

**Exploring learning experiences and outcomes among cardiologists participating in a web
conference workshop series.**

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Abstract

Opportunities for supporting physician continuing professional development (CPD) may exist through careful instructional design and creative use of information and communication technology. The overarching goal of this study was to explore the learning experiences and outcomes of cardiologists participating in a web conference (“webinar”) series to understand the factors that can support webinars in being an appealing and satisfying CPD medium for these learners. Acknowledging that a pedagogically-based framework for program design is a cornerstone of effective CPD (Hutchinson & Estabrooks, 2009; Inan & Lowther, 2007; Casimiro, MacDonald, Thompson, & Stodel, 2009), this study used the W(e)Learn Framework (MacDonald, Stodel, Thompson, & Casimiro, 2009) as a process guide and quality standard for program design, development and delivery.

Cardiologists voluntarily participated in an educational webinar series in which they shared their observations and experiences. Informed by the results of a systematic review of physician eLearning design preferences, this dissertation serves as a mechanism to learn about how webinars can be implemented to support learning and practice change within a population of highly specialized physician learners. Methodological approaches included a systematic review of literature examining physician preferences for eLearning design, a case study of webinar implementation, and interviews with cardiologists who participated in the webinars.

The findings of the systematic review, the case study and the interviews aligned to characterize key considerations in webinar implementation. Webinar designers must carefully determine program structures, content, and media to create a satisfying learning experience. Cardiologists

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seek a webinar experience that responds to their professional reality of competing priorities, complex patients, and ambiguous clinical questions. They seek a mix of evidence-based, authentic and challenging content, delivered by credible content experts. The study found that purposefully designed webinars can be a satisfying learning experience for cardiologists with the potential to influence changes in knowledge and practice. The use of an instructional design framework may structure and enrich webinar implementation; this dissertation encourages their use.

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When I set out to pursue a doctoral degree, I envisioned a primarily solo journey, advancing month by month by way of my own initiative. Looking back, I now know a PhD is anything but an independent endeavor. Like an exploratory river trip, by the time the expedition was underway, many had joined my company to variously follow and lead through an amazing wilderness that, at every turn, presented curiosities, challenges, and small victories. The degree is my reward, but, for me, the magic was fully in the people and the path we traveled together.

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CHAPTER 1

This chapter describes the foundation for this study which explores the learning experiences and outcomes among cardiologists participating in a web conference workshop series. The chapter begins with an overview of the current landscape in healthcare as it relates to knowledge-to-practice gaps, a role for continuing professional development (CPD) in closing this gap, and the potential for eLearning¹ as a medium for delivering CPD.

The description of the healthcare context is followed by a presentation of the research problem, and an in-depth review of the literature. The literature review addresses CPD, information and communication technology (ICT), and constructivist learning theory, to provide the necessary foundation for studying cardiologists' learning experiences in and outcomes from a webinar-based CPD program. The study's conceptual framework is then presented to illustrate the relationship between the theories and constructs upon which this study is grounded. The research questions are then specified, followed by presentation of the research design and methods. To assist readers in navigating this body of work, the chapter concludes with an outline of how this article-based dissertation is organized.

Healthcare Context

The speed and magnitude at which the research base in medicine is expanding has created a compounding challenge for physicians in keeping informed about evidence-based changes to best practices (Grimshaw et al., 2004; Lenfant, 2003). A landmark 2003 study on the quality of

¹ eLearning is defined as "the development of knowledge and skills through the use of information and communication technologies (ICT) to support interaction for learning - interactions with content, with learning activities and tools, and with other people" (Rossiter, 2005, p. 5). A more thorough explanation of eLearning is presented in the review of the literature. The term eLearning / ELearning has a number of accepted spelling options, including e-learning and elearning. ELearning / eLearning is used throughout the thesis except in direct quotes, official names and cited documents.

healthcare in the United States found gaps between current research and practice resulting in patients receiving recommended care less than 55% of the time (McGlynn et al., 2003). Other researchers have similarly shown that patient care is frequently inconsistent with best practice guidelines; some interventions are not only unnecessary, but contraindicated (Cochrane et al., 2007; Grol, 2001; Lang, Wyer, & Haynes, 2007). In response to these findings, concerned individuals and groups have suggested that strengthening the tools and techniques for continuing professional development (CPD) for physicians may contribute to reducing the knowledge-to-practice-gap (Bloom, 2005; Bordage, Carlin, & Mazmanian, 2009; Marinopoulos et al., 2007).

Continuing professional development is a career-long activity which enables physicians to keep current with best practices in the broad spectrum of skills and knowledge required in the practice of medicine (Peck, McCall, McLaren, & Rotem, 2000). Its purpose is to support ongoing development of professional competencies by keeping physicians abreast of the latest advances in patient care, helping them accept or reject new practices, and convincing them to discontinue less effective practices (Bordage et al., 2009). Fostering changes in attitude and knowledge through CPD has been identified as one mechanism to support physicians in moving research evidence into clinical practice (Hutchinson & Estabrooks, 2009).

Ever-evolving information and communication technology (ICT) is transforming the way people work and learn, enabling new forms of interpersonal connections and knowledge production (Edwards & Usher, 2008; Punie & Carbrera, 2006). Similar to within the workforce at large, ICT has become wide-spread, user-friendly, and readily applied to physician CPD (Curran, 2006; Fordis et al., 2005). According to a recent national survey of Canadian physicians (The College of Family Physicians of Canada [CFPC], 2008), by 2007, over 70% of physicians self-

rated as proficient or highly proficient with the use of computers, almost 80% had high-speed internet at work, and over 40% had access to videoconferencing and webcasting at work.

Historically, didactic lectures have been a dominant format for physician CPD (Satterlee, Eggers, & Grimes, 2008). Critical reviews of the effectiveness of lectures and conferences have shown that these educational interventions on their own have little impact on changing complex care practices (Davis & Willis, 2004; Forsetlund et al., 2009; Spivey, 2005). In addition, physicians' ability to access CPD programs can be limited by variables such as lack of time, funding, and/or backup coverage. The 2007 national physician survey revealed that over 50% of Canadian physicians experience these pressures which affect their ability to participate in traditional, conference-style CPD (CFPC, 2008). There is evidence of effectiveness in positively influencing behaviour and patient outcomes for a wide range of educational interventions and approaches to instructional design (Hutchinson & Estabrooks, 2009). There is also solid evidence that mixed interactive and didactic education approaches can be more effective than didactic education alone (Davis & Willis, 2004; Forsetlund et al., 2009; Spivey, 2005).

Research suggests that the effectiveness of CPD in changing practice can be enhanced when educational programs are developed in accordance with sound pedagogical learning theories and practices that meet the needs of learners (Hager & Fletcher, 2008; Hutchinson & Estabrooks, 2009; Satterlee et al., 2008). Many learning theories can be readily applied in CPD design for healthcare providers; however, constructivist learning theory lends itself well to this undertaking because of elements such as a focus on real-world problem-solving skills and emphasis on negotiation of personal meaning through experience (Mann, 2004). Approaches that enhance the effectiveness of CPD programs may be found in instructional design models or

frameworks including those based on constructivist theory and pedagogy (Allen, 2005; Loyens, Rikers, & Schmidt, 2006; Casimiro, MacDonald, Thompson, & Stodel, 2009; Tsai, 2008).

With the combination of sophisticated applications and physicians' computer proficiency and access, technology is well-positioned to support CPD. Opportunities for supporting physician CPD may exist through ICT-enabled learning programs and careful instructional design.

Research Problem

Physicians are challenged with keeping current with research evidence and integrating evidence into practice (McGlynn et al., 2003). CPD is one strategy that can support physicians in ongoing development of knowledge, skills and practice (Peck et al., 2000). The effectiveness of CPD can be enhanced through careful instructional design (Hutchinson & Estabrooks, 2009), and accessibility of CPD can be supported through carefully considered use of ICT (Fordis et al., 2005).

My work involves developing CPD programs on behalf of the Canadian Cardiovascular Society, Canada's professional association for cardiologists. Similar to other medical specialists, cardiologists are inundated with best practice guidelines and face the dual challenges of information overload and pressures on their time (Grimshaw, Eccles, Walker, & Thomas, 2002). The release of new clinical practice guidelines on the topic of heart failure prompted me to consider ways to support cardiologists in their professional development beyond the Society's traditional CPD offerings of costly and time-consuming face-to-face workshops. The desire to expand the Society's range of CPD offerings and take advantage of the benefits of ICT encouraged the Society to consider webinars as a medium worth exploring. With no experience in webinar design, development or delivery, the Society was presented with the opportunity to explore the learning experiences and outcomes of cardiologists participating in a webinar series

on the topic of heart failure. The outcome of primary focus of this initial exploration was participant satisfaction, though outcomes including changes in knowledge and practice were also explored. If this study could inform how to design and deliver webinars that would satisfy cardiologists, then future studies could be undertaken to rigorously assess CPD outcomes such as sustained changes in knowledge and practice.

Acknowledging that a pedagogically-based framework for program design is a cornerstone of effective CPD (Hutchinson & Estabrooks, 2009; Inan & Lowther, 2007; Casimiro et al., 2009), a validated instructional design framework known as W(e)Learn (MacDonald, Stodel, Thompson, & Casimiro, 2009) was used to guide the design, development and delivery of the educational intervention.

Literature Review

To provide the necessary background and context for this study, an extensive literature search of peer-reviewed articles, textbooks, and relevant government reports and documents was conducted. The results of this review are synthesized below.

I will define CPD and make the distinction between CPD and the related concept of continuing medical education (CME). This is followed by a discussion about CPD in healthcare and specifically for physicians. An overview of physician CPD in the Canadian context is provided including the Royal College of Physician and Surgeons of Canada (RCPSC) leadership in and standards for CPD.

The application of ICT in physician CPD is described, leading to a focus on eLearning and webinars. This discussion then makes the link between CPD, ICT and learning theory. Learning theory provides the foundation for CPD design (Mann, 2004). As such, the literature review will progress with an overview of learning theory, narrowing to focus on constructivist

learning theory and how constructivist learning theory is reflected in CPD. Herein, the W(e)Learn framework is described, as is the rationale for choosing W(e)Learn as a design framework and quality standard for the webinar intervention developed for this research.

Continuing Professional Development

The terms continuing professional development (CPD) and continuing medical education (CME) are frequently used interchangeably, which can lead to some ambiguity in definitions (Alahuhta, Mellin-Olsen, Blunnie, & Knape, 2007). To position the discussion on CPD, these terms are defined and discussed to provide clarity of definition within the bounds of this dissertation and a rationale for why CPD is the concept of focus.

Continuing Medical Education. CME is education that takes place after professional licensure (Davis et al, 2003). It has been described as a “gestalt of short courses” (Davis & Davis, 2009, p.113) or a form of clinical update focusing on the skills and knowledge directly related to improving medical expertise (Peck et al., 2000). Mazmanian and Davis (2002) contribute that formal CME is commonly understood to mean a system of education credits earned based on time spent on focused, professional learning activities.

Traditionally understood by physicians as an add-on to daily practice, CME focuses on ways to keep up to date on new diagnoses, the management of health conditions, and/or new technologies (Horsley, Grimshaw, & Campbell, 2010). Evaluation has focused more on participation than on learning outcomes such as knowledge gains, skills improvement, or improved patient outcomes (Horsley et al., 2010). Acknowledgement of differing learning preferences and/or the benefits of a range of educational strategies has not always been inherent (Horsley et al., 2010).

While CME does not dictate approaches to educational design, Mazmanian and Davis (2002) note that historically CME activities have frequently been passive (e.g., lectures) and teacher-driven. A report by the Institute of Medicine (2010) characterizes early approaches to continuing education in healthcare as sometimes being narrow in focus and consisting of “didactic learning methods, such as lectures and seminars; traditional settings, such as auditoriums and classrooms; specific (frequently mandated) intervals; and teacher-driven content that may or may not be relevant to the clinical setting” (p.4). Traditionally, CME assumed that if experts delivered lectures about how to practice medicine, physicians would automatically implement new knowledge in practice (Horsley et al., 2010).

CME is generally understood to connote medical practice-specific content pursued to maintain knowledge and skills of clinical care. However, the content focus should not be confused with today’s pedagogically-informed methods for developing and delivering CME (Kaufman & Mann, 2010). Today, CME programs often employ a range of learning mediums (e.g., face-to-face, technology-enabled, etc.) and apply learning theory to enhance program effectiveness such as by making programs self-directed, interactive, reflexive, etc. (Davis & Davis, 2009; Kaufman & Mann, 2010). This is evident through a review of the carefully-designed CME offerings of many organizations and institutions that specialize in CME design and delivery (RCPSA, 2012a).

Defining Continuing Professional Development. The Institute of Medicine (2010) defines continuing professional development as “the system for maintaining, improving, and broadening knowledge and skill throughout one’s professional life” (p.18). The report specifies that CPD focuses on promoting effective practice and effecting practice change. Similarly, in an

international comparison of definitions of CME and CPD which notes a worldwide gradual shift in focus from CME to the broader CPD philosophy, Peck et al. (2000) define CPD as follows:

Continuing professional development is the process by which health professionals keep updated to meet the needs of patients, the health service, and their own professional development. It includes the continuous acquisition of new knowledge, skills, and attitudes to enable competent practice. The term continuing professional development acknowledges not only the wide ranging competences needed to practice high quality medicine but also the multidisciplinary context of patient care. (p. 436)

CPD includes components of CME but focuses more broadly on factors such as problem solving, integrating knowledge into practice, self-directed learning and learning tailored to settings and individual learning needs (Institute of Medicine, 2010). A CPD system reflects a holistic view of health professionals' learning where learning spans from the classroom to the point of care. CPD can be either learner-driven, where an individual pursues a question or a gap in knowledge, or externally-driven as a result of individual or organizational practice gaps identified through mechanisms such as practice audits or 360 degree assessments (Horsley et al., 2010). Learning is approached through consideration of context, environment, opportunity, and social, cultural and financial issues. CPD methods are grounded in theory and research from many fields, and embrace information technologies to provide learners with wide-ranging opportunities to learn (Institute of Medicine, 2010). Today's unremitting volume of emerging medical knowledge drives the need for ongoing, effective, accessible, dynamic, evidence-based CPD (Bennett et al., 2000; Grol & Grimshaw, 2003; Van Harrison, 2004).

