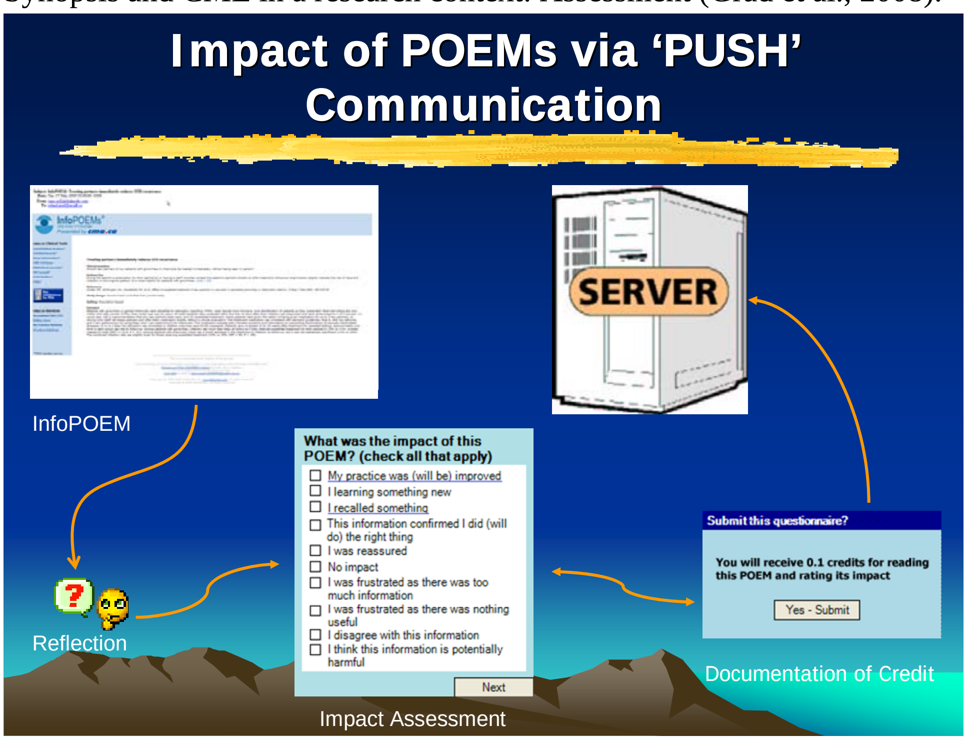
Funding: Self-funded or unfunded

Allocation: Uncertain

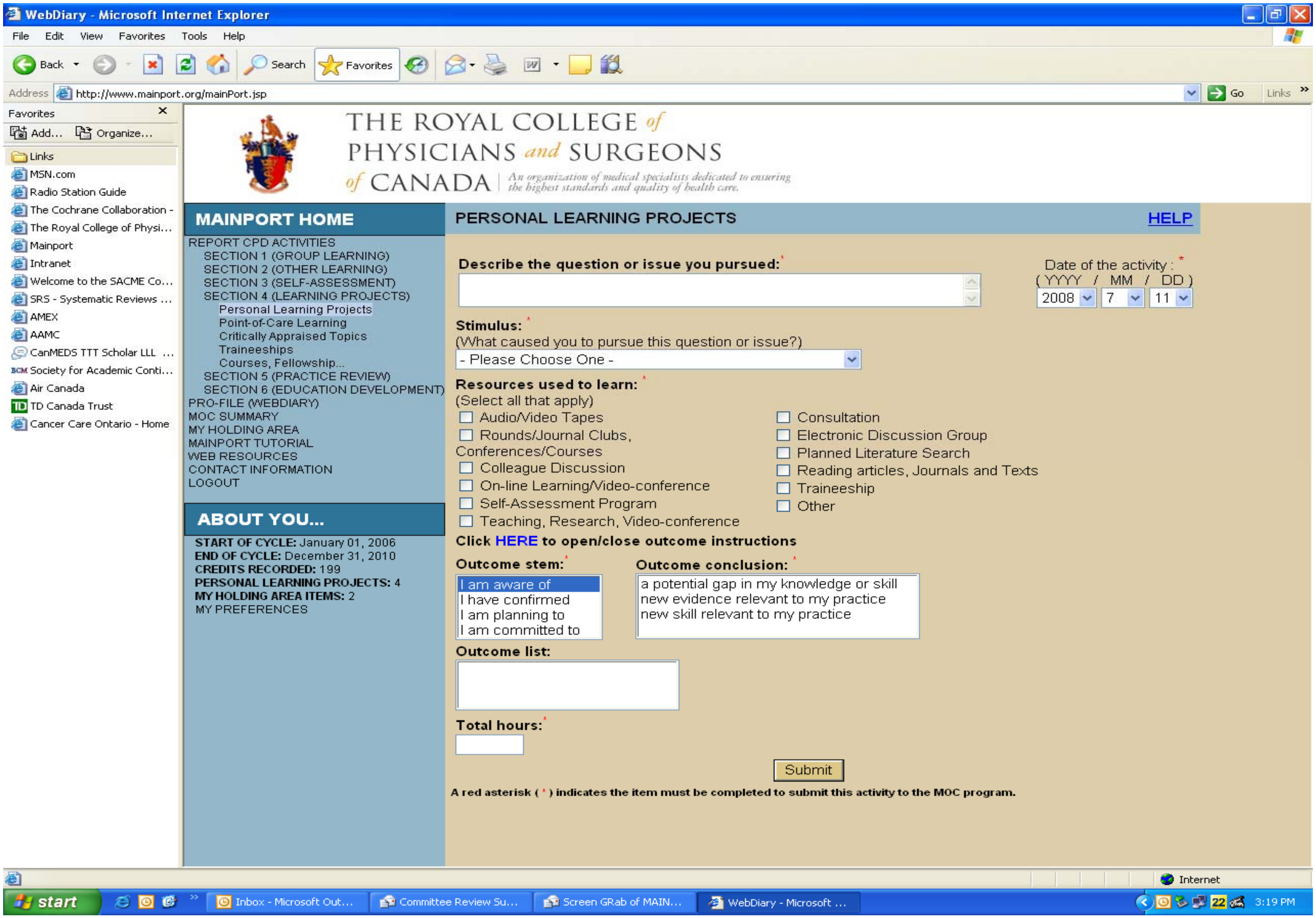
Setting: Population-based

Synopsis
The most important outcome of any screening study is all-cause mortality. After all, the whole idea behind screening is that we do something to otherwise healthy persons with the implicit promise that it will help them live a longer life. Is that true of FOBT? The authors combined data from the 3 large published randomized trials of FOBT: one Danish, one British, and one from the United States. All studies compared FOBT, performed every 2 years, with no screening. The British and Danish studies used unrehydrated FOBT in adults aged 45 to 75 years; the American study used rehydrated FOBT in adults 50 to 80 years. All 3 studies followed up patients for a mean of 12 years; which means that 245,217 subjects were followed up for more than 3 million patient years. Overall, there was a 13% relative reduction in colorectal cancer mortality. In absolute terms, dividing the total colorectal cancer deaths by total participants, that is a less impressive 0.82% vs 0.94% (P = .002; number needed to treat = 833 for 12 years). But here's the interesting finding: When you look at all-cause mortality, there was actually a 1.9% relative increase in noncolorectal cancer deaths and no overall difference between groups in all-cause mortality (26.51% if screened and 26.46% if unscreened). Potential explanations for this paradox include unintended consequences of screening (eg, failure of the patient to adopt a healthier lifestyle because he or she has been screened, or mortality from follow-up colonoscopy) and better identification of colorectal cancer as a cause of death in screened patients.

Synopsis and CME in a research context: Assessment (Grad et al., 2008).



