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Point of care information services: a platform for self-directed continuing medical education for front line decision makers

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ABSTRACT

The structure and aim of continuing medical education (CME) is shifting from the passive transmission of knowledge to a competency-based model focused on professional development. Self-directed learning is emerging as the foremost educational method for advancing competency-based CME. In a field marked by the constant expansion of knowledge, self-directed learning allows physicians to tailor their learning strategy to meet the information needs of practice. Point of care information services are innovative tools that provide health professionals with digested evidence at the front line to guide decision making. By mobilising self-directing learning to meet the information needs of clinicians at the bedside, point of care information services represent a promising platform for competency-based CME. Several points, however, must be considered to enhance the accessibility and development of these tools to improve competency-based CME and the quality of care.

INTRODUCTION

The medical community supports continuing medical education (CME) as a key intervention for the advancement of knowledge, development of new skills and capabilities, and, ultimately, the improvement of patient health and outcomes. For physicians across many countries, CME activities are mandatory for the maintenance of certification or renewal of licenses by professional associations.[1 2] Traditional CME activities implement didactic, teacher-driven methods in the form of large audience residential meetings, small-group workshops, and printed guidelines with the purpose to strengthen the knowledge base of health professionals. A key element of traditional CME activities is that someone else (ie, the instructor) determines what the attendees need to know, an approach often described as passive learning. Studies, however, consistently report the modest effects of these interventions, irrespective of the level of participation or the amount of resources dedicated to the programme (box 1).

These studies, combined with concerns over escalating healthcare costs and discrepancies between real and ideal practice across national healthcare systems,[7] have prompted efforts for CME reform. Over the last two decades, the definition and role of CME in healthcare systems evolved markedly, giving way to competency-based initiatives. The development of the terms "competency-based continuing medical education" (box 2) and "continuing professional development" reflect the changing face of CME, which aims not only to increase the knowledge of physicians, but to equip them with the skills and capabilities necessary to practice high-quality medicine.[8] In fact, competency refers to the ability to effectively translate high-quality knowledge into practice to positively impact patient outcomes.

Medical regulatory authorities and CME accreditation bodies have supported this shift in CME, modifying their accreditation standards to prioritise the evidence of competence rather than time or passive attendance as the measure of credit distribution. The Accreditation Criteria of the Accreditation Council of CME, for example, specifies that CME programmes should be designed to change physicians' competence, performance, or patient outcomes.[11] In 2000, the American Board of Specialties initiated Maintenance of Certification, a continuing professional development recertification programme that requires physicians to participate in performance assessment to maintain their specialty certificate.[12] In 2010, the Federation of State Medical Boards in the USA adopted the Maintenance of Licensure framework by which state medical and osteopathic boards can require physicians with active medical licenses to demonstrate continued clinical competence to obtain license renewal.[13]

Other countries have adopted similar competency-based initiatives. The Medical Council of New Zealand's CDP programme, General Scope Recertification, requires non-specialist physicians to complete a clinical audit and peer review in addition to CME.[14] Since 2004, the Federation of Medical Regulatory Authorities of Canada announced that all licensed physicians must undergo a recognised revalidation process, demonstrating commitment to continued competence and performance as a part of professional self-regulation. Regulatory authorities are currently implementing two continuing professional development programmes, the Maintenance of Certification programme run by the Royal College of Physicians and Surgeons of Canada,[15] and the similar Maintenance of Proficiency programme run by the College of Family Physicians of Canada (CFPC).[16] Similar revalidation programmes are being implemented in the UK, Ireland, and Australia. The standardisation of CME requirements is likely to expand into other geographical areas as well with formal accreditation systems becoming vaster on a global scale.[1 2]

In this climate for CME reform, self-directed learning has gained prominence as a promising

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Box 1 Evidence of effect of traditional continuing medical education (CME) methods