In summary, CPD is a process that includes CME. CPD is a broad approach to professional learning, seeking to achieve more than a clinical update. CPD encompasses content such as interpersonal and communication skills, practice management, patient advocacy and/or team-building skills, in addition to pure medical expert content (Peck et al., 2000).

Effectiveness of CPD methods. Questions surrounding methods, models and frameworks for physician CPD have catalyzed research in CPD effectiveness (Estabrooks, Thompson, Lovely, & Hofmeyer, 2006; Hager & Fletcher, 2008; Kilian, Binder, & Marsden, 2007; Leist & Pennington, 2003). Researchers have addressed the impact of a wide range of CPD approaches including printed education materials, educational outreach visits, small group learning, use of local opinion leaders, email alerts, audit and feedback, workshops, conferences, online learning, and more (Davis & Davis, 2009; Grol & Grimshaw, 2003). While various strategies effect some measurable change in awareness, knowledge and/or practice, the impacts are often insignificant or of uncertain relevance to practice (Davis & Davis, 2009; Forsetlund et al., 2009; MacDermid, Solomon, Law, Russell, & Stratford, 2006). Conferences and dissemination of print materials may influence small changes in attitude or knowledge (Forsetlund et al., 2009; Oxman, Thomson, Davis, & Haynes, 1995) while larger impacts have been found through interactive workshops, outreach visits, use of opinion leaders, and combinations of approaches (Forsetlund et al., 2009; Marinopoulos et al., 2007; Satterlee et al., 2008). Didactic approaches might improve knowledge but may not influence practice, whereas small group and interactive CPD may be more likely to influence skills/behavior (MacDermid et al., 2006). A review by Satterlee et al. (2008) called for studies with a focus on interactive CPD approaches, recommending qualitative research methodologies be used to clarify how specific CPD attributes may influence learning and behaviour change.

In a systematic review, Bloom (2005) noted that the least effective means for changing physician practice - didactic lectures and dissemination of printed material - were also the most widely used, perhaps because they are familiar, convenient and inexpensive. Bolderston (2007) likened attendance at lectures to “stamp collecting” where academic credits are acquired but little authentic learning occurs.

In contrast, more interactive CPD approaches and combinations of approaches such as workshops, case-based discussions, dialogue with key opinion leaders, audits with feedback, and person-to-person outreach programs have been shown to increase the likelihood of successful integration of knowledge into practice (Davis et al., 1999; Forsetlund et al., 2009; Satterlee et al., 2008). A greater effect on behavior was also achieved through interventions occurring over an extended period (Grol & Grimshaw, 2003). Even low-efficacy techniques (i.e., dissemination of print materials) can be useful when combined with interactive strategies (Bloom, 2005). CPD research stresses the importance of putting learning in context through tailoring programs to address the types of decisions that clinicians face, the environments in which they work, and the organizational and political factors which influence practice (Lavis, Robertson, Woodside, McLeod, & Abelson, 2003). Needs assessments, flowcharts, and repetitive sessions also appear to support learning (Casebeer, Strasser, & Spettell, 2003). Grol (2001) emphasized that no single CPD approach works best under all circumstances, necessitating creative combinations of approaches tailored to address a range of learners and contexts.

Models and frameworks for assessing educational outcomes in CPD. Through participating in CPD activities, physicians seek to maintain and develop knowledge, skills and professional competencies (Institute of Medicine, 2010). Many conceptual models have been developed to help us describe and understand the educational outcomes of these efforts.

First published in 1967, Kirkpatrick's framework for evaluating educational outcomes has been widely used in CPD in the healthcare setting (Beckman & Cook, 2007; Curran & Fleet, 2005; Kirkpatrick, 1967). The framework describes a hierarchy of educational outcomes beginning with reaction (satisfaction), and progressing in a step-wise fashion to learning (knowledge and skills), behaviour (transfer of learning to practice), and results (impact on society) (Kirkpatrick, 1967).

Over time, Kirkpatrick's framework has been adapted to align with evolving theoretical perspectives in assessing outcomes in education. As summarized by Sargeant et al. (2011), Moore (2003) expanded the framework by adding and renaming levels and integrating levels of competence proposed by Miller (1990), forming a 6-level model for planning and CPD outcomes assessment. Barr, Koppel, Reeves, Hammick and Freeth (2005) adapted Kirkpatrick's framework for interprofessional education by adding detailed sublevels related to changes in attitudes and practice, and benefits to patients. The model developed by Barr et al. was subsequently adopted by MacDonald et al. (2009) for integration into the W(e)Learn framework for online interprofessional education. W(e)Learn is the instructional design framework of choice in the present study and will subsequently be discussed in detail.

Time has witnessed evolution and increasing levels of detail and complexity in models for assessing educational outcomes (Glanz, Rimer & Viswanath, 2008). Evolution has been catalyzed by research and practice, which have variously challenged, confirmed or expanded ideas. Glanz et al. (2008) advise us to "press forward within the limits of current methodologies while striving to build a cumulative body of knowledge in a fast-changing world" (p. 35) and sustain a dialogue between theory, research, and practice to create, critique and build on existing theory. The

ongoing development and critiquing of theory reflects a healthy curiosity and the need for further exploration of the linkages between learning and practice.

The Canadian context for CPD/CME. Leaders in healthcare education research in Canada were among the earliest developers and adopters of broader principles of CPD, shifting from a focus on CME to CPD in the early 1990s (Institute of Medicine, 2010). Through exploring new frameworks for continued competency to foster more self-directed and self-reflective approaches to learning, the Royal College of Physicians and Surgeons of Canada (RCPSC) adopted a CPD framework known as CanMEDS (RCPSC, 2012b). CanMEDS competencies include the range of knowledge, skills and attitudes which must be developed throughout a medical career including the roles that support optimal patient health and healthcare outcomes. Medical expert is positioned as the central role, fully and equally supported by roles including collaborator, health advocate, communicator, manager, scholar and professional. The CanMEDS competencies have been integrated into the RCPSC Maintenance of Certification (MOC) professional development program to support healthcare professionals' lifelong learning needs. Participation in the MOC Program is a requirement for admission and renewal of Fellowship in the College (RCPSC, 2012b).

RCPSC requirements for accreditation of educational programs. Canadian physicians who are fellows of the RCPSC must participate in, complete and report on CPD activities every year. To ensure time dedicated to CPD is worthwhile, the RCPSC has provided leadership in developing standards to support high quality CPD programs (Institute of Medicine, 2010). For programs to gain accreditation by the College, design and development must involve learner needs assessments, clear learning objectives derived from the needs assessment information, purposefully selected delivery methods, evaluation, and management of conflict of interest

(RCPSC, 2012c). Programs can be in-person or computer-based and may employ a range of learning formats such as plenary or small group sessions, workshops, and/or debates. The College requires that, regardless of approach, opportunities for learners to interact must account for 25% or more of program time. The College also requires evaluation of all accredited programs to prompt learners to reflect on the relationship between what they learned and their personal practice, and to assess learner engagement and whether learning needs were met (RCPSC, 2012c).

Physicians as adult learners. Adult learners are action-oriented, self-directed, and critically reflective, with a wealth of life experience to draw upon (Knowles, 1984; Merriam, Caffarella, & Baumgartner, 2007). Intrinsically motivated and problem-centred in their learning, adults enjoy collaborative learning and value learning that is situated in context. They seek immediate application of knowledge and efficient learning processes (Keenan, 2002; Slotnick, 1996).

Physicians can be generally characterized as inquisitive, internally motivated, and self-directed (Mann, 2004; Mansouri & Lockyer, 2007). Their professional environment requires continuous updating of practice balanced against vast amounts of complex concepts, multifaceted clinical problems, and time and resource pressures (Lenfant, 2003). Despite the learning challenges in this field, physicians often engage in CPD in the absence of objective evaluation feedback about individual gaps in knowledge or behavior, or information about how they perform against referenced norms (Smith & Schmitz, 2004; Spivey, 2005).

Modern medicine is a dynamic, collaborative activity requiring a range of learning supports for physicians. In light of this reality, there is a demand for CPD that reflects the needs of adult learners and supports the ongoing development of the competencies of medical practice.

Information and Communication Technologies and eLearning

Widely-used in adult education (Curran & Fleet, 2005; Valaitis, Akhtar-Danesh, Eva, Levinson, & Wainman, 2007), information and communication technologies (ICT) enable new forms of knowledge production and opportunities for learning (Edwards & Usher, 2008).

Common applications include email; video, audio, and text; electronic bulletin boards; list-serves; social software such as wikis, chat rooms and blogs; and instant messaging (Gillies, 2008; Orey, 2008). ICT can support learning by bridging barriers to access such as distance, time and budget constraints (Curran & Fleet, 2005; Gillies, 2008).

ELearning in healthcare. ELearning is defined as "the development of knowledge and skills through the use of information and communication technology (ICT) to support interaction for learning - interactions with content, with learning activities and tools, and with other people" (Rossiter, 2005, p. 5). Enabling synchronous and asynchronous² learner interaction with instructors, peers, and content in an environment that can accommodate a range of learning preferences, eLearning can be a satisfying and effective learning medium (Beldarrain, 2006; Kamin, Glickin, Hall, Quarantillo, & Merenstein, 2001; Weeks & Molsberry, 2008).

Systematic reviews have addressed a range of questions about eLearning among healthcare professionals. Reviews addressed effects on clinical practice (Curran, Lockyer, Sargeant, & Fleet, 2006; Lam-Antoniades, Ratnapalan, & Tait, 2009; Wutoh, Boren, & Balas, 2004), elements of effective eLearning for health professionals and students (Carroll, Booth, Papaioannou, Sutton, & Wong, 2009; Childs, Blenkinsopp, Hall, & Walton, 2005), comparisons

²*Synchronous* technologies such as webinars enable real-time or live interactions. *Asynchronous* technologies such as archived online learning programs enable any-time collaboration where users are not necessarily interacting at the *same* time (Driscoll, 2001).

of eLearning to non-internet-based learning programs (Cook et al., 2008), and theory to guide the development and evaluation of eLearning in medicine (Wong, Greenhalgh, & Pawson, 2010).

Collectively, these reviews found that, among healthcare professionals, computer-based learning programs can be as satisfying and effective at improving knowledge and skills as non-computer-based CPD approaches (Cook, 2007; Curran et al., 2006; Lam-Antoniades et al., 2009; Wutoh et al., 2004).

Wong et al. (2010) found the appeal of eLearning is not in reproducing face-to-face educational programs but in using technology to its full potential by carefully employing a range of educational approaches (e.g., interactive and didactic; independent and group work). In accordance, Ruiz, Mintzer, & Leipzig (2006) added "advantages in learning enhancement are a less well recognised but potentially more revolutionary aspect of e-learning... Learning enhancements permit greater learner interactivity and promote learners' efficiency, motivation, cognitive effectiveness, and flexibility of learning style" (p. 208). A literature review by Manning and DeBakey (2001) reported on accessibility as a primary advantage of eLearning. Along with Wutoh et al. (2004), they stressed the role of eLearning should be to offer learning opportunities that respond to self-identified learning needs and support the goals of CPD which extend beyond knowledge uptake to knowledge construction and application. They stated that eLearning programs could differentiate from face-to-face programs by being "highly self-directed, with content, learning methods, and learning resources selected specifically to maintain or improve the knowledge, skills, and attitudes needed daily in clinical practice" (p. 47).

Reviews have also revealed challenges posed by eLearning. Barriers include equipment failure, cost, and maintenance of infrastructure, though these challenges are diminishing over time as technology improves and users gain experience (Driscoll, 2001; Gillies, 2008; Smyth,

2005). From a learner-centred standpoint, synchronous applications can limit learner autonomy, requiring students to be present at a set time (Weeks & Molsberry, 2008).

Reviews have variously included a range of healthcare provider populations. Reviews by Carroll et al. (2009), Childs et al. (2005), Cook et al. (2008) and Lam-Antoniades et al. (2009) included studies with heterogeneous groups of healthcare providers (e.g., physicians, nurses, therapists, and other allied health professionals). Populations of focus in reviews by Curran et al., (2006), Wong et al. (2010), and Wutoh et al. (2004) included medical students and physicians. None focus specifically or exclusively on practicing physicians' eLearning design preferences, which leaves a gap in understanding preferences of this specific population.

Four reviews include only quantitative studies with results derived from randomized control trials (Cook et al., 2008; Curran et al., 2006; Lam-Antoniades et al., 2009; Wutoh et al., 2004) while Carroll et al. (2009) and Wong et al. (2010) include all study designs (e.g., quantitative, qualitative, and/or mixed methods). No reviews focused heavily on qualitative research findings which could contribute additional context and deepen our understanding of eLearning preferences and outcomes among healthcare providers including physicians.

In summary, reviews of eLearning among healthcare professionals and students have suggested eLearning can be satisfying and effective. Attention to eLearning design and program customization contributes to satisfaction and effectiveness. To date, systematic reviews have not focused specifically on physician populations or synchronous eLearning design. A gap remains in understanding in depth how program design and delivery influence physicians' eLearning experiences. As recommended by Cook et al. (2010), additional research evidence including qualitative studies are needed to guide the use of eLearning and clarify relationships between learner characteristics, program design, context, content, and course objectives.

Webinars. Korb (2000) coined the term "webinar" to describe his company's service offering workshops or lectures over the internet. Derived from two words, "web" referring to the World Wide Web and "seminar", webinars are real-time, online meetings where individuals can gather at a specific time to listen, observe, and/or participate in a "virtual" seminar. Simulating the experience of live seminars, webinar participants use personal computers connected to the internet to join a host site where they can listen to a speaker, view a slide and or video presentation, and dialogue with other participants via video, audio or text chat.