APPENDIX I. THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF CANADA: LEARNING PROJECTS



APPENDIX J. INTERVIEWS WITH MEMBERS OF THE CME EXPERT PANEL

- Acknowledgement
- Summary of answers regarding questions on push technology and CME
- Interview guide

Acknowledgement: CME Expert Panel

Name	Organization	Country
Dr. Craig Campbell	The Royal College of Physicians and Surgeons of Canada	Canada
Dr. Nancy Davis	National Institute for Quality Improvement and Education (www.niqie.org)	USA
Dr. Mark Ebell	Medical College of Georgia, University of Georgia	USA
Dr. Tom Emslie	Department of Family Medicine, University of Ottawa	Canada
Dr. Michael Fordis	Senior Associate Dean for Continuing Medical Education, Baylor College of Medicine	USA
Dr. Roland M. Grad	Department of Family Medicine, McGill University	Canada
Francine Kerdman	The College of Family Physicians of Canada	Canada
Dr. Bernard Marlow	The College of Family Physicians of Canada	Canada
Dr. Allen Shaughnessy	Public Health & Family Medicine, TUFTS University	USA
Dr. David Topps	Northern Ontario School of Medicine, Sudbury, Ontario	Canada

Summary of answers regarding question 3: Do you know other examples of claiming CME credits for information delivery activities (push)?

Answers classified by theme and presented in alphabetical order

Yes

- E-mails come with a printed based packet.
- MedPages, similar to InfoPoems, is developed in University of Pennsylvania, information is being pushed out and receive CME credits (http://www.medpagetoday.com/). Recent articles that primarily discuss new findings go through a summary process in the Medical School of University of Pennsylvania. After subscription, users receive MedPages regularly.
- Medscape
- Prescribers' Newsletter (printed letter, delivered in the mail). Reading this matter and answer a few questions are eligible to earn one M1 credit.
- Printed version of information.
- There are, but not on top of my head now.

No

- I don't know. CME credits should not be eligible for merely subscribing to InfoPOEMs.
- No, except InfoPOEMs.

Comment

- In the USA, the Accreditation Council for CME, the American Medical Association (AMA), and the American Academy of Family Physicians (AAFP) contribute to the accreditation of informational resources such as CD ROM, journals, and other educational materials. This accreditation requires pre and post tests. In Canada, there is no such accreditation.

Summary of answers regarding question 4: In your opinion, under what conditions should information delivery (push) be eligible for CME credits?

Answers classified by theme and presented in alphabetical order

Answering a ‘reflective learning’ questionnaire:

- How information delivery is linked to the learning process or reflection determines the eligibility for accreditation .
- In this way, there are incentives for information use, especially when micro credits are accumulated, and doctors are more likely to use pulled and pushed information.
- Self assessment of learning.
- The demonstration that information is processed.
- Thinking refers to reflection. When a doctor reflects on information delivered, he or she should get credits for it.
- Using the InfoPOEMs questionnaire.

Valid information:

- Good evidence coming from a reliable source.
- Similar to information retrieval: creditable and non-biased sources.

Group learning:

- Both pulled and pushed information can be put onto a doctor’s personalized web-sites such as blogs for discussion. In a discussion, right questions are probed, and additional information either pulled or pushed is used to answer questions raised.
- Interactivity with either other physicians or a facilitator.

Information use:

- Documentation of some inputs to their practice.
- Some documentation of the receiver whom read pushed information and then implement it in clinical practice.
- Same conditions as information retrieval. Document the actual use of information, and its impacts. The documentation is about change.

Alternative stances:

- As for ‘reading’ activities.
- InfoPOEMs makes it too simple.
- Information delivery is passive, and should set the bar higher to get reflection (in comparison with information retrieval).
- No CME credits.
- Push is like reading a journal on paper.

Guide for Interviewing CME Experts

Name:______________________________ Date:______________ Hour:___________

The interviews will be composed of three parts in the sequence of introduction, elicitation of information guided by prepared questions, and conclusion. The contents of these parts are organized and presented in chronological procedures. Part 1 comprises procedures from one to six. Part 2 includes procedures seven to eleven, and procedure 12 is for Part 3.

1. **Greeting – A brief introduction of the interviewer**
   Interviewer: I am Kit Leung, Ph D Candidate in Education, and a research assistant working for Pluye and Grad. Thanks for your participation in this interview in the context of our research project of a CIHR-funded literature review & environmental scan. (CIHR is equivalent to the NIH)

2. **Requesting permission to record the interview**
   Interviewer: Do you mind if I audiotape our conversation? I will use the recording for note taking, and for writing up an interview report. This recording will be deleted after all follow-up tasks for this interview are completed. No research issues will be included, and your quotes will not be cited.