- In a literature review of educational techniques for health workers continuing professional education, didactic instruction (ie, passive instruction such as reading or lecture) either showed no statistical difference in learning outcomes or was found to be less effective than other techniques (eg, small-group interactive approach, self-directed study, clinical simulations).[3]
- In a meta-analysis of CME moderator variables in 61 interventions (31 studies), passive methods had modest effects (mean effect size of r=0.20; 95% CI 0.15 to 0.26) and active methods had larger effects (in comparison the mean effect size of r=0.33; 95% CI 0.13 to 0.50).[4]
- In an overview of systematic reviews and meta-analyses, passive learning (eg, clinical practice guidelines and opinion leaders' sessions) was shown to be less effective than interactive techniques in changing physician care and patient outcomes. Didactic presentations and distribution of printed information exhibited little or no beneficial effect on changing physician practice.[5]
- In a systematic review of 14 randomised controlled trials (17 interventions) studying the effect of traditional CME interventions on physician performance and healthcare outcomes, didactic sessions (ie, lectures or presentations with minimal audience interaction or discussion) were ineffective in changing physician performance.[6]

Box 2 Key terms used in this review

- *Competency-based continuing medical education*: postgraduate medical education programmes that prioritise competence, demonstrable skills and capabilities necessary to practice high-quality medicine, as the main outcome of the curriculum.
- *Self-directed learning*: an active learning approach in which learners take autonomy over the learning process, selecting what to learn, how to learn it, and where and when to engage in the learning.
- *Point of care information services*: online information sources that are integrated with technological innovations such as real-time information systems and portable electronic devices. *Examples*—ACP Pier, Best Practice, Clinical Evidence, Dynamed, EBMGuidelines, eMedicine, eTG, Micromedex, and UpToDate
- *Electronic health record*: an automated, electronic version of a patient's health history, which includes information such as past medical history, physical examinations, medications, immunisations, diagnoses, progress notes, and laboratory and radiology reports.[9]
- *Computerised decision support system*: information systems that link patient-specific data from electronic health records with evidence-based knowledge from point of care information services to generate case-specific reminders or guidance messages using a rule- or algorithm-based software.[10]

educational paradigm for ensuring the maintenance of the competence of the health professional workforce. In contrast with passive, didactic methods in which the teacher is the driver for learning, self-directed learning is an active approach in which learners take personal responsibility and authority over their learning. In other words, they independently identify their learning needs, define the goals, select the strategy, locate the appropriate resources, and reflect on the results and implications of what has been learnt.[17] Through self-directed learning, physicians can tailor their learning strategy to meet the needs raised in practice and directly apply the gained knowledge to accomplish specific tasks.

In 2001, the Institute of Medicine made a vital link between performance improvement and technology, articulating the need for a service that will align health professionals with current best practices through information services.[7] Today, busy clinicians have access not only to Medline, but to a plethora of online information solutions that can synthesise relevant medical literature and generate up-to-date information that matters in everyday practice.[18] Compared with traditional educational resources such as textbooks, online information sources that are integrated with technological innovations such as real-time information systems and portable electronic devices can better meet the information needs arising from patient–physician interactions.[18] These web-based compendiums are commonly referred to as point of care information services (or summaries) and are developed and produced by major medical publishers. Examples of point of care information services include: ACP Pier, Best Practice, Clinical Evidence, Dynamed, EBMGuidelines, eMedicine, eTG, Micromedex, and UpToDate.

This paper will discuss why self-directed learning is central for competency-based CME, how point of care information services can support self-directed learning, and strategies that can enhance the accessibility and improve the development of these tools to improve competency-based CME and its impact on the quality of care. Point of care information services are an innovative platform for self-directed learning at the front line of clinical decision making that can meet the growing information needs of clinicians.