Webinar technology is steadily improving and is especially well-suited for synchronous, multimedia, collaborative, interactive learning (Gillies, 2008; Grant & Cheon, 2007; Smyth, 2005; Valaitis et al., 2007). Using Voice over Internet Protocol (VoIP) communication between a network of computers, webinars enable sharing of images, sound and computer applications. They are widely used in healthcare to connect sites in real-time for activities such as grand rounds, lectures, journal clubs, small group meetings and simulations (Beldarrain, 2006; Weeks & Molsberry, 2008). Webinars have become a popular CPD modality because they are cost-effective and user-friendly. Findings of the 2007 National Physician Survey (CFPC, 2008) found over 50% of physicians surveyed participate in webinars.

Webinar use by cardiologists in Canada. Despite being early adopters of ICT for communication and data access (e.g., personal digital assistants, smart phones, etc.), Canadian cardiologists as a collective had not embraced webinars for multi-site professional collaboration and/or distance learning to the same extent as other physician groups (CFPC, 2008). Similarly, a Canadian Cardiovascular Society (2009) member survey found that while 91% of cardiologists used technology such as smart phones and personal digital assistants, less than 17% of cardiologist respondents (n=401) had participated in webinars. This contradiction between a

general affinity for technology but limited uptake of a convenient and accessible medium for CPD by a sophisticated group of physician learners raises interesting questions about what may be contextually unique about cardiologists' eLearning preferences.

Conclusions about eLearning for physicians. We know that eLearning can increase accessibility to CPD and can lead to knowledge construction. Questions linger about how ICT can be best used to enhance learning. Suggestions to improve instructional design include applying tested design models or frameworks, improving instructor mastery of ICT, and focusing on promoting interactivity through using active learning techniques, providing prompt feedback, and respecting diversity in ways of learning (Darabi, Sikorski, & Harvey, 2006; Casimiro et al., 2009; Smyth, 2005). The opportunities and challenges posed by this evolving technology drive a need for further research to determine the conditions under which ICT can be used most effectively in supporting CPD among physicians (Fordis et al., 2005; Satterlee et al., 2008).

In separate papers, Colliver (2002) and Regehr (2010) reflect on the idea that context specificity is a core fact of medical education and medical education research. Acknowledging that there may be unique contextual elements of cardiologists' professional learning needs, educators would benefit from a better understanding of cardiologists' preferences for eLearning mediums such as webinars and how to best develop technology-enabled CPD programs to satisfy physician learning needs. This is the area of interest for this study.

Learning Theories

Learning can be understood from a range of perspectives which have shaped development of many theories of individual learning (Merriam & Caffarella, 1999). Learning theories provide a language for interpreting observations about learning and inform choices for educational interventions.

Following is a high-level overview of four dominant paradigms from which many learning theories have been developed. These paradigms include behaviorism, cognitivism, humanism and constructivism. A full exploration of these paradigms and related learning theories is beyond the scope of this dissertation. This overview is intended to provide the necessary background to inform the decision to use constructivism as the theoretical foundation for this study. An in-depth review of constructivism and constructivist learning theory will also be provided.

Behaviourism. Concerned with measurable responses to stimuli, behaviorism is focused on objectively observable aspects of learning (Merriam & Caffarella, 1999). Behaviorism assumes learning is a passive response to context-specific stimuli. The learner starts from a clean slate (i.e., *tabula rasa*) and behaviour is shaped through positive and negative reinforcement (Merriam & Caffarella, 1999). The role of the teacher is to provide individual feedback to shape and support learning (Mann, 2004). In the context of adult professional learning and development, behaviorism lends itself to activities such as performance measurement and setting of behavioural learning objectives and plans (Hutchinson & Estabrooks, 2009).

Cognitivism. The cognitivist paradigm seeks to explain brain-based learning such as how information is encoded and how memory is involved in learning. Cognitivism is interested in processes that support increased awareness, understanding and meaning-making (Merriam & Caffarella, 1999). A focus is on problem-solving skills and how to apply these skills to new situations (Mann, 2004). In healthcare education, a cognitivist approach is reflected in activities such as role modeling, mentorships, preceptor programs, and problem-based learning (Hutchinson & Estabrooks, 2009). In problem-based learning, relevant and realistic problems are explored through small group discussions, tutorials, and/or self-directed learning designed to

enhance development and retention of practical, realistic knowledge (Hutchinson & Estabrooks, 2009).

Humanism. Humanism assumes humans are intrinsically motivated to improve themselves and learn as part of natural development and personal growth. The humanist paradigm stresses autonomy, self-directedness and a relationship between learning and experience (Merriam & Caffarella, 1999).

A dominant humanist theory is adult learning theory, or andragogy (Merriam & Caffarella, 1999). Advanced by Malcolm Knowles (1984), andragogy characterizes adult learners as rich in experience and knowledge, and motivated, goal-oriented, and self-directed in their learning (Knowles, Holton & Swanson, 2005). Adult learning theory is frequently referenced in healthcare education in the context that adults pursue learning that is realistic, relevant to their needs, active, transferable to practice, and self-directed, as opposed to teacher-centred (Hutchinson & Estabrooks, 2009). Reflective of these principles, instructional design in the humanist paradigm would include learner needs assessment, setting clear and practical learning objectives, reflecting on existing knowledge, engaging learning activities such as small group discussions, and problem solving through case studies.

Some scholars have questioned Knowles' theory, suggesting andragogy is not empirically supported but simply describes the adult learner (Merriam, Caffarella, & Baumgartner, 2007). In support of Knowles' work, Wautier and Vileyn (2004) point out Knowles' own position that andragogy is not an all-or-nothing ideology but should be viewed as a system of elements that could be adopted individually or as a whole, depending on the situation. Merriam (2001a) lends support by pointing out that this work has stimulated meaningful discussion about adult learning. Knowles' work remains frequently applied in adult education today.

Constructivism. Constructivism suggests learning is based on experience which shapes meaning and understanding (Merriam & Caffarella, 1999). Learners actively construct subjective representations of objective reality and link new information to prior knowledge to form understanding. Each person forms unique interpretations and knowledge construction processes and continuously tests hypotheses through social negotiation (Merriam & Caffarella, 1999). In healthcare, constructivist learning theory is evident in practices such as small group learning, reflective practice, coaching of novice professionals by senior professionals and preceptorships (Hutchinson & Estabrooks, 2009).

The present study is rooted in constructivism. To provide the rationale for this theoretical stance, constructivist learning theory will be discussed in depth.

Constructivist learning theory. Constructivist learning theory characterized learning as involving active inquiry, construction of ideas based on past experience, self-regulated learning, and development over the lifespan (Loyens et al., 2006; Merriam et al., 2007; Palincsar, 1998; Piaget, 2000; von Glaserfeld, 2005). In a synthesis of the key aspects of constructivist learning theory, Proulx (2006) explains “knowledge is personally construed by the learner on the basis of his or her own lived experiences...it is through their own interpretations of their experiences that they come to know” (p. 5). Personal knowledge expands as the learner reorganizes and elaborates on existing knowledge, testing new variations of previously encountered problems, and making sense of ever-broadening realms of experience (Davis & Sumara, 2003; von Glaserfeld, 2005). Learning is enhanced through mastery of previous problems and curiosity about new applications of that knowledge. Constructivist learning theory does not dictate teaching approaches, but cautions that teachers should not assume that *telling* automatically leads to *understanding*

(Proulx, 2006). Constructivism characterizes learning as active, self-directed, learner-driven, and constructed (Mann, 2004; Merriam et al., 2007).

The role of a teacher who espouses constructivist learning theory is to structure and guide learning experiences, using deliberately selected teaching approaches to support learning (Proulx, 2006). Teaching strategies are selected to enable learners to make meaningful connections between existing and new knowledge (Beldarrain, 2006; Hmelo-Silver, 2004). The amount of guidance provided to the learner depends on his/her level of knowledge and experience (Hartnell-Young, 2006).

Although an in-depth exploration of constructivism's evolution is beyond the scope of this dissertation, it is important to note Vygotsky's (1978) crucial contribution towards understanding the sociocultural aspects of knowledge construction. His theory of social constructivism provides additional theoretical underpinnings for the present study.

Vygotsky's theory of social constructivism stresses that individual learning is enabled by and cannot be separated from social interactions (Palincsar, 1998; Vygotsky, 1978). He accepted that learning is an individual construct influenced by context and experience, but emphasized that learning is a collaborative process supported by integrating individual learners into a knowledge community (Piaget, 2000). Key to social constructivism is the distinction between two levels of individual development: actual and potential. The level of actual development is the level already achieved by the learner where independent problem solving can occur. The "potential level" where learning takes place – what Vygotsky named the zone of proximal development (ZPD) – is a higher level where, with help from teachers or more advanced learners, the learner can master concepts they could not master if left on their own. Through interactive dialogue with self, others, and texts, then, collaborative groups may experience more learning success than individuals

working alone (Loyens et al., 2006; Tan, Amin, & Khoo, 2007). Furthermore, over time, individuals 'internalize' these social interactions (conceptual discussions, problem-solving strategies and so on); in other words, they learn and can individually accomplish more as well.

Constructivist learning theory and eLearning. Many learning theories have contributed to our evolving understanding of eLearning (Knowlton, 2000). Early eLearning programs tended to apply behaviourist teaching strategies (e.g., multiple-choice tests of individual content knowledge), however the unique opportunities for interaction through eLearning has catalyzed a move toward constructivism (Curran, Fleet, & Kirby, 2010; Kanuka, 2002). Mason and Rennie (2006) stated "constructivism does seem to be the approach most commonly evident in eLearning courses" (p. xviii).

Healthcare providers need to develop relevant, real-world problem-solving skills, learn to consider multiple perspectives, and negotiate personal meaning from their experiences. As such, Mann (2004) suggested that CPD approaches should consider a constructivist approach. Similarly, Burniske and Monke (2001) recommended constructivist principles be considered for eLearning to provide authentic learning opportunities and respond to workplace demands. For Mason and Rennie (2006), "the aim of constructivist principles as applied to eLearning is to engender independent, self-reliant learners who have the confidence and skill to use a range of strategies to construct their own knowledge" (p. xviii).

Constructivist learning theory and CPD. Constructivist learning theory is strongly reflected in CPD theory and practice (Curran et al., 2010). In accordance with constructivist and social constructivist learning theory, CPD strategies call for physicians to engage actively in purposeful learning and knowledge exchange, acknowledging that mere possession of information does not mean it will be applied. Social constructivist principles suggest that

engaging learners in active construction of knowledge through social negotiation may support learning and ultimately lead to evidence-based practice change among physicians (MacDermid et al., 2006).

There are many paradigms through which learning can be understood. Constructivism is a meaningful lens to view CPD. Constructivism is the chosen paradigm for this study which seeks to explore cardiologists' experiences in an interactive, case-based CPD intervention. Building on this discussion of learning theory, this literature review will move to discuss instructional design models for eLearning.

ELearning Instructional design models. ELearning program success has been linked to solid design based on a well-articulated theoretical foundation (Hung & Der-Thanq, 2001; Morrison & Guenther, 2000). Abrami et al. (2006) advise "technology alone is of little importance in effecting achievement gains in students. Course design and instructional strategies are far more important aspects of effective teaching than the technology that is used" (pp. 55-56). As eLearning design and technology continue to evolve, so do best practices for the design, development, delivery, and evaluation of educational programs (Jones & Asensio, 2002).

Models and frameworks have been proposed to guide educational program development and ensure high quality standards (Cook, Gelula, Dupras, & Schwartz, 2007; Inan & Lowther, 2007; MacDonald et al., 2009). As Dean (2004) explains, an instructional design model "helps to ensure that students will achieve the desired learning outcomes by providing a tool that makes planning for instruction more systematic and thorough" (p. 93). Many eLearning instructional design models have been developed. A discussion of each one exceeds the scope of this thesis, however, Inan and Lowther (2007), Gustafson and Branch (2002) and Ryder (2007) are recommended references for general descriptions and comprehensive reviews of many existing

models. Inan and Lowther (2007) suggest that educators choose a design model possessing the characteristics that best suit the eLearning program context.

The unique opportunities for interaction posed by computer-mediated formats such as webinars have promoted and been accompanied by a move toward constructivism (Huang, 2002; Inan & Lowther, 2007; Kanuka, 2002). Constructivist design models and frameworks can structure eLearning design according to the context of application without hindering flexibility in design (MacDonald, Stodel, Farres, Breithaupt, & Gabriel, 2001). The review of eLearning frameworks by Inan and Lowther (2007) included several that are based in constructivism (Appendix A).

Anchored in constructivism, the webinar-based CPD workshops developed for this study focused on the opportunity for interaction afforded by synchronous program delivery and co-construction of a common understanding of best practices among physicians. As such, I sought a constructivist design model suitable for the healthcare milieu to guide program development and delivery. This led to W(e)Learn as the framework of choice.

The W(e)Learn Framework for online education. The W(e)Learn Framework is the result of work carried out over more than a decade to develop and refine a quality standard and guide for design, development and delivery of instructional programs (MacDonald et al., 2009). A description of the evolution and validation of the framework follows to provide background information to support the selection of W(e)Learn for use in this study.

The origin of W(e)Learn: The Demand-Driven Learning Model. The Demand-Driven Learning Model, or DDLM, was developed by MacDonald et al. (2001) through a collaborative process between academics with foundations in curriculum design, evaluation methods and educational psychology, and technology industry experts. The team was motivated by

dissatisfaction with the quality of instructional design models for adult education. MacDonald, Breithaupt, Stodel, Farres, & Gabriel (2002) sought to develop a model specifically suited to the learning context of working adults and the needs of the modern workplace. The resulting DDLM serves as a guide for instructional design and program delivery. While the DDLM is broadly applicable in adult education, it was developed with eLearning as a medium of focus (MacDonald et al., 2001).