3. **Introducing the CIHR-funded review project, and the goals of the interview**
   Interviewer: Our review project examines the ways electronic knowledge resources can be used for continuing medical education , hereafter "CME". These resources we specifically examine are **Information Retrieval**, and **Information Delivery**. The goal of this interview is to find out how CME credits can be earned using information retrieval and delivery for learning.

4. **Explaining the two key concepts**

   Interviewer: We sent you our definitions of the key concepts. Do you agree with these definitions?

   If not, I explain the two key concepts:

   Information Retrieval is defined as a system of computers that serves to store information in different databases, and to **PULL** this information from these databases. This system is incorporated in networks and with search engines such as InfoRetriever for example, to find answers to questions asked by a physician.

   Information Delivery PUSHes reference materials such as synopses of clinical research evidence. In the form of e-mail messages, synopses such as InfoPOEMs are delivered to clinicians on mailing lists. The clinician learns about current research evidence, and then decides which evidence should be used for a specific patient case.

5. **Explaining What we know from our background and literature review:**
   Interviewer: We also sent you the findings of our background and literature review. Would you like me to go through these findings with you?

   If yes, explain the findings:
   The findings of our background and literature review indicate three things:

First, Information retrieval and delivery are increasingly used by doctors to update their knowledge and in clinical practice for problem solving.

Second, this use leads to three learning outcomes based on the Bloom taxonomy. They are
- Knowledge (e.g. describing a medical problem)
- Application (e.g. solving a problem of a specific patient)
- Evaluation (e.g. critically evaluating retrieved information)

Third, information retrieval and delivery consist of self-learning activities that may involve self-assessment. For example in family medicine in Canada & USA:
- Canada Information retrieval activities may lead to claim M2 credits (College of Family Physicians of Canada), like readings.
- *US: Information retrieval activities may lead to claim Prescribed credits (American Academy of Family Physicians), like searches in InfoRetriever.*
- Canada Information delivery may lead to claim M1 credits in a research context (Practice Solutions - Canadian Medical Association subsidiary- College of Family Physicians of Canada & McGill InfoPOEM study).

6. **Introducing the structure of the interview**
Interviewer: In this interview, I'll ask you five questions. Questions 1 and 2 concern information retrieval, questions 3 and 4 concern information delivery, and question 5 wraps up learning activities associated with both information retrieval and delivery.

7. **Interview: Question one**
Interviewer: Here we go. Question one: "Do you know other examples of claiming CME credits for information retrieval activities?"

Interviewee: "YES" – Would you please explain me these examples, and suggest contacts and websites for more information.

"NO" – Question 2

8. **Interview: Question two**
Interviewer: Here is question two: "In your opinion, under what conditions should information retrieval or PULL be eligible for CME credits?"
Interviewee: XXXXXX

Interviewer: To recap, I have a list of **"yes" and "no" sub-questions** for you. After I ask each **sub-question**, please give me a "yes" or "no" response. If you would like to elaborate or justify your response feel free to do so.

2.1. Should information retrieval be eligible for CME credits only when PULLED information is relevant for a specific patient?

Interviewee: "NO" - Question 3

Interviewee: "YES" – Probe 2.2

2.2. Should information retrieval be eligible for CME credits only when PULLED information is relevant and is used to modify any doctor's action?

9. **Interview: Question three**
Interviewer: Now we move on to Question three: "Do you know other examples of claiming CME credits for information delivery activities?"

Interviewee: "YES" – Would you please explain me these examples, and suggest contacts and websites for more information

"NO" – Question 4

10. **Interview: Question four**
Interviewer: Here is question four "In your opinion, under what conditions should information delivery or PUSH be eligible for CME credits?"
Interviewee: XXXXXX

Interviewer: To recap, I have a list of **"yes" and "no" sub-questions** for you. After I ask each **sub-question**, please give me a yes or no response. If you would like to elaborate or justify your response feel free to do so.

4.1 Should information delivery be eligible for CME credits only when PUSHED information is relevant for at least one doctor's patient?