SELF-DIRECTED LEARNING: PREPARING LIFELONG PHYSICIAN-LEARNERS

Although the definition of self-directed learning varies across literature, the core of self-directed learning is exemplified by autonomy over the learning process in which an individual chooses what to learn, how to learn it, and where and when to engage in the learning.[19] As Knowles well captures, "It is the sense of personal autonomy, not self-teaching that seems to be most important for adults."[20] Self-directed learning is a long-existing educational approach that can be traced back to the ancient Greek philosophers.[21] However, the approach's rise to prominence in the recent decades as a driver of CME can be attributed to the rapid advancement of science and technology and the resulting proliferation of information. Stiftelsen for industriell og teknisk forskning (SINTEF), an independent research organisation in Scandinavia, reported that 90% of all data in the world have been produced within the last 2 years.[22] Researchers at the University of California, Berkeley, estimated that the amount of new stored information nearly doubled between 1999 and 2003, growing at an estimated annual rate of 30%.[23]

The overwhelming influx of information presents two key challenges: keeping up to date with current information to avoid obsolescence and navigating the complex information system to identify the best available data. In the past, education represented a preparation for life.[24] In the late 1940s, for instance, secondary education provided students with 75% of the knowledge necessary to maintain employment until retirement; by the 1990s, the figure had dropped to 2%.[25] Without active learning, physicians cannot remain competent for more than a few years after graduation.[26] If the obsolescence of evidence in guidelines and systematic reviews is used as a proxy of the decay speed, half of the knowledge would expire in about 5 years.[27–29] It is imperative, therefore, that societies engage health professionals in CME activities that promote self-directed learning and active information-seeking behaviour to maintain competence.

Evidence for self-directed learning in health professions

Self-directed learning is an effective education tool. In addition to studies demonstrating positive correlations between self-directed learning readiness and academic achievement in undergraduate and graduate students both in real and online learning environments,[30–33] self-directed learning readiness has been positively correlated with work performance in the business, education, and public service sectors.[24] In a study by Reynolds and colleagues, hands-on simulation sessions in which students took an active role in their learning process led to significantly greater knowledge gains and overall learner satisfaction compared with passive lectures.[34] In a recent systematic review and meta-analysis by Murad *et al*, self-directed learning was associated with a moderate increase in the knowledge domain (standardised mean difference 0.45, 95% CI 0.23 to 0.67).[35] Results, moreover, suggested that learners make larger improvements in the knowledge domain if they are involved in selecting their own learning resources.

The level of learners' involvement in selecting their learning objectives and their level of direct engagement within the learning activities seem to be key predictors of the success of educational programmes and change in clinical practice. In a review of formal meta-analyses or other systematic reviews (26 reviews), Bloom concluded that interactive techniques (eg, audit/feedback, academic detailing/outreach, and reminders) are most effective in simultaneously changing physician care and patient outcomes, whereas didactic presentations and the distribution of printed information have little or no beneficial effect on modifying physician practice.[5]

TECHNOLOGY AND EDUCATION

The advancement of technology has created new platforms for the integration of self-directed learning into CME programmes. The use of technology as a medium for the delivery of instruction (eg, transfer of traditional teaching methods to virtual classrooms), however, does not guarantee improved learning outcomes.[36] While highly valued for reducing costs and increasing user access, education activities using internet technologies, referred to as e-learning, showed modest effects akin to those of traditional CME programmes in a recent meta-analysis of more than 200 studies.[37] Rather, in order to affect learning, the technology itself must directly integrate into the very method of instruction. The challenge, then, is how to channel technology to alter the educational paradigm of traditional CME to maximise physician competence and clinical outcomes.