As illustrated in Figure 1, the DDLM is a three-tier system that collates five main constructs: structure, content, delivery, service, and outcomes. The first tier considers the learners' needs in terms of knowledge and learning environment. The pedagogical approaches and program objectives are chosen according to the identified needs. The second tier involves the design, development, delivery, and evaluation of contents, learning activities, and support services for both the facilitator and the learner. Tier three reflects outcomes as determined by the learner and other consulted stakeholders (educators, instructional designers, programmers, employers, etc.).

The DDLM provides a constant feedback loop with learners and key stakeholders at each of the three tiers. This allows for continual adaptations or improvements of the learning program. It is the interplay between the levels of the model, the resulting emergent design, and the sustained focus on the learner that reflects the constructivist orientation of the DDLM.

Figure 1.

(MacDonald et al., 2001)

Validation of the DDLM. MacDonald et al. (2002) developed a summative companion survey which supported a primary validation study of the DDLM's constructs. Testing demonstrated good internal reliability of each subscale (structure, content, delivery, service, and outcomes) with Pearson correlation products yielding internal consistency values ranging from .93 to .97 (MacDonald et al., 2002). A predictive regression model was also conducted to verify the direction and strength of the relationship between the DDLM's constructs. The results showed that content, service, delivery and outcomes were positive predictors of superior structure with delivery and service obtaining the strongest statistically significant indicators. Breithaupt and MacDonald (2003) undertook a second study to evaluate the DDLM constructs in a separate web-based learning program to determine the strength of association between constructs. This study found the reliability of the mean scores was acceptable. Findings from the studies suggested the

underlying relationship between DDLM constructs is generalizable, adding validity to the applicability of the model to a range of educational programs (Breithaupt & MacDonald, 2003).

The DDLM aims to comprehensively support superior quality in eLearning. It offers guidance for program design, development, delivery, and evaluation and is sufficiently flexible for use in continuing professional development for healthcare providers. The authors recommended that the model be used to develop online resources to test its applicability. The DDLM has subsequently been cited in the literature and, along with its accompanying evaluation tool, has been used eLearning courses in various disciplines (Chambers, Conklin, Dalziel, MacDonald, & Stodel, 2008; MacDonald et al., 2009; Stodel, Thompson, & MacDonald, 2006; Thompson & MacDonald, 2005).

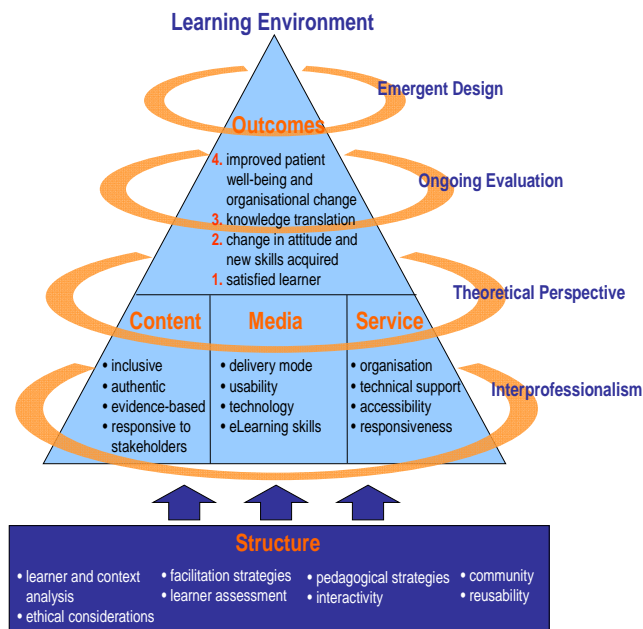
Adaptation of DDLM for the healthcare setting: W(e)Learn. W(e)Learn is grounded in the DDLM (Casimiro et al., 2009; MacDonald et al., 2009). Drawing on the knowledge and experience of healthcare experts and also on the literature including D'Amour and Oandasan's (2005) framework for interprofessional education, W(e)Learn extends the DDLM and adapts it specifically to the healthcare setting. W(e)Learn also refines the eLearning component of the DDLM to reflect advances in the knowledge base and improvements that have emerged through the experience of several years of using the DDLM (MacDonald et al., 2009).

Building on the DDLM, W(e)Learn specifies four critical program design domains: structure, content, media, and service. W(e)Learn upholds that addressing these domains through careful program design can lead to a hierarchy of learning outcomes progressing from learner satisfaction, to attitude and practice change, and ultimately, to improved patient and health system outcomes. MacDonald et al. (2009) evaluate educational outcomes in W(e)Learn in accordance with a framework advanced by Barr et al. (2005) whose work builds on that of

Kirkpatrick (1967). A key element of W(e)Learn is its “emergent design” which demands continuous program evaluation, adaptation, and improvement in response to learner feedback.

Since publication, W(e)Learn has been used in numerous healthcare studies (Archibald, MacDonald, & Trumpower, 2011, July; Halabisky et al., 2010; Kellam, MacDonald, Archibald, & Puddester, in press; MacDonald, Archibald, Stodel, Chambers, & Hall, 2008; MacDonald, et al., 2010; Puddester, MacDonald, Archibald, Sun, & Stodel, 2010). The framework is depicted in Figure 2.

Figure 2



(MacDonald et al., 2009)

Subsequent to the present study, with the support of a Health Force Ontario grant, a bilingual toolkit of quantitative and qualitative instruments was designed to accompany W(e)Learn. The framework and tools have been used to develop and evaluate numerous programs. For example, in Canada, they have been used in provincial-level eLearning programs including ePhysician Health (<http://ephysicianhealth.com/>) and eWorkplace Health

(<http://eworkplacehealth.com>). In the United States, a team at the University of North Carolina at Chapel Hill has used the W(e)Learn toolkit over four sequential terms to implement an elearning program on patient safety as part of the Agency for Healthcare Research and Quality (AHRQ) TeamSTEPPS initiative (<http://teamstepps.ahrq.gov/>) (M. Baker, personal correspondence, May 21, 2012).

The instruments have been tested for reliability in programs involving over 1600 healthcare providers in Canada and New Zealand (Archibald, MacDonald, & Trumpower, 2011, July). Reliability analysis included internal consistency which was assessed using Chronbach's Alphas. Item-total correlations were also calculated. All scales reported adequate internal consistency.

Construct validity was assessed using confirmatory factor analysis. Four factors were extracted to correspond to WeLearn subscales of content, structure, service, and outcomes. It was expected that elements from the each domain would correspondingly load onto the same domain. The study found that, while there was some overlap between elements, items did load onto the corresponding factors.

Conclusion of the Review of Literature

CPD has a role to play in supporting ongoing advances in physician practice. There is a substantial body of research evidence surrounding the potential for ICT to enhance CPD, and this potential is being tapped through eLearning. Webinars are one such eLearning application for supporting physicians in ongoing professional learning.

Constructivist learning theory is well-aligned with the principles of and evolving practices in eLearning design. Best practices in eLearning design can be supported by instructional design

models and frameworks. The W(e)Learn Framework is one such instructional design tool that has been shown to support eLearning program implementation.

Research Design and Methodology

This study explores the learning experiences and outcomes of cardiologists who participated in a CPD program consisting of an interactive, multi-module webinar series.

Study Setting and Context

The Canadian Cardiovascular Society (CCS) is the professional association for Canada's cardiologists. The CCS membership includes over 800 cardiologists representing almost 100% of the Canadian cardiologist population (CCS, 2012). Member cardiologists range in age and experience from early stages of training for a cardiology sub-specialty (having already completed undergraduate medical school and several years of training in internal medicine), to nearing the end of professional medical careers. Membership is national, spanning all provinces and territories, and includes males and females in a ratio of approximately 3:1 (Ross et al., 2006).

Ross et al. (2006) reported that, on average, cardiologists work 57 hours/week and perform an average of 106 hours of on-call duties per month. The high workload in cardiology creates tensions in the profession: in 2004, 31% of cardiologists reported being somewhat or very dissatisfied with the balance between personal and work commitments. Cardiologists under the age of 45 and female cardiologists were most likely to be dissatisfied.

The reputation of cardiology as a sub-specialty with high time demands is having a negative effect on the number of young physicians choosing to sub-specialize in cardiology such that the cardiologist population in Canada is aging (Ross et al., 2006). In 2001, 22% of cardiologists were over the age of 55. By 2004, that had risen to 29%. The data above suggest

that creative strategies to reduce time burdens on cardiologists, including making mandatory CPD more accessible and less time consuming, could be supportive of cardiologists.

Access to customized CPD programs is a key incentive for membership in the Society. In support of CPD, the CCS publishes a scientific journal and delivers national and regional face-to-face conferences, workshops, and asynchronous eLearning programs. The CCS's most recognized CPD program is a face-to-face, interactive, case-based workshop focused on national heart failure clinical practice guidelines.

The CCS clinical practice guidelines for the management of heart failure.

Predominantly a disease of older adults (Hunt et al., 2001), heart failure is an increasingly prevalent (Taylor & Lahey, 2008), complex, progressive cardiac disease (Arnold et al., 2008). Heart failure is associated with decreased quality of life and life expectancy and high healthcare costs; it has the second highest total number of hospital days and the third highest number of admissions of all major diseases in Canada (Tsuyuki, Shibata, Nilsson, & Hervas-Malo, 2003). There is a particularly high rate of heart failure in rural settings³ in Canada (Jin, Quan, Cujec, & Johnson, 2003; Taubert, Bergmeier, Andresen, Senges, & Potratz, 2001; Tsuyuki et al., 2003) where a high proportion of residents are older (Statistics Canada, 2008). Heart failure patients in rural communities are more likely to be hospitalized and less likely to get optimal care (Clark, Freyberg, Heath, McDonald, & Strain, 2008; Jin et al., 2003; Johnson, Jin, Quan, & Cujec, 2003; Statistics Canada, 2007; Tu, Gong, Austin, Jaakimanian, & Tu, 2004). A 2001 study by Taubert et al. showed that heart failure management according to current guidelines, using β -

³ Statistics Canada defines a "predominantly rural region" as having more than 50% of its population living in rural communities. A "rural community" has a population density of less than 150 persons/km² (Statistics Canada, 2008).

blockers, ACE inhibitors, and invasive cardiac examination was performed significantly less often in community hospitals than in metropolitan centres. Given the growing burden of heart failure on Canadians and the documented inconsistencies in practice between care settings, the CCS found a clear need for a major focus on CPD activities for cardiologists on the topic of heart failure management (Howlett et al., 2009).

The CCS developed a multi-pronged CPD strategy to support its members and the cardiovascular care community at large to implement best practices in the care of patients with heart failure. Elements of the strategy include developing and publishing an annual heart failure clinical practice guideline update, delivering live heart failure CPD workshops across the country, developing and disseminating tools and resources such as quick reference cards and smart phone “apps”, and developing asynchronous eLearning programs on the topic of the heart failure guidelines.

Study Intervention: A Webinar Series for Cardiologists

Canadian cardiologists had not embraced webinars to the same extent as other physician groups (CCS, 2009; CFPC, 2008). Until 2010, the CCS had not experimented with offering webinar-based CPD programs and had no knowledge of how webinars might be accepted by members. To explore the potential of this medium to determine whether a future significant investment should be made in developing a webinar-based CPD stream for members, the CCS sought to develop and deliver an accredited, interactive series of four bi-weekly heart failure webinars for cardiologists. The webinar medium would enable live, multimedia interaction between participants and facilitators. The goal of the webinar series was to capture cardiologists’ feedback about a new CPD medium which could support dialogue on an important topic with Canadian experts, without the time and expense required to attend a face-to-face program.

The development process was collaborative between faculty who provided content expertise and a technical team who managed all aspects of program development and delivery. The W(e)Learn framework was used as a guide for instructional design and as a quality standard for webinar development and delivery. Each one-hour module of the webinar series included live, interactive case-based discussions addressing key recommendations for diagnosing and treating heart failure patients. Cases were developed and delivered by authors of the CCS Heart Failure Guidelines. A sample workshop case is shown in Appendix C.

Research Questions

The overarching research questions guiding this study were the following:

1. What are the learning experiences of cardiologists who participate in a webinar series designed according to a constructivist eLearning design framework?
2. What factors related to webinar design, development and delivery contribute to an appealing and satisfying CPD experience for cardiologists?
3. How can a design framework support the design and delivery of a webinar series for cardiologists?

These questions call for an exploration of participants' experiences in an interactive, computer-based learning experience shaped through the use of a deliberately-selected eLearning design framework.

A simple, graphic conceptual framework for this study is provided in Figure 3 to illustrate the relationships between theory, structures and processes. This study is framed by constructivist learning theory which influenced the choice of W(e)Learn as the instructional design framework and is well aligned with a computer-based educational intervention. The dominant principles of constructivist learning theory are those widely documented in the educational theory canon,

including that learning is learner-driven, self-regulated, active, based on past experience, social, and contextual (Loyens et al., 2006; Merriam et al., 2007; Palincsar, 1998; Piaget, 2000; von Glaserfeld, 2005).

Using W(e)Learn as a quality standard and process map, the study focuses on the design, development and delivery of an interactive, case-based webinar series for cardiologists.

W(e)Learn specifies the structures and processes considered in the design, development and delivery of the webinar series. Structures include elements such as learner and context analysis, pedagogical and facilitation strategies, interactivity, community, and reusability. The design process carefully considered key aspects of content (e.g., inclusiveness, authenticity, responsiveness to stakeholder needs), selection and adaptation of media (e.g., delivery mode, usability, learner and faculty skills) and service (e.g., access to and responsiveness of technical support). The framework also describes the hierarchy of possible learning outcomes for cardiologists, including satisfaction and possible changes in attitude, knowledge and behavior. It must be noted that, as shown in Figure 2, W(e)Learn includes a fourth level of outcome: improved patient well-being and organizational change, which is beyond the scope of this study.