Interviewee: "NO" – Question 5

Interviewee: "YES" – Probe 4.2

4.2. Should information delivery be eligible for CME credits only when PUSHED information is relevant and is used to modify any doctor's action?

11. **Interview: Question five**
Interviewer: Now, I wrap up this interview of information retrieval and information delivery by asking you this question: "What is currently under review regarding claiming CME credits for information retrieval and delivery activities?"

Interviewee: xxxxxxx

12. **Interview: Ending**
Interviewer: I would ask you if you have any comment about our review project or the interview.

Interviewee: XXXX

Interviewer: I thank you very much for your contribution to our CIHR-funded literature review & environmental scan.

APPENDIX K. MCGILL 'INFORMATION ASSESSMENT METHOD' (IAM) FOR PUSH TECHNOLOGY (COPYRIGHT # 1057518)

InfoPOEMs are emailed to the members of the Canadian Medical Association by Practice Solutions (cma.ca). For each InfoPOEM® rated using IAM2008, members of the College of Family Physicians of Canada automatically receive credits.

InfoPOEMs CME Program - Impact Assessment

You have earned 10/15 CME credits in 2008.

Notice: Change to InfoPOEMs Assessment Form

The questionnaire has been revised and is now faster to complete.

Receive 0.1 Mainpro-M1 credits from the CFPC for completing the assessment.

What is the impact of this InfoPOEM? (Check all that apply).
Note: You can check more than 1 box.

My practice is (will be) changed and improved ☐

What will you do differently?
(Check all that apply.)

	Change	Commitment to Change
Diagnostic Approach	☐	☐
Therapeutic Approach	☐	☐
Health Education / Disease Prevention	☐	☐
Prognostic Approach	☐	☐
Other (please specify)	☐	☐

I learned something new ☑

I am motivated to learn more ☐

This information confirmed I did (am doing) the right thing ☐

I am reassured ☐

I am reminded of something I already knew ☐

I am dissatisfied ☐

There is a problem with this information ☐

Which of the following problems did you encounter?
(Check all that apply.)

Too much information ☐

Not enough information ☐

Information poorly written ☐

Information too technical ☐

Other problem (please specify)

(Limit: 0/4000)

I disagree with the content of this information ☐

I think this information is potentially harmful ☐

☐ This information has no impact at all on me or my practice

Comment on this InfoPOEM or this questionnaire:

(Limit: 0/4000)

Is this information relevant for at least one of your patients?

- (•) Totally relevant
- ( ) Partially relevant
- ( ) Not relevant

Since this information is relevant for one of your patients, how will you use it?
Check all that apply. You may check more than 1 box.

☐ I will not use this information for a specific patient.

For thinking about this patient (e.g. to better understand a particular issue) ☑

To justify or maintain the management of this patient ☐

To modify management of this patient ☐

To persuade this patient or other health professionals to make changes ☐

With respect to a specific patient, do you anticipate any health benefits from using this information?
Check all that apply. You may check more than 1 box.

☐ I do not anticipate any benefits for a specific patient.

Increasing patient knowledge about health or healthcare ☑

Avoiding unnecessary or inappropriate treatment, diagnostic procedure or preventive intervention ☐

Increasing patient acceptability of treatment, diagnostic procedure or preventive intervention ☐

Preventing disease or health deterioration (including acute episode of chronic disease) ☐

Improving patient health or functioning or resilience (the way patients face difficulties) ☐

InfoPOEMs CME Program - Impact Assessment

Thank you for your feedback. You have earned 0.1 Mainpro-M1 credits by fully completing this assessment.

You have earned a total of 10.1 out of 15 CME Mainpro-M1 credits to date for 2008.

Transfer CME credits to CFPC
Your credits request will be transferred to the CFPC using the CFPC membership number: 92312.

You can de-activate the option or modify your membership number.

CME Credit Report
To receive your Daily InfoPOEMs CME Program credit report by email, click here.

View my CME Activities

IAM: SELECTED PUBLICATIONS (newest to oldest)

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APPENDIX L. LIST OF REVIEWERS

The authors gratefully acknowledge the contribution of the reviewers.

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