The internet as a primary source of information

Physicians regularly engage in learning at the point of care, using online resources to support clinical decision making. A Canadian Medical Association physician survey in 1999 showed that 60% of its participants used the internet, 53% searched literature, and 41% used CME sites.[38] In a 2002 survey concerning internet use and learning, 80% of a random sample of 2200 US office-based physicians of all specialties reported that they the used the internet (eg, literature searches, accessing online journals) to locate medical information.[38] In recent years, the percentage of physicians accessing the internet to obtain health-related information has remained consistent, reaching 86% in 2009.[39]

Physicians, like many in modern society, are becoming much more digitally savvy: 58% of physicians perform searches more than once per day, including 65% of primary physicians. The 2012 Physician Channel Adoption study by Manhattan Research and Google added that physicians spend twice the amount of time reviewing online resources (eg, search, professional websites, drug references, and mobile apps) compared with print (ie, journals and reference materials), the majority of which (64% of online time) is used on resources for clinical decisions.[40]

Use of mobile devices to access information

The use of personal digital assistants, tablet computers, smart phones, and other mobile devices is increasing in the medical profession, reflecting the demand for more accessible information to support clinical decision making. The 2012 Manhattan Research-Google study showed that 87% of US physicians use a smart phone or a tablet in the workplace.[40]

A 2011 survey at a large Canadian medical school found the use of mobile computing devices to be widespread and frequent among medical students, residents, and faculty: 85%, 90%, and 85%, respectively, reported using a device.[41] Eighty-five per cent of the users, overall, used the device at least once a day for medical purposes. Portability, flexibility, and access to multimedia were identified as their main advantages of mobile devices, whereas information management, communication, and time management were considered the main uses of the technology. In regards to information management, participants accessed various resources such as online textbooks, medical journals, medical podcasts, medical calculators, and online lectures. Participants, however, raised concerns about navigating the available information to find relevant applications and determining the quality of contents.

In a more recent survey of medical students, residents, and faculty members at four Canadian universities (1201 respondents), about 93% and 48% of the participants, respectively, reported to owning a mobile device and using it to access medical resources.[42] Interestingly, when the survey asked participants to list their favourite resources as well as the most recently accessed resource, 7 (ie, UpToDate, Epocrates, Medscape/eMedicine, Lexicomp, DynaMed, Pepid, and Micromedex) and 6 (ie, UpToDate, Medscape/eMedicine, Lexicomp, Epocrates, DynaMed, and Pepid) of the top 10 most frequently cited resources, respectively, were point of care services.

Physicians' concern over negatively affecting the patient experience may impede their adoption of mobile devices during patient consultations. A 2009 survey found 92% of physicians to access health information from their office compared with only 21% who perform searches while a patient is in the examination room.[39] The 2012 Manhattan Research-Google study

showed similar trends: 77% of physicians use search engines between patient consultations, 70% after work or on weekends, and 41% during patient consultations to locate clinical or treatment information.[43] A recent survey of US patients, however, indicated that the majority (greater than 80%) would not be bothered by physicians' use of electronics (ie, tablet, laptop computer, and desktop computer) during exams.[44] Patients, in fact, showed a stronger preference towards the use of electronic versus paper health records at the point of care. We suggest that further research is important to explore patients' perceptions and receptivity to the use of technology in the decision-making process.

Medical information-seeking behaviour plays a key role in physician learning

A specific patient problem has been identified as the most common reason for seeking information on the internet.[38] On average, clinicians generate at least one question per patient visit.[45 46] Questions that arise from interacting with patients contextualise learning, serving as a key trigger for the self-directed learning process. Most of these questions can be answered, although several barriers (eg, too much information to scan and the lack of question-specific information) often impede physicians from accessing the right information at the right time.[38] If these triggers are not adequately channelled to locate the appropriate information, the opportunity to improve knowledge and adopt best practice strategies is missed. The interaction between the clinician and information sources, such as bibliographic and journal databases (eg, PubMed), should be facilitated at the point of care.

POINT OF CARE INFORMATION SERVICES FOR SELF-DIRECTED LEARNING

Two characteristics distinguish point of care information services from other self-directed learning activities: (1) focus on information that matters and (2) on-site learning.