Figure 3

Researcher Philosophical Assumptions

Kanuka (2002) maintains that understanding the researcher's ontological and epistemological beliefs lends clarity to why a certain research question is asked and why particular modes of inquiry are chosen. The focus on participants' learning experiences called for an interpretivist approach to research. In describing an interpretivist approach to the research process, Denzin and Lincoln (2005) outline interconnected activities: ontology, epistemology and methodology. They point out that these activities are filtered through the researcher's unique viewpoint. This combination of ontology, epistemology and methodology forms an interpretive

set of beliefs that guide the researcher's actions. Guba (1998) identifies four major interpretive paradigms: positivist, constructivist, critical and feminist-poststructural, each making particular demands on the researcher.

As described by Denzin and Lincoln (2005), the positivist paradigm includes a realist ontology, an objective epistemology, and relies on experimental, quasi-experimental, survey and rigorously defined qualitative methodologies. Critical and feminist-postcultural paradigms use a materialist-realist ontology where the real world is considered to make a difference with respect to class, race and/or gender. A subjectivist epistemology is assumed in which knower and subject create understanding, and they employ naturalistic methodologies set in the natural world.

The constructivist paradigm aligns well with this study which is qualitative and exploratory in focus. It accommodates multiple mental constructs which may be local, specific, sometimes conflicting, and dependent on the individuals involved (Denzin & Lincoln, 2005). Constructivism includes 1) a relativist ontology which assumes that the attempt to capture the complex experiences of cardiologists in a webinar experience will be examined through multiple realities; 2) a subjectivist epistemology which assumes that the meanings behind the situation and the study are negotiated between all study participants including the researcher; and 3) naturalistic methodologies which assume that the theory is grounded in the data which arise from participants in the natural setting of a webinar series (Denzin & Lincoln, 2005).

Methods

The research questions in this study seek an in-depth understanding of the human experience within a specific learning environment to inform webinar design, development and delivery strategies. The pursuit of understanding about experiences is well-suited to a qualitative approach to inquiry (Yin, 2009).

Qualitative research does not imply a particular approach to data collection, analysis, or interpretation. Rather, it opens the door to a range of research strategies (Atkinson, Coffey, & Delamont, 2003; Stake, 2005). The way research strategies are selected, combined, and directed is linked to the investigator's beliefs and affects the way human experience is portrayed and interpreted (Wolcott, 1992). Observations, interpersonal communications, individual feedback, and in-depth participant interviews were major sources of data informing this study. Discussed below, this study uses case study as the qualitative method of inquiry.

Systematic review of literature. To inform the case study, the first phase of this study involved a systematic review of literature. A systematic review is an organized method to critically assess all research studies that address a particular clinical issue (Agency for Healthcare Research and Quality [AHRQ], 2011). The systematic review, described in greater detail in Chapter 2, was conducted in accordance with the University of York Centre for Reviews and Dissemination methodology for identifying, appraising, and synthesizing the best available evidence (Centre for Reviews and Dissemination, 2009; McKibbin & Lokker, 2009).

The systematic review examined studies which used qualitative research methods to explore physician preferences for and experiences with eLearning design and implementation. The aim was to garner a rich description of a complex interaction between sophisticated learners and an emerging learning technology.

Case study. According to Yin (2009), "the more that your [research] questions seek to explain some present circumstance (e.g., "how" or "why" some social phenomenon works), the more the case study method will be relevant" (p. 4). The case study focuses on describing, understanding and explaining (Stake, 1995). It is an exploration of a case over time through in-depth data collection involving multiple sources of context-rich information (Merriam, 2001b;

Yin, 2009). Allowing for multi-perspective analysis, case study research considers the interaction between individuals and groups and can enable a researcher to retain meaningful characteristics of real-life events such as small group behaviour.

The case should be representative of a common issue yet possess some unique characteristics and should take place within a “bounded system” (Stake, 1995). The webinar series in this study was well-suited to a case study, presenting a single, unique, time-bounded opportunity to explore with a high level of sensitivity the experiences of participants in a synchronous, web-based learning environment.

In this research, a single case study was used to explore learning experiences and outcomes among cardiologists who participated in a webinar series designed in accordance with the W(e)Learn framework. Data sources included email correspondence, surveys, webinar recordings and chat transcripts, and semi-structured interviews.

Basic descriptive statistics. Basic statistical information was derived from the systematic review, and demographic, needs assessment and feedback surveys. As discussed by Yin (2009), case studies can generate quantitative data which can support the analytic strategy. Embedded units of data included frequency counts of qualitative data elements uncovered in the systematic review, numbers of webinar participants, and webinar data related to attendance and feedback about satisfaction. These data were used to add context and more fully inform the interpretation of the study findings (Maxwell, 2005; Yin, 2009).

Study Population and Recruitment

The primary study participants were cardiologists who registered voluntarily to participate in the webinar series. Motivation to participate was driven by factors such as a recent update to the national heart failure guidelines, the professional requirement to practice evidence-based

medicine, the opportunity to interact with Canada's leaders in heart failure care, and the convenience of the webinar format. The CCS encouraged registration by promoting the program to cardiologists on its website and through email.

A secondary population that informed the study was the webinar implementation team who contributed project management, technical and content expertise for webinar design, development and delivery. Distributed between 5 cities across Canada, the team never met face-to-face. The team of six included the researcher who was also the project manager, an eLearning design specialist, a web specialist, and three cardiologists who are also heart failure guideline authors and who acted as the webinar facilitators. The cardiologists had several years of experience in delivering face-to-face heart failure workshops and were proponents for testing the webinar format.

Data Collection Methods

A case study relies on a mix of data collection methods that correspond to an underlying theoretical framework and research questions (Stake, 2005; Yin, 2009). Enabling rich, multifaceted representation of a phenomenon, mixing data collection methods is an approach often used in qualitative research (Shah, 2006; Stein & Short, 2001), and in eLearning (Kozma, 2003). Moran-Ellis et al. (2006) describe that mixing data collection methods allows different data sets to be brought together to create a better and more thorough understanding of a phenomenon of interest.

Following is a description of the data collection methods developed for this study. Table 1 summarizes the relationship between the research methods, purpose and target.

Systematic review. Conducted in accordance with standard practices (AHRQ, 2011) and described in detail in Chapter 2, the systematic review of literature examined studies which used

qualitative research methods to explore physician preferences for and experiences with eLearning design and implementation. The aim was to garner a rich description of a complex interaction between sophisticated learners and an unfamiliar learning technology. The results of this study informed the design, development and delivery of the webinars that were the intervention of focus in this study. Implications of the findings of the systematic review are discussed in Chapter 5 in tandem with findings from other data sources (e.g., the case study).

Email records of the Implementation Team. Throughout the webinar design, development and delivery process, the email messages among the Implementation Team members were collected. The purpose of this data was to provide insight into webinar design, development and delivery processes from the perspective of the involved designers, technical specialists and faculty. All team members were aware that this data capture was part of a research study and each consented to participate in the study acknowledging that email data would be collected, analyzed and reported.

Demographic and needs assessment survey. Each webinar registrant was sent a demographic and learning needs assessment survey and a study consent form to voluntarily complete and return. The survey consisted of 28 open- and closed-ended questions. Questions related to basic demographics such as sex, age range, years in practice, geographic location, etc. The survey also inquired about participants' learning needs with respect to medical content, and also about experience with eLearning and preferences for eLearning design. The demographic and needs assessment data were reviewed by the Implementation Team and were used to guide the structure of the program and the development of content.

Webinar transcripts. Each webinar was recorded to capture information about the webinar experience with a focus on the nature and amount of interaction through verbal

discussion and text chat. Data such as results from live audience-response polls (multiple choice questions that the facilitators posed to participants during each webinar) were also captured. A recording of each webinar (audio recording synchronized with the corresponding PowerPoint slides) was generated and posted on the CCS website. Visitors to the website could download and view the file at their leisure. The number of downloads and duration of views of these files were captured. This data informed the nature and amount of interactivity that occurred during each webinar and the extent to which the asynchronous version of the webinar was used.

Webinar feedback surveys. In accordance with the emergent design of the W(e)Learn framework (MacDonald et al., 2009), participants were asked to voluntarily complete an anonymous feedback survey following each webinar. The feedback survey consisted of open- and closed-ended questions about the webinar experience. Feedback was collected to guide ongoing modifications to program design, delivery, and/or content to improve each subsequent webinar. The feedback also informed the Implementation Team about participant learning experiences and any possible webinar outcomes related to satisfaction, knowledge gains or practice change.

Interviews. Following the completion of the webinar series, all cardiologists who consented to participate in the study were invited to participate in a one-on-one, semi-structured telephone interview. The purpose was to conduct an in-depth exploration of individual perceptions and experiences during the webinar series. Interviews took place between two to seven weeks following the completion of the webinar series.

Please refer to Appendices G to M for documentation about ethics approval, informed consent, and survey samples.

Data Analysis

Systematic review of literature. Following screening by two reviewers of all included articles, I independently extracted data from the included studies. I used a standard data extraction tool (Centre for Reviews and Dissemination, 2009), and added additional cells to capture data specific to this study. These data were qualitative findings from each study that could be mapped to or fell outside the domains of the W(e)Learn framework. I read each manuscript and identified the unit of text (a phrase, sentence or paragraph representing a single, specific result) relevant to physicians' perceptions of and preferences for eLearning design. Each unit was entered into a hermeneutic unit created in Atlas.ti and then coded according to the relevant and pre-established code list (e.g., interactivity, evidence-based content, etc.). When a unit of text did not fit within the fields in the data extraction tool, a new code was created, which further refined and expanded the preliminary list of codes.

Following initial coding, codes were aggregated into Families (e.g., text coded as “interactivity” were assigned to the W(e)Learn “Structure” Family). Codes could then be sorted by Family, source, frequency of occurrence, etc.

While the results of the systematic review can stand alone as a single study, they were synthesized into the discussion of the results of case study in the integration chapter of this dissertation (Chapter 5), which added depth and breadth to this body of research.

Case study. Within the case study, data collection and analysis went hand in hand. Data were collected beginning with the assembly of the Implementation Team eight weeks in advance of the launch of the webinar series, and continued through the development, delivery, and evaluation of the program and the completion of the participant interviews.

Guided by Maxwell (2005), Merriam (2001b) and Yin (2009), the qualitative data were subjected to an interpretive analysis to understand the meaning of the feedback from and actions taken by participants. Email records, digital records including webinar transcripts, and transcribed recordings of interviews were uploaded to Atlas.ti which supported coding. The data were read and re-read to glean meanings, disconfirming instances and alternative explanations. Guided by the W(e)Learn domains (e.g., structures, content, media, service and outcomes), data were coded and assigned to Families, which is an Atlas.ti term for themes.

Thematic analysis was a process of understanding the data and systematically identifying key concepts and linkages. Atlas.ti supported analysis by enabling ease of searching, graphic representations of relationships between data elements, and generation of frequency counts by code, source, Family, etc. The analysis process was influenced by Maxwell (2005), Merriam (2001b), and Yin (2009). Analysis was a careful and creative process that attempted to understand a range of descriptions, experiences and observations. Wolcott (1994) described the process as follows: describing (what's happening?), analyzing (how does this work?), and interpreting (what does this mean?). Descriptive statistics were calculated from the survey data to more fully inform the findings and add support and context to interpretations.

Ethical Considerations

Research participants should feel that they can trust the researcher to inform them about the study, maintain their anonymity, and do no harm (Glesne & Peshkin, 1992). A distinguishing characteristic of qualitative research, participants can be co-explorers and the researcher is more akin to a research tool (Brogden & Patterson, 2007). With this shift in hegemony, ethics in qualitative research is reflected in part by the way researchers manipulate data to reflect as

accurately as possible what the participants are trying to communicate, while being sensitive to issues of confidentiality, secrecy and power.

I dealt with the position of power I held as the researcher and project manager by recognizing and acknowledging my role, presence and potential influence (Baez, 2002). Participants could choose freely to participate or decline to participate in the study. This study was approved by the University of Ottawa's Social Sciences and Humanities Research Ethics Board (Appendix H). A participant consent letter was disseminated to webinar registrants and the Implementation Team providing details about the study and offering the choice to participate. Exposing my position as researcher and project manager helped build a relationship of trust (Pitts & Miller-Day, 2007) so participants could freely make an informed decision about participation. It was also paramount that participants felt confident that their contribution to the study would be held in strict confidence and that participation was anonymous.

My position as researcher and project manager allowed me privileged information about the case, which led to a deeper understanding of the inner workings of webinar design, development and delivery (Labaree, 2002). I believe this insider position strengthened the accuracy of the interpretation of the data but it also made it possible to introduce biased information stemming from my relationships with the Implementation Team and some participating cardiologists. In accordance with an intersubjective epistemology, the data collected was thus a reflection of both the learners' perspective and my own. I was deeply committed to making the webinar learning experience a success according to the learners' expressed needs, and I actively invited participants to candidly share their experiences. By honestly documenting and weaving my perceptions about the webinar experience throughout this thesis, I exposed my researcher and professional agendas. In Wolcott's (1994) opinion, clearly stating one's position

and views enables readers to make their own inferences about the data and leads to an ethical account of the phenomenon under study.

Trustworthiness

As researchers, we trust ourselves to conduct the research process ethically; however, a bigger question is whether others can trust us. The question of validity or what many term trustworthiness in qualitative research surfaces constantly in the field of social sciences (Sinding & Aronson, 2003).

On the subject of trustworthiness, Lincoln and Guba (1985) stated that the extent to which the findings of a qualitative inquiry are worth paying attention to rests on four criteria: 1) credibility, 2) transferability, 3) dependability, and 4) confirmability. They provided criteria and presented a strong basis from which to explore trustworthiness. To expand their thinking and reflect considerations related to case study, I also reference Stake (2005) and Merriam (2001b) on the subject of trustworthiness.

Credibility can be evaluated in terms of prolonged engagement with the phenomenon under study, persistent observations, and triangulation⁴. Prolonged engagement builds an understanding of the cultural particularities of the phenomenon under study and builds trust with the participants. In this study, I had four year's experience in a senior staff position responsible for CPD at CCS and had established relationships with Implementation Team members and many CCS member cardiologists. Data collection for this particular study occurred over a period of 26 weeks (November 2009 to May 2010). I was immersed in the research process which allowed me to have meaningful interactions with the participants in the study.