Information that matters

An important characteristic of point of care information services is its ability to engineer meaningful and up-to-date syntheses of evidence for use at the point of care.[18] These services are positioned at the tip of Haynes' pyramidal model for evidence-based literature products for clinical decision making: they are comprehensive and sophisticated information tools (ie, systems and summaries) built upon a systematic assembly of evidence.[18 47]

Point of care information services assemble information from primary (eg, clinical trial results, original articles) and secondary (eg, systematic reviews) research articles in authoritative biomedical journals, logically order the data according to a medical scenario, and translate the data into a set of actions.[48] The actions are presented to physicians as a structured list of items featuring a summary, background information on a disease or condition, prevention measures, diagnoses, recommendations for treatment or management, and options for additional reading. By mimicking the natural thought flow of physicians from diagnosis to treatment, point of care information services can easily integrate into their regular clinical work flow.[18]

On-site learning to build professional competence

Point of care services can increase health professional's competence by moving learning directly to the site of practice. Much of the knowledge that is used in everyday practice is learnt within practice itself;[49] such knowledge, in turn, gains meaning through the context by which it was acquired.[50] Learning occurs when new knowledge is acquired and when existing knowledge is used in a novel context or in new combinations.[51] When health professionals apply prior knowledge to a new patient case, for example, they create personal knowledge, cognitive resources that individuals bring to a situation that enable them to think, interact, and perform.[51 52]

Skills are a part of personal knowledge, a representation of individual competence or expertise.[51] Health professionals acquire competence through non-formal learning in clinical practice as they expand their personal experiences and interact with their surroundings.[53] Contrary to formal learning, which occurs in structured learning environments (eg, courses and training seminars) with a prescribed curriculum and designated teacher or trainer, non-formal learning is often spontaneous and unplanned, triggered by the challenges and complexities of work as well as interactions with colleagues and patients.[51 54] Health professionals regularly learn during clinical practice as they participate in a multidisciplinary team, collaborate with colleagues, encounter patients, confront challenges, and solve problems.[55]

Point of care information services as a vehicle for self-directed learning

David Sackett, the pioneer of evidence-based medicine, describes evidence-based medicine as "a process of life-long, self-directed learning in which caring for our own patients creates the need for clinically important information about diagnosis, prognosis, therapy, and other clinical and health care issues…"[56] He further explains five steps that physicians regularly undergo to convert knowledge into practice so as to improve performance: (1) the conversion of information needs into answerable questions; (2) search for the best available evidence to answer the questions; (3) critical appraisal of the evidence to determine its validity (closeness to the truth) and usefulness (clinical applicability); (4) integration of this appraisal with personal clinical expertise, and the application of the evidence into practice; and (5) evaluation of performance. These five steps can be consolidated into the three mechanisms of self-directed learning integrated in point of care information services: needs assessment, problem-based learning, and self-reflection (box 3).

This approach offers several advantages. It stimulates reflection, a key component of self-directed learning activity that occurs before, during, and after a particular situation (eg, patient visit). The purpose of reflection is to develop a greater understanding of both oneself and the situation in order to use the experience to inform and improve future encounters with the situation.[57] Introduced by Donald Schön, the concept of

Box 3 Self-directed learning activities driven by point of care information services

- *Needs assessment* assessing practice needs and knowledge gaps.
- *Problem-based learning* identification of problem and conversion of problem into a testable question; searching and locating the appropriate resources (literature); critical appraisal of evidence; selection of best-available, high-quality knowledge for application in practice.
- *Reflection*: reflecting on the outcomes of applied knowledge and its efficacy for future cases.

reflective practice identifies reflection as a key component of professional growth.[58] Through his research, Schön determined that 'skilled practitioners' are 'reflective practitioners' who regularly use their experiences to assess and revise existing 'theories of action,' one's perception of how something works, to develop more effective strategies of action.[58 59] When information triggered by a patient-specific question is directly applied back to the patient, the physician must then evaluate the results of his or her action. These outcomes build upon the physician's knowledge base and help inform future encounters with similar patient cases.

Moreover, point of care information services create opportunities for the consolidation of new knowledge. Practitioners tend to pursue traditional education around topics they are already good at, while avoiding areas in which they lack understanding.[60] The technology's speed and close connection with practice needs support the simultaneous identification of knowledge gaps and pursuit of new information in areas for improvement. The use of point of care information services can also limit the risk of information inertia, a knowledge gap that remains unanswered.[45 46]

Review of available point of care information services

The number of high-quality point of care information services on the market is increasing. In 2008, Banzi *et al*[18] performed a comprehensive search to identify English language point of care information services, which they defined as online-delivered summaries that are regularly updated, claim to provide evidence-based information, and are engineered to be used at the bedside (ie, the point of care). All of the selected services complied with the two pillars of evidence-based information mastery: filtering and organising. In other words, medical literature is selected for relevance and validity (filtering) and presented in a quick, easy, accessible form (organising). The investigators excluded meta-lists and search engines that collects and duplicates information sources to privilege original products that elaborate this information into original and structured contents.[18] They found 30 eligible point of care information services, 18 of which met all of their criteria: 5-Minute Clinical Consult, ACP-Pier, BestBETs, CKS (NHS), Clinical Evidence, DynaMed, eMedicine, eTG complete, EBM Guidelines, First Consult, GP Notebook, Harrison's Practice, Health Gate, Map Of Medicine, Micromedex, Pepid, UpToDate, and ZynxEvidence.[18]

In 2012, the same team repeated the search and screened 42 eligible online products, including four new EBP point of care information services (ie, Best Practice, Mosby's Nursing Consult, Nursing Reference Center, Rehabilitation Reference Center).[61] Most services were produced in the USA. The main target audience remained physicians, while three new services targeted nurses and physiotherapists.

When compared with the first analysis (2008), Banzi *et al* noticed some improvements in the summary content presentation features. However, point of care information services still varied widely in their quality of content development and capacity to update and grade evidence. The high variability of the quality of point of care information services has been assessed in several other studies that considered the speed of updating,[18 62 63] editorial quality and coverage,[64] and type of citations.[65] Clinicians should carefully assess the characteristics of each point of care information service (eg, speed of updating) to determine its overall quality and suitability for a particular practice.

There remains limited evidence on the effectiveness of point of care information services on practice improvement and patient outcomes (eg, morbidity, mortality, quality of care indicators) despite the increasing number of available services. Early assessments of access to diverse evidence repositories, however, suggest that 'filtered' evidence (eg, in the form of evidence-based synopses, systematic reviews, and clinical practice guidelines and computerised decision support tools) can improve clinical care compared with 'unfiltered' evidence (eg, in the form of bibliographic, journal, and drug information databases).[66]

While were unable to locate any data regarding the cumulative diffusion of point of care information services, it is our impression that the use of these services is becoming common. For instance, one service reports that more than 850 000 clinicians across 164 countries have access to point of care information services.[67] Finland and Belgium, for example, have a national provision of one point of care information service for all healthcare professionals.[68] This pattern of diffusion parallels the results from studies exploring the information-seeking behaviour of healthcare providers.

Although health professionals use a wide spectrum of information resources such as consulting their colleagues, PubMed, and Google, there is a strong predilection for point of care resources to provide pre-appraised information.[69 70] As health professionals adopt point of care information services, there is a need to assess the evolution of these products over time and their effectiveness as vehicles for the dissemination of best practice strategies. Seeking to measure the impact of point of care information services, quasiexperimental and experimental studies have explored different patterns of care in primary and secondary settings with and without access to the information services.[71–73] Overall, health professionals with access to point of care information services seemed to improve the quality of patient care: for instance, 6% of physicians who used point of care information service stated that the death of a patient was avoided as a result of the information.[73] These results are promising. By better connecting the information needs of physicians with CME activities, point of care information services can support self-directed learning and help improve the efficiency and quality of healthcare delivery.

STRENGTHENING POINT OF CARE INFORMATION SERVICES FOR COMPETENCY-BASED CME

The following strategies can support the integration of CME activities with point of care information services to advance the self-directed, competency-based model of CME.