⁴ Moran-Ellis et al. (2006) stated "triangulation is an epistemological claim concerning what more can be known about a phenomenon when the findings from data generated by two or more methods are brought together" (p. 47).

Persistent observation means detailed focus on issues at hand. All data collection methods were structured to tackle the elements of structure, content, media, service, and outcomes within the webinar series. This created redundancy within the data collection system, allowing different perspectives on similar elements to surface. When new issues arose through one data source, redundancy was built into other data sources. For example, the issue of time first arose through the systematic review and was further explored through the needs assessment survey and the interviews.

Triangulation uses multiple sources and methods to explore the phenomenon under study from several perspectives. I used triangulation to contrast and compare the data collected through persistent observation and six data collection methods. Triangulation served to expose confirming and disconfirming instances between methods, the data sources, and the participants to provide a credible and holistic understanding of the webinar experience.

Transferability relates to the extent to which the conclusions of the study can be applied to other situations. It is up to readers to make their own inferences, yet it is the researcher's responsibility to present the data in a way that enables readers to reach a conclusion (Wolcott, 1994). In this study, rich and thick descriptions of the processes of webinar design, development and delivery, and the inclusion of the various participants' voices throughout the process provided the basis for readers to infer about transferability.

Dependability pertains to the extent to which a study could be reproduced and yield similar results; it is related to both credibility and triangulation. Overlapping different data collection methods through triangulation increases accuracy in the analysis. This study's data were obtained from different data collection methods and sources representing different views of the same experience. Direct quotations were used when possible to preserve the voice of the

participants and increase authenticity. Reflexivity and a critical review by the researcher of processes to analyze and interpret data also contribute to consistency and dependability (Nilan, 2002). Reflexivity and critical review were reflected in this study through activities such as the recursive and constant comparison process used for data analysis, and through involving multiple researchers in the screening of articles for inclusion in the systematic review (described in detail in Chapters 2 and 3).

Confirmability relates to the ability to verify the original data sources and the process that was followed to do so. This study's methods and the process for data interpretation were briefly described in this chapter and are described in depth in subsequent chapters. Summaries of the raw data are presented in table format in the appendices and all raw data, transcripts and notes are accessible from a secure location.

Structure of this Dissertation

This dissertation consists of five chapters. These include an introductory Chapter which addresses the review of literature and the research design and methods (Chapter 1), three chapters developed as stand-alone publishable articles (Chapters 2-4), and an integrative conclusion chapter (Chapter 5). Chapters 2-4 each have distinct research questions and may be read independently of each other. Each of these chapters is prefaced with a title page that provides the article title, the intended journal of publication, and an abstract structured according to the headings. For ease of navigation, the references and appendices related to the stand-alone articles (Chapters 2-4) appear with the chapter. The supporting documents that underpin the dissertation at large and which are referenced in Chapter 1 are included as appendices at the end of the full dissertation document.

The collection of articles was developed to follow a particular train of thought that weaves throughout the dissertation to provide overall structure and to contribute to answering the overarching research questions specified in Chapter 1. The structure of the dissertation is outlined in Table 2. The research objectives specified in Table 1 are derived from the research questions which are specific to each article and methodology. The sub-questions addressed in each chapter contribute to answering the overarching questions of the overall study.

Table 2

Chapter, Methods of Inquiry, and Research Objectives

Chapter	Methods	Research Objectives
Chapter 1 Introduction and Review of Literature	Provides an introduction and detailed overview of the dissertation including review of key concepts, literature review, conceptual framework and methods.	
Chapter 2 Article 1: A systematic review of physicians' experiences with and preferences for eLearning programs	A systematic review was undertaken using an established methodology for identifying, appraising, and synthesizing evidence.	To examine studies that used qualitative research methods to explore physician preferences for eLearning design and implementation. To assess identified physician eLearning preferences against W(e)Learn domains to suggest possible framework refinements.
Chapter 3 Article 2: Heart Failure Bootcamp: Design, implementation and outcomes of an educational web conference series for cardiologists	A case study describes the process of designing and delivering an educational webinar series for cardiologists, outlining key steps and considerations in webinar implementation.	To explore the webinar implementation process to learn about the factors that contribute to an appealing and satisfying CPD experience for cardiologists.
Chapter 4 Article 3: Cardiologists' perceptions and learning outcomes from a synchronous, case-based webinar series	Semi-structured interviews were conducted with seven cardiologists who participated in the webinar series.	To explore characteristics of program structure, content, service, and media that influence cardiologists' perceptions of the webinar experience. To explore learning outcomes

		for cardiologists who participated in a webinar series.
Chapter 5 Integration of results and discussion	Offers insights about the collective findings and presents the broader implications of the dissertation for practice and future research. The strengths and limitations of this dissertation are also discussed.	To elaborate on and discuss insights about the collective findings and broad implications of the dissertation for practice and future research.

Conclusion

This dissertation explores cardiologists' design preferences and learning experiences and outcomes in a case-based webinar series. It adds to the broad body of research focusing on the acceptability and effectiveness of eLearning as a CPD modality among physicians.

As will be described in detail in subsequent chapters, the study suggested that carefully crafted webinars can be satisfying CPD experiences for cardiologists and can contribute to achieving desirable CPD outcomes. The findings of a systematic review, a case study of webinar implementation, and post-webinar interviews with cardiologists aligned to characterize key considerations in webinar design and delivery. Ultimately, webinars show potential as appealing, satisfying and effective learning experiences for cardiologists. Cardiologists are more likely to be attracted to webinars if their unique eLearning preferences are reflected in webinar design. Educational design frameworks may enrich and structure the design process; this dissertation encourages their use.

Contribution to the Field of Education

Through enhancing our understanding of the learning experiences and outcomes of cardiologists participating in a purposefully-designed CPD webinar series, this case study makes several contributions to the field of education. Firstly, this study reinforces existing knowledge about eLearning design preferences among cardiologists. Similar to other systematic reviews (Cook et al, 2010; Wutoh et al, 2004; Wong et al, 2010), this study found that cardiologists share

with their multidisciplinary healthcare colleagues a preference for interactive programs and skilled program facilitation. This study's unique focus on cardiologists allowed it to drill in depth into the webinar learning experiences of cardiologists to uncover preferences that may be distinct to cardiologists. The participating cardiologists had strong eLearning preferences for program design characteristics such as facilitation by highly credible experts; highly customized, challenging, and solidly evidence-based content; live/synchronous eLearning experiences as opposed to asynchronous ones; and case-based design.

This dissertation also provides an in-depth description of the design, development and delivery of a webinar series developed using a constructivist instructional design framework as a quality standard and a process guide. The description of the design process and the successful delivery of a webinar series illustrate the usefulness of a framework to guide a CPD development endeavor, and adds to the growing literature supporting W(e)Learn (MacDonald et al., 2009) as a suitable and highly adaptable framework for this purpose.

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CHAPTER 2 (Article 1)

A systematic review of physicians' preferences for eLearning design and implementation.

This manuscript is developed for submission to a journal such as the *Journal of Continuing Education in the Health Professions*, a peer-reviewed forum for scholarly works addressing all aspects of continuing professional development (CPD) for physicians and other health care professionals.

Word Limit: 3000 words excluding references, tables, and figures.

Abstract

Introduction and purpose: The use of computers in continuing professional development (CPD) is growing, leading to questions about best practices in eLearning design for physicians. Studies using quantitative and qualitative methods have examined these questions, and design frameworks have been proposed to enhance program effectiveness. Qualitative studies offer rich descriptions of the interactions between physicians and learning technology and may offer insights into physician design preferences beyond what quantitative methods offer. This review synthesizes studies which used qualitative methods to explore physician preferences for eLearning implementation, and assesses preferences against the domains of an existing instructional design framework to suggest possible framework refinements.

Methods: A systematic review was undertaken using an established methodology for identifying, appraising, and synthesizing evidence. Three researchers were involved in article selection and data analysis. Coding was guided by a validated eLearning design framework which suggested broad thematic domains and provided a lexicon for coding.

Results: The search of electronic databases generated 1,537 unique citations. After screening, 25 studies were included in the review. Included studies represented 808 physicians who participated in postgraduate degree and medical specialist eLearning programs. Dominant themes related to eLearning design structures, content and media. The instructional design framework reflected the dominant themes with the exception of the recurring theme of *Time*.

Discussion: Physicians show preferences for interactivity, skilled program facilitation, and program customization informed through learner analysis. They seek unbiased, evidence-based content, high usability, and ease of navigation. The design framework captured most key preferences; however, refinement could be made to the framework to prompt consideration of time requirements for learners and for program developers.

Keywords: systematic review, physician, eLearning, preferences, cardiologist

Introduction

The use of computers for physician continuing professional development (CPD) has grown exponentially (Lam-Antoniades, Ratnapalan, & Tait, 2009; Stergiou et al., 2009). Synchronous (real time) and asynchronous (any time) eLearning⁵ programs can offer variety in instructional methods, easy access, low cost, flexibility, and self-directed options for learning (Cook, 2007). Strategies to support learning can be incorporated using audiovisual technology and interfaces such as email, web-conferencing and discussion boards (Davis et al., 1999; Marinopoulos et al., 2007). This has been an important development because, in recent years, physicians have seen a decrease in the accessibility of traditional face-to-face CPD (Bloom, 2005) due to reductions in time and funding for CPD and reduced resources such as backup coverage (College of Family Physicians of Canada, 2008). As computer technologies have become widespread, user-friendly, and readily adopted for physician CPD (Wutoh, Boren, & Balas, 2004; Wong, Greenhalgh, & Pawson, 2010), they are well positioned to support CPD.

Systematic reviews have addressed a range of questions about eLearning among healthcare professionals, including effects of eLearning on clinical practice and health outcomes (Curran, Lockyer, Sargeant, & Fleet, 2006; Lam-Antoniades et al., 2009; Wutoh et al., 2004), elements of effective eLearning for health professionals and students (Carroll, Booth, Papaioannou, Sutton, & Wong, 2009; Childs, Blenkinsopp, Hall, & Walton, 2005), comparisons of eLearning to non-internet-based learning programs (Cook et al., 2008), and theory to guide the development and evaluation of eLearning in medicine (Wong et al., 2010). These reviews found that computer-based learning programs can be as satisfying and effective at improving knowledge

⁵ For the purpose of this review, eLearning is defined as "the development of knowledge and skills through the use of information and communication technologies (ICT) to support interaction for learning - interactions with content, with learning activities and tools, and with other people" (Rossiter, 2005, p. 5).

and skills as other pedagogical approaches (Cook et al., 2008; Curran et al., 2006; Lam-Antoniades et al., 2009; Wutoh et al., 2004).

Several reviews identify program characteristics which support learning among healthcare providers in general (Carroll et al., 2009; Childs et al., 2005; Cook et al., 2008; Lam-Antoniades et al., 2009), or among medical students and physicians (Curran et al., 2006; Wong et al., 2010; Wutoh et al., 2004), but none focus specifically on practicing physicians' eLearning design preferences. Four reviews include only quantitative studies with results derived from randomized control trials (Cook et al., 2008; Curran et al., 2006; Lam-Antoniades et al., 2009; Wutoh et al., 2004) while Carroll et al. (2009) and Wong et al. (2010) include all study designs (e.g., quantitative, qualitative, and/or mixed methods).

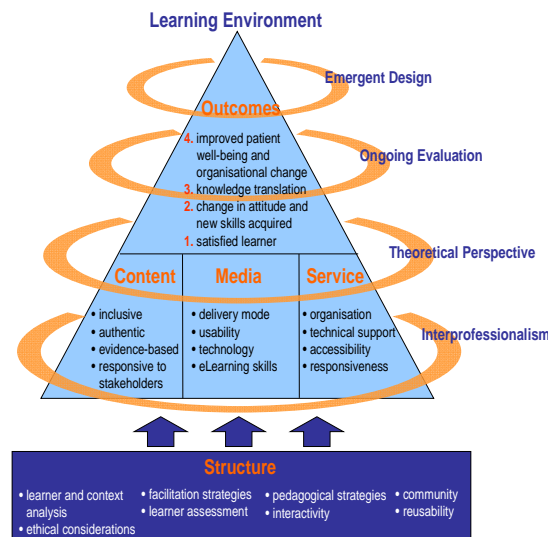
The preceding reviews focused on describing the effectiveness and acceptability of eLearning and characteristics that strengthen eLearning design among groups of healthcare practitioners and students. These reviews relied primarily on quantitative data. A gap remains in understanding in depth how program design and delivery influence physicians' eLearning experiences. To more fully understand relationships between eLearning design and physician preferences, studies using qualitative methodologies were reviewed to garner a rich description of a complex interaction between sophisticated learners and new learning technology.

eLearning program success has been linked to solid design based on a well-articulated theoretical foundation (Hung & Der-Thanq, 2001; Morrison & Guenther, 2000). A validated framework for eLearning instructional design is W(e)Learn, a constructivist eLearning design framework developed for use in CPD design within a healthcare milieu (Breithaupt & MacDonald, 2003; MacDonald, Stodel, Thompson, & Casimiro, 2009; Casimiro, MacDonald,

Thompson, & Stodel, 2009). Depicted in Figure 1, W(e)Learn specifies four critical program design domains: structure, content, media, and service.

Figure 1

The W(e)Learn framework



(MacDonald et al., 2009)

W(e)Learn includes four levels of outcomes (MacDonald, et al., 2009). These include: 1) satisfaction and a positive reaction to the learning experience; 2) changes in attitude or development of new knowledge or skill; 3) knowledge translation⁶; and, 4) improved patient health and organizational change. This hierarchy of outcomes is based on earlier work by Barr, Koppel, Reeves, Hammick and Freeth (2005) which draws upon Kirkpatrick’s (1967) original work on evaluation of learning outcomes.

⁶ W(e)Learn defines “Knowledge translation” as a change in learners’ behavior (MacDonald et al., 2009). This study is interested in behaviour related to clinical practice, therefore, the term practice is used herein to describe behaviour-related outcomes.

W(e)Learn is uniquely an instructional design framework developed specifically for eLearning within a healthcare context. It has been applied both in eLearning implementation and numerous healthcare studies (Archibald, MacDonald, & Trumpower, 2011, July; Halabisky et al., 2010; Puddester, MacDonald, Archibald, Sun, & Stodel, 2010). As a study interested in physicians' experiences and preferences related to eLearning design, W(e)Learn was a suitable choice as the theoretical frame of reference.

This study was led by a novice researcher with professional interest in CPD and eLearning among physicians. Co-researchers also worked professionally in the healthcare CPD milieu and were similarly new to conducting systematic reviews. As new investigators, we adhered to advice from Malterud (2001) that beginners should “follow a path that has been trodden by others, even though the more artistic potentials of analysis might then be traded off for a more mechanical, but transparent, approach” (p.487). In accordance, our decisions about theoretical underpinnings and methods were influenced by the literature and observations of methods used in other similar reviews. This study is a component of a larger study undertaken in fulfillment of a doctoral dissertation with ethics approval from the University of Ottawa.

This systematic review served two purposes: 1) to examine studies which used qualitative research methods to explore physician preferences for eLearning design and implementation, and 2) to assess identified physician eLearning preferences against the W(e)Learn framework's domains to suggest possible framework refinements.

Methods

A systematic review is an organized method to critically assess research studies that address a particular clinical issue and meet specific search criteria (Agency for Healthcare Research and Quality, 2011). The present systematic review was conducted using the University

of York Centre for Reviews and Dissemination methodology for identifying, appraising, and synthesizing the best available evidence (Centre for Reviews and Dissemination, 2009; McKibbin & Lokker, 2009).

Search Strategy and Selection Criteria

A search strategy to identify relevant studies was developed and is shown in Appendix A. The search identified articles which expressed “eLearning” and equivalent database search terms (e.g., eLearning, web-based learning, online learning, etc.) in text. To ensure a comprehensive search, a list of all physician types was obtained from the Royal College of Physicians and Surgeons of Canada to capture all medical specialties, subspecialties and general practitioner terms. Search strategies were modified as needed for each database searched: Medline, EMBASE, ERIC and the Research and Development Resource Base. The search was conducted on November 5, 2010. As eLearning is a recent phenomenon, no date restrictions were placed on the search. The search was limited to English-language publications.

Included in the review were primary research articles which satisfied the following criteria: 1) the study sample was comprised of practicing physicians, medical residents or groups of healthcare professionals that included practicing physicians and/or medical residents; 2) the intervention was a computer-based learning program; 3) studies used either qualitative or mixed methods designs, though only the qualitative data were included in this study; 4) the eLearning intervention was specified; and 5) the participant eLearning experience was described in reference to satisfaction, identified preferences, and/or attitude or practice change. Studies that did not fulfill the criteria above were excluded.

All citations were downloaded into a Reference Manager database and duplicates were removed. Two researchers (CP and LP) performed the primary screening of titles and abstracts of

articles by referring to the inclusion and exclusion criteria listed above. Disagreements were resolved by discussion.

Full manuscripts of all studies included during the primary review process were then reviewed by two researchers (CP and KH) and screened against the inclusion/exclusion criteria. Again, disagreements were resolved by discussion. Citations of the final selection of included studies were searched to identify studies missed in the original search of databases.

Quality Assessment

The quality of included studies was assessed using the Critical Appraisal Skills Programme (CASP) tool for appraisal of qualitative research (Critical Appraisal Skills Programme, 2006). Recognizing that many important aspects of qualitative research are difficult to measure (Dixon-Woods, Shaw, & Agarwal, 2004; Malterud, 2001), CASP's 10 questions, listed in Appendix B, provide a methodology-neutral guide for systematic assessment of dimensions of qualitative research that describes rigour, credibility and relevance. The assessment helped determine the relative quality of the included studies based on criteria such as reporting and conduct of methods of data collection and analysis (Centre for Reviews and Dissemination, 2009; Thorne, 2000). It also provided support for the internal validity of the review.

Data Extraction and Analysis

To the best of our knowledge, at the time of this review, there was no universal taxonomy for classifying physician eLearning preferences. As such, we used a theory-based analysis style to organize text according to pre-existing theoretical or logical categories (Miller & Crabtree, 1999). Given the alignment between W(e)Learn and our interest in eLearning among physicians, W(e)Learn was selected to provide the foundational taxonomy and lexicon for data extraction and coding. The W(e)Learn taxonomy did not, however, limit data extraction or coding; important

results that did not have a clear fit within W(e)Learn were included, and the code list was expanded as required.

One reviewer independently extracted data (e.g., author(s), date, purpose, ethics approval, methods, population, qualitative findings) from the included studies using a standard data extraction tool (Centre for Reviews and Dissemination, 2009). Data of interest consisted of the reported and clearly supported qualitative findings from each study. Extracted data were units of text expressing findings about physicians' perceptions of and preferences for eLearning design and delivery. These included phrases, sentences or short paragraphs representing a single, specific result (e.g., "time commitment was cited as a common challenge" (Dyrbye, Cumyn, Day, & Heflin, 2009, p. e43). Units of data were entered into a Microsoft Excel spreadsheet which was subsequently uploaded in Atlas.ti, a qualitative data analysis software.

Primary data analysis was carried out by one researcher (CP). Data analysis focused on coding reported findings and classifying coded data into themes (Miles & Huberman, 1984). Coding was a deductive process, guided by the W(e)Learn framework. Each unit of data was coded using W(e)Learn terminology (e.g., interactivity, evidence-based, etc.). A second researcher (KH) examined whether the first researcher's interpretations of the data and coding were plausible and noted contradictions for further discussion. When a unit of data did not fit within the W(e)Learn lexicon, a new, mutually agreed-upon code (e.g., *Time* and *Cost*) was generated, further enriching and expanding the preliminary list of codes.

Following initial coding, the researchers agreed on aggregation of codes into Families (e.g., text coded as "social interaction" and "discussion" were assigned to the "*Interactivity*" Family), which in turn were nested into main themes (e.g., "evidence-based" and "authentic"

were assigned to the “*Content*” theme). Families and themes were ordered according to the number of studies in which they were identified.

Results

The search of electronic databases generated 1,781 citations which reduced to 1,537 unique citations once duplicates were removed. After screening titles and abstracts, 98 full papers were retrieved and examined using the inclusion/exclusion criteria. Twenty four of these studies plus one study located by citation searching of the included studies, spanning the years 2000 to 2010, were assessed using the CASP tool (Critical Appraisal Skills Programme, 2006).

CASP scores for the included studies ranged from 15/20 to 20/20. Overall, studies had an average score of 17.8/20. It is interesting to note that only 7 studies reported the relationship between researchers and participants. This was the least frequently reported CASP criterion and may indicate that some researchers did not reflect on the influence their relationships may have had on their results. Similarly, while 22/25 studies described in general any consideration of ethics issues, few provided specific detail related to participant consent or the study’s formal ethics approval.

While the quality of the studies varied, the researchers felt that the quality of each was sufficient; therefore, all studies were included. A summary of the quality assessment results for included studies is shown in Table 1 in Appendix B. The total number of studies included in this review was 25. Details on the screening process are shown in the flow diagram in Figure 2.

Included studies representing a total of 808 participants were undertaken in Canada (8), the United States (5), Europe and Australia (12). The CPD programs studied ranged from postgraduate degree courses (5) to stand-alone courses on technical aspects of medical practice (20). Participant groups varied and included homogenous groups of practicing specialist

physicians and specialist residents (n=14); a mix of practicing physician/resident types (n=7); general practitioners only (n=3); or a mix of physicians and other health professionals (n=1). See Appendix C for a table summarizing the characteristics of the included studies.

All findings are summarized in Appendix D. The dominant elements identified through data analysis are reported below, grouped by overarching themes. They relate to eLearning program structure, content, media, service and outcomes.

Structure

Individual elements within the W(e)Learn domain of Structure were cited most frequently and appeared across studies involving all years and population types. These elements include interactivity, learner and context analysis, pedagogical strategies, and facilitation strategies and ethical considerations.

Interactivity. The nature and quality of social interactions in eLearning (learner to learner, learner to facilitator, learner to computer) was the most dominant element identified for successful eLearning for physicians. Cited in the findings of 25/25 (100%) of studies, the presence, absence, or preference for online interaction was the most commonly-reported element. Repeatedly highlighted by study participants, lack of interactivity was recognized as a barrier to participation, program completion, and/or satisfaction, while meaningful interaction was perceived as a learner motivator and desirable program characteristic.

Learner and context analysis. The assessment of learner needs, experience, preferences and goals was explicitly expressed in 17/25 (68%) studies. Studies articulated the importance of conducting comprehensive learner assessment in the program planning stage to ensure programs are contextually tailored, sufficiently challenging, relevant to learners' practice, and flexible in design to reflect learner preferences. Where learner and context analysis was insufficient, studies

reported lack of program completion. Avoidable pitfalls included lack of content relevance, lack of interaction, lack of time/time constraints, and/or inadequate computer skill levels (e.g., Blumberg, Quigley, & Goldberg, 2009; Cahill, Cook, Sithers, Edwards, & Kenkins, 2002; Jokela & Karlsudd, 2009; Zisook et al., 2009).

Pedagogical strategies. Constructing eLearning programs according to an appropriate pedagogical strategy can stimulate dialogue and critical inquiry (MacDonald et al., 2009). Discussed in 15/25 (60%) of the studies, the dominant theme was a preference for a case-based format. Four studies (Bridgemohan, Levy, Veluz, & Knight, 2005; Falkman, Gustafsson, Jontell, & Torgersson, 2008; MacDonald, Archibald, Stodel, Chambers, & Hall, 2008; Stergiou et al., 2009) suggested that designs requiring active involvement in discussion forums foster community, engagement and motivation and make it difficult for participants to “hide”. Self-pacing, self-directed content management, and having content organized into manageable “chunks” were also cited as desirable characteristics of the eLearning programs discussed in the studies (Bridgemohan et al., 2005; Curran, Hoekman, Gulliver, Landells, & Hatcher, 2000; MacDonald et al., 2008; Sargeant et al., 2004). Problem-based learning was another pedagogical strategy that was mentioned as desirable (Robson, 2009; Zisook et al., 2009), though less frequently than the case-based approach was highlighted.

Facilitation strategies. Guided by the selected instructional design and eLearning tools, the facilitator’s role in eLearning is to guide learning to meet individual and collective goals. Facilitators manage relationships among participants, ensuring all voices have a chance to be heard (MacDonald et al., 2009). Eleven studies (44%) addressed skills and characteristics of effective facilitation. Effective facilitators were characterized as those who asked thought-provoking/challenging questions and/or provided rapid responses and individual feedback.

Leadership in the role was characterized by setting and communicating the agenda and keeping discussions on track.

Bridgemohan et al. (2005) and Falkman et al. (2008) spoke about situations where some participants could “lurk”, being present online but not actively participating in the program. They saw it as the role of the facilitator to draw these individuals from their low level of participation into active discussion. Five studies (Allen, Sargeant, Mann, Fleming, & Premi, 2003; Curran, Kirby, Parsons, & Lockyer, 2003; Dunet, Reyes, Grossniklaus, Volansky, & Blanck, 2008; Jokela & Karlsudd, 2009; Sargeant, Curran, Allen, Jarvis-Selinger, & Ho, 2006) spoke about the need for facilitators to pursue training and develop skills to be effective in this capacity.

Ethical Considerations. Only five studies described learner concerns about the confidentiality of discussion forums and/or unease about exposing a lack of knowledge in front of peers (Cahill et al., 2002; Curran et al., 2003; Falkman et al., 2008; Kelly & MacKay, 2003; MacDonald et al., 2008). Though not identified as a major theme across all studies, confidentiality was stressed as an important issue in the studies where it was explicitly raised.

Content

Evidence-based. The next most-cited element was “*Evidence-based*” from the Content domain of the framework. The importance of program content being evidence-based, grounded on validated empirical research and aligned with theories, practices and skills, was highlighted in 11/25 (44%) of the studies. In many cases, programs were based on clinical practice guidelines which were presumed to be peer-reviewed and evidence-based. The perceived high quality of the evidence was cited as a major driver for participation in eLearning programs.

Media

Both “Usability” and “Technology” from the Media domain of W(e)Learn were important elements cited among the studies included in the systematic review.

Usability. Thirteen studies (52%) reported usability as an important enabler of or barrier to eLearning. Difficulty in program navigation was cited as a barrier (Blumberg et al., 2009; Dyrbye et al., 2009). Studies indicated a preference for eLearning programs that were intuitive to navigate and where long discussion threads were easy to follow (Kelly & MacKay, 2003; MacDonald et al., 2008; Robson, 2009).

Technology. W(e)Learn suggests that choices about the selection and use of hardware, software, and media should be made in consideration of practicality, context, and learning objectives (MacDonald et al., 2009). Thirteen studies (52%) concluded that adequate program software and hardware was an important success factor in eLearning, with reports that inadequate software and hardware had, for some participants, been a barrier to course uptake or completion (Allen et al., 2003; Brace-Govan & Gabbott, 2004; Curran et al., 2003; Gagnon et al., 2007; Jokela & Karlsudd, 2009). Four studies involving specialists (Bridgemohan et al., 2005; Grunewald et al., 2006; Hardy, Jones, & Kastelik, 2010; Jokela & Karlsudd, 2009) addressed the importance of rapid download times/high speed internet and high resolution graphics, particularly for programs such as those in radiology, where a high volume of images would typically be included in a learning program.