Credits where credit is due

Physicians and other health professionals should earn CME credits while searching through point of care information services. The search for high-quality evidence, its filtration, and application to a clinical case are important tasks that should be recognised as CME activities. When health professionals modify their behaviour or advice given to patients based on evidence from randomised controlled trials or systematic reviews, they are refining their information mastery. In this context, information mastery entails the skills necessary to locate clinically sound and relevant information in the least amount of time, as well as to transfer the information to patients. Publishers and accreditation entities should coordinate their activities such that point of care information services can easily track, record, and communicate the searches completed by health professionals to accreditation bodies, which can then issue the earned credit.

In addition to the recognition of searches using point of care information services as a type of CME activity in and of itself,

CME accreditation bodies should support the maturation of point of care information service developers as CME providers. The accreditation process is becoming increasingly challenging. CME stakeholders are required to produce large amounts of information to fulfil the expectations of accreditation bodies. The content areas addressed by the CME programme; target audience; types of activities; expected results in terms of changes in knowledge, competence, or patient outcomes at the completion of the programme; activity formats; and commercial support are only a fraction of the overall requirements requested by accreditation bodies. Currently, it is easier for a drug company-sponsored residential event to fulfil accreditation requirements compared with point of care information services, especially as the outcome of the latter is considered more unpredictable. In fact, we cannot predict exactly who will use point of care information service contents, how the content will be implemented, and for which patient; however, the impact of point of care activities potentially exceeds that of commercially sponsored meetings.

Valuing the impact of the information

A few accreditation entities are beginning to recognise the importance of point of care information services and searches as well as other innovative educational programmes as CME activities. For instance, the CFPC issues up to 0.5 CFPC credits for each search submitted. However, the educational value of using point of care information services may still be undermined. The value of a CME activity is often evaluated according to three dimensions: its absolute value (eg, 0.5 or 1 credit), formal recognition (eg, category 1—formal or 2—informal, in the American Medical Association Physician's Recognition Award system), and relative value compared with other educational activities (eg, the activity is limited to minimal and maximal amounts compared with others). Again, passively participating in a scientific meeting may award more credits than locating essential information that matters to a patient at a crucial time. We urge accreditation entities, therefore, to support the transition from traditional CME models to a competency-based framework that promotes self-directed learning.

Furthermore, accreditation entities should recognise physicians' ongoing commitment to information mastery and restrict policies (ie, 'one size fits all') that ascribe value to a CME activity based on its length or duration. Rather, accreditation bodies should evaluate each CME activity according to the quality and utility of the information presented. This policy will address the problem of overwhelming irrelevant information (ie, the information paradox).[74]

Education 'on-demand'

Publishers that develop point of care information services should continue to invest in maturing these services for educational purposes. The use of 'just-in-time' (ie, solving a doubt about the clinical management of a patient that a physician can apply to that patient in real time) can be enhanced by an 'on-demand' teaching approach (ie, the physician chooses different clinical scenarios that he or she might face in future practice and explores the relevant evidence to solve the case).[75 76] Clinical vignettes serve this role and can provide users with the opportunity to understand the clinical applicability of evidence while transforming point of care evidence into a more interactive learning experience.[18 77]

CME on demand might also differ from traditional e-learning platforms owned by publishing groups. The advent of Free Open Access Meducation (FOAM) resources has opened a new outlet for the synthesis and exchange of information within the medical community.[78] FOAM builds upon social networking websites (eg, blogs, podcasts, tweets, Google hangouts, web-based applications) to create a space for health professionals to discuss, for example, treatment options and best practice strategies as well as critically appraise and evaluate scientific literature.[78] The content within discussion forums are regularly scrutinised by the online community, providing a mechanism for postpublication peer-review to ensure the accuracy and quality of the evidence presented. EMCrit, a FOAM resource comprising of a blog and a series of podcasts on emergency department critical care, has been accredited by the Accreditation Council of Continuing Medical Education (1 h of American Medical Association Category 1 credit per podcast episode) and various international accreditation entities.[79] We advocate for the identification of other open learning contents and their subsequent accreditation.

Electronic health records

Publishers should regularly update users on the availability of new contents and applications in their point of care information services to maximise their use and potential payback. Publishers that provide only one stand-alone service (eg, information), regardless of its quality, might be perceived as static and remote from practice. The information needs of health professionals will be better satisfied through information hubs in which evidence are rearranged to serve different purposes. The key aggregation point is likely to be the electronic health record (EHR).

The integration of point of care information services with EHR constitutes the modern computerised decision support system (CDSS). These information systems link patient-specific data from EHRs with evidence-based knowledge from point of care information services and generate case-specific reminders or guidance messages through a rule- or algorithm-based software.[10] The messages are based on the latest evidence from scientific literature and delivered to physicians via electronic media (eg, computer, smart phone, or tablet). CDSSs can also generate structured practice audits and performance metrics for self-assessment. Finland's Evidence based Medicine electronic Decision Support is one such technology.[80]

The interaction of point of care information services with EHRs will constitute the core of modern CME activities, and will align the maintenance of certification to best practice uptake.[81] If this interaction fails due to the prevailing interests of one entity over the others, resulting in the maintenance of separate services that serve narrow, albeit valuable needs, health professionals will waste time and efforts to overcome microlegal and organisational requirements outside of their clinical workflow.[82] We recognise that this step requires further resource and infrastructure investments by publishers as well as accreditation and health policy entities; however, this proposal can increase the overall efficiency of physicians' regular routines, promoting education, information, and quality improvement as an integrated and iterative process.

CONCLUSION

Accreditation bodies and medical societies have already begun to shift from the traditional model of CME towards competency-based CME in which physicians must prove ongoing competence and performance through participation in CME activities.

Accreditation entities, medical societies, and publishers should continue to support this shift by providing physicians with functional opportunities and additional incentives to engage in competency-based CME programmes. Questions

arising from patient visits are key opportunities for competency-based CME. To encourage the active seeking of evidence that matters at the point of care, better credit compensation for these efforts should be awarded. The EHR should be explored as an aggregation point for professional development, a space in which physicians can continuously transfer questions and observations from practice and obtain answers to mature their expertise. These changes would meet the growing needs for competency-based CME reform to optimise patient outcomes and sustain a proficient healthcare professional workforce.

Main messages

- Continuing medical education (CME) is shifting from a traditional, passive model to a competency-based, self-directed learning model.
- The integration of point-of-care services into web-based CME programmes can better meet the information needs of clinicians during practice.
- CME providers should increase physician participation in a competency-based model by recognising and incentivising the usage point of care services as CME activities.

Current research questions

- What role will the electronic health record play in linking point of care service searches and continuing medical education (CME) activities?
- How can accreditation bodies accurately evaluate the quality of point of care services for CME for improving clinician behaviour and patients' outcomes?
- What is the best organisational infrastructure to support collaboration among health professionals, accreditation bodies, publishers, and CME providers to maximise the benefit of CME activities?

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Self-assessment questions

Please answer true or false to be below,

1. Systematic reviews consistently show the modest effects of traditional continuing medical education interventions such as large audience residential meetings, small-group workshops, and printed materials.
2. Point-of-care services are web-based compendiums that facilitate clinician interaction with information resources at the bedside to support decision making.
3. Information mastery signifies the skills to locate relevant and evidence-based information in the least amount of time as well as the ability to successfully transfer the information to the patient.
4. Clinical vignettes are promising tools for supporting the 'on-demand' teaching approach in which a physician engages with different clinical scenarios that may be encountered in future practice and explores relevant evidence to solve the case.
5. Self-directed learning is a novel education model that involves the ability to take control of the mechanics and techniques of teaching oneself a particular subject.

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Answers

1. True
2. True
3. True
4. True
5. False

Point of care information services: a platform for self-directed continuing medical education for front line decision makers

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