Outcomes

While a range of outcomes was addressed among the included studies, the qualitative data provided little in-depth description of the outcomes related to participation in eLearning programs. Just over half (14/25) the studies addressed satisfaction as an outcome (assessing the

extent to which the eLearning experience was positive), and only two studies (Cahill et al., 2002; Stergiou et al., 2009) reported attitude change or an increase in knowledge as an outcome. These findings were generally captured through closed-ended evaluation surveys in mixed-methods studies and, therefore, did not provide rich qualitative information to inform this study.

Within health research, measuring and attributing knowledge use is still in its early stages (Straus, Tetroe, Graham, Zwarenstein, & Bhattacharrya, 2009). Reflective of this evidence gap, higher-level outcomes such as changes in learner behaviour were described in 11/25 (44%) of studies based on learner self-reports, but none reported systematic measurement of this outcome. Qualitative self-reports suggested that eLearning may have supported behavior change.

Two studies addressed organizational change enabled by the eLearning experience as an outcome. Participants in the Robson (2009) study observed that individuals alone (those who participated in the eLearning program) could not induce organizational change; additional colleagues would also need to be educated to support widespread change. MacDonald et al. (2008) reported that 30/60 study participants (50%) noted organizational changes resulting from participation in the eLearning program, and 44 (73%) could provide examples of how patient care had improved following the eLearning program.

Service

“Service” is the broad W(e)Learn domain that addresses the level of support for eLearning programs from a technical and organizational perspective. None of the individual Service elements (*organization, technical support, accessibility, responsiveness*) were strongly identified as physician preferences or determinants of satisfaction in eLearning programs.

Time. Not an explicit W(e)Learn element, references to *Time* were a recurrent finding. Time was expressed in three ways: 1) practitioners suffer a perpetual, general lack of time and

many priorities compete for their time (7 studies); 2) some programs were of the right length or too time-consuming (not quantified) (5 studies); and 3) dedicated time to participate in eLearning programs during work hours might improve participation and program completion rates (6 studies). Aside from Time, the analysis did not identify other dominant themes that were not already explicit in the W(e)Learn framework.

Discussion

This systematic review sought to 1) examine studies which used qualitative research methods to explore physician preferences for eLearning design and implementation, and 2) to assess identified physician eLearning preferences against W(e)Learn domains to suggest possible framework refinements.

In relation to Question 1, findings suggest that dominant physician preferences for eLearning design and implementation include interactivity, context and learner assessment, skilled facilitation, confidentiality, case-based design, and program usability. In relation to Question 2, the review did not identify the *Service* domain of W(e)Learn as a dominant preference or influencer of the physician eLearning experience. This review also found that the element of *Time* should be added as a structural element in the W(e)Learn framework. This would encourage explicit consideration of dimensions of time in relation to learner needs and preferences. The following discussion will address each question in turn in reference to study findings.

Physician Preferences for ELearning Design

Of the key elements identified through this review, none was unique to only one type of study population or course type, and W(e)Learn elements related to structures, content, media and outcomes were strongly identified across the included studies. Interactivity was the most

commonly cited preference across all studies. While the term was rarely explicitly defined, it was generally used to express program design that required active engagement and communication between learners, between learners and faculty, and/or between learners and content. This finding closely aligns with the findings from reviews by Wong et al. (2010) and Carroll et al. (2009). Wong et al. (2010) found that, among physicians and medical students, interaction was one of two highly valued drivers of effective eLearning. In a review of the experience with eLearning of healthcare professionals in the UK, Carroll et al. (2009) noted similar results with communication, especially between learners, being of prime importance. Sargeant et al. (2006) found that physicians may judge the quality of interactivity within eLearning programs against the level of interactivity they find in face-to-face learning experiences. They seek an eLearning experience that is at least as interactive as a face-to-face program, offering face time with a key opinion leader(s) and the same or better degree of responsiveness that would be found in a face-to-face session.

In a pilot eLearning program for teaching advanced resuscitation skills, Jensen, Mondrup, Lippert, and Ringsted (2009) concluded that the critical missing success element was social interaction. They suggested that program developers should incorporate principles of both social and cognitive learning theories into eLearning design as opposed to cognitive and/or behavioural theories alone. Uniquely, they also noted how the commercial video game industry has achieved success through making social interaction between multiple players a major part of the experience, and suggested that eLearning might be enhanced by using similar design strategies.

Findings related to interactivity highlight the social nature of learning in general, regardless of the medium used. Learner feedback from numerous studies highlighted the perceived high value of the opportunity to interact with local or national experts. This emphasizes

the potential opportunity that eLearning offers for dialogue with thought leaders without the time and financial burdens inherent in travelling to meetings.

One recent study of preferences of healthcare providers including physicians found mixed preferences related to interactivity. Puddester et al. (2010) describe how some learners would prefer very brief (<10 min) eLearning programs where text and graphics could be quickly scanned over programs that offer more interaction. This suggests there may be subsets of “eLearners”: those who might prefer less interactive programs, and those who seek interactivity. Learner and context analysis at the outset of the program design process would inform how programs could be designed to accommodate learner preferences.

The next most dominant theme in this review, the importance of learner and context analysis, is a key conclusion reached by many education researchers (Davis & Davis, 2009; Marinopoulos et al., 2007; Wong et al., 2010). It cannot be overstated that program design and delivery should be determined through careful learner needs and context analysis, using objective assessment instruments such as chart or practice audits, performance data and peer review, when possible (Davis & Davis, 2009). A solid understanding of learner needs informs design considerations such as pedagogical preferences, scheduling, content development, and choices about which media to use and/or combine based on learner preferences and aptitudes.

ELearning programs offer the flexibility to rapidly change and adapt content, and this feature must be capitalized upon to glean the maximum benefit from the medium. This review found that participants seek challenging program content (e.g., Blumberg et al., 2009; Falkman et al., 2008; Jensen et al. 2009). Further, even within homogeneous groups of users, resources were used differently and a high degree of tailoring was valued by learners (Brace-Govan & Gabbott, 2004; Zisook et al., 2009). Again, learner and context analysis can inform important decisions

about the depth and breadth of content required to meet learner needs. ELearning platforms are well-suited to offer tailored learning opportunities that can suit a range of learner needs and preferences within a single program (e.g., real-time and asynchronous components, print material versus multi-media resources, multiple assessment instruments, etc.)

The importance of the role of the facilitator and the skill required to be an effective facilitator were themes that mirrored the results of the review by Carroll et al. (2009). Also emphasized by Carroll et al. (2009) and echoed in this review was the need for facilitators to be trained for the role. Not necessarily a strength of all facilitators, facilitation skills should be deliberately developed and refined. While both Carroll et al. (2009) and W(e)Learn (MacDonald et al., 2009) highlight the need for facilitators to act as moderators, balancing positions of power in the learning environment, this review revealed no comments about individuals dominating the discussion. The findings of this review primarily highlighted the need for facilitators to identify and draw out silent participants (Bridgemohan et al., 2005) and “lurkers” (Falkman et al., 2008).

The subject of “lurkers” was alluded to in another way in five of the included studies (see Table 1) under the theme of “Ethical Considerations” with an emphasis on confidentiality. These studies (Cahill et al., 2002; Curran et al., 2003; Falkman et al., 2008; Kelly & MacKay, 2003; MacDonald et al., 2008) discussed learner concerns about the confidentiality of discussion forums and unease about exposing a lack of knowledge in front of peers. This highlights the need for facilitators of physician eLearning programs to set participants at ease by assuring confidentiality within the learning environment, and for program designers to consider ways of balancing easy access to programs while still protecting the closed context of the program.

Repeatedly stated was the preference for a case-based eLearning design format. The present review is unique among similar reviews in its finding of a strong preference for case-

based learning, though other recent single studies have shown a similar preference among physicians (Srinivasan, Wilkes, Stevenson, Nguyen, & Slavin, 2007). The case-based approach is commonly used in CPD presentations at medical conferences and workshops. It is not clear whether a case-based format was preferred because it is what practitioners are accustomed to, or whether it is more effective at stimulating discussion and active learning.

Other enablers of eLearning were program usability and adequate software/hardware technology. Studies where the importance of usability and technology were addressed dated from 2000 to 2010. Early in the development of eLearning, programs may have required skills that were more advanced than the skills of many users, or may have had non-user-friendly platforms. Programs may have had slow download times or other technological barriers. In 2010, where physicians commonly have access to high-speed internet and are emerging as enthusiastic adopters of technologies such as smart phone applications and tablets with touch screen technology, etc. (Canadian Cardiovascular Society, 2009), physicians seek up-to-date, user-friendly platforms in eLearning. Developers are well-advised to use current program design approaches and technology that supports functionality such as intuitive navigation and rapid download times.

The present review revealed some commonalities across all studies with respect to findings about physician preferences for eLearning design. The dominant themes such as the need for interactivity, thorough context and learner analysis, and skilled facilitation are applicable to all educational designs. While no single study emphasized physicians' strong desire for balanced, evidence-based content and system user-friendliness, this review found these to be recurring themes.

This review also uncovered physician preferences related to confidentiality and flexibility in program timing. Further research focused on these themes would provide additional direction on how to address these preferences through program design.

Suggested Refinements to the W(e)Learn Framework

This review identified one element which could be explicitly reflected in W(e)Learn's *Structure* domain. Not explicitly discussed as part of the W(e)Learn Framework is consideration of the amount of time learners have available for eLearning, or the degree of flexibility in timing needed for optimal participation. Six studies commented on aspects of time: 1) programs took too much time to complete (Gagnon et al., 2007; MacDonald et al., 2008); 2) participants experienced a lack of time in general for CPD (Cahill et al., 2002; Kelly & MacKay, 2003); 3) planners and organizations should build dedicated time to complete programs into regular work hours (Hardy et al., 2010; MacDonald et al., 2008).

Wong et al. (2010) assert that eLearning design should accommodate a range of delivery mediums selected to suit learners and context. W(e)Learn reflects this principle through the learner and context assessment element within the domain of *Structure*. *Time* is a context-specific element that should be accounted for through learner needs assessment. However, the frequency that *Time* was discussed as an important design consideration may suggest that it is important to explicitly prompt designers to thoroughly assess learner needs and preferences about optimal scheduling and time available to participate in programs. This review suggests that adding *Time* as an explicit element within W(e)Learn's *Structure* domain could strengthen the framework.

The individual elements of W(e)Learn's *Service* domain (e.g., helpful, accessible and responsive technical support) were not identified as dominant physician preferences. Five studies (Kelly & McKay, 2003; Falkman et al., 2008; Grunewald et al., 2006; Jensen et al., 2009; Jokela

& Karlsudd, 2009) included limited reference to aspects of *Service* such as the requirement for adequate technical support, user training, cost-free program access, and responsiveness to user feedback. Possibly, in many included studies, the interventions were well-planned and executed such that few problems arose requiring extensive technical support. It is also possible that included studies did not ask explicit service-related questions and therefore did not elicit feedback on this theme.

From an empirical standpoint, many technology users, especially those using a new technology, experience technical problems. Under those conditions, timely access to helpful support is invaluable. With this in mind, this review supports the inclusion of *Service* as a key domain in W(e)Learn.

Limitations

This review was subject to several limitations. The literature search was systematic and replicable; however, there is always a risk that some eligible studies were not included. This possibility is balanced by the highly consistent findings across the 25 studies lending trustworthiness to the interpretation of the results and suggesting that the included studies provided a high degree of saturation of important themes (Cohen & Crabtree, 2008; Malterud, 2001).

There are challenges inherent in synthesizing qualitative findings, including varied reporting styles between included studies, misrepresentation of data, misuse of quotes, and/or lack of clarity in identifying themes (Sandelowski & Barroso, 2002). The consistency across findings between studies helped balance this potential threat.

Individual studies represented many contexts and researcher biases. Providing the quality scores for individual studies is intended to justify the inclusion of each study in the review based

on research merits and relevance. Relying solely on works cited in publications to fully understand physician preferences is imperfect (Cohen & Crabtree, 2008). Although the included studies are representative of the body of formal research, informal discussions on this topic arise in other places such as conferences and hallway conversations, and these sources are not captured in the present study.

Reviews can be biased by researcher preconceptions and motivations (Cohen & Crabtree, 2008; Malterud, 2001). In this review, systematic methods were followed and described to achieve a trustworthy and transparent research process. Peer review was supported through the involvement of other researchers whose dual perspectives helped balance the selection of eligible studies (Malterud, 2001). One researcher performed the initial coding but an external audit was conducted by a second researcher to assess the accuracy of the coding and the extent to which the findings and interpretations were supported by the data (Cohen & Crabtree, 2008).

A theoretical framework was used as the lens for data analysis. Providing information about the framework and its role is intended to contribute to the trustworthiness of the research (Malterud, 2001). W(e)Learn guided the coding process; disclosure about this approach makes the process repeatable and clear. While the framework provided a helpful lexicon for coding, codes that were not inherent or explicit in the framework (e.g., *Time*) were introduced, enabling identification of constructs potentially missing from the framework. This approach served dual purposes: supporting the confirmability of the research; and enabling assessment of the framework by not forcing data to fit predetermined constructs.

Conclusion

This review highlights key considerations for educators who seek to support physician CPD through eLearning. The importance to physicians of interaction and the social nature of

eLearning were reflected here as they have been in other reviews which used quantitative methods and/or included heterogeneous groups of healthcare providers. Skilled facilitators can support meaningful interaction, and with the right skills and training, can enhance the eLearning experience. Learner and context analysis is important, allowing designers to understand learners and customize programs, capitalizing on an inherent advantage of eLearning technology and platforms. Physicians are highly attuned to the source of content in CPD programs and seek evidence-based content that is free of bias. Further, physicians seek high usability and ease of navigation in eLearning programs. Physicians can be deterred from eLearning by technical problems, and seek rapid and seamless functionality.

This study also assessed identified physician eLearning preferences against the domains of the W(e)Learn framework to suggest possible framework refinements. Findings suggest that overall, the framework reflects physician eLearning design preferences with respect to structure, content and media. Framework domains of Service and Outcomes were not substantially addressed in the included studies. Refinement could be made to the framework to explicitly prompt developers to consider the implications of *Time* from the point of view of both learners and program developers.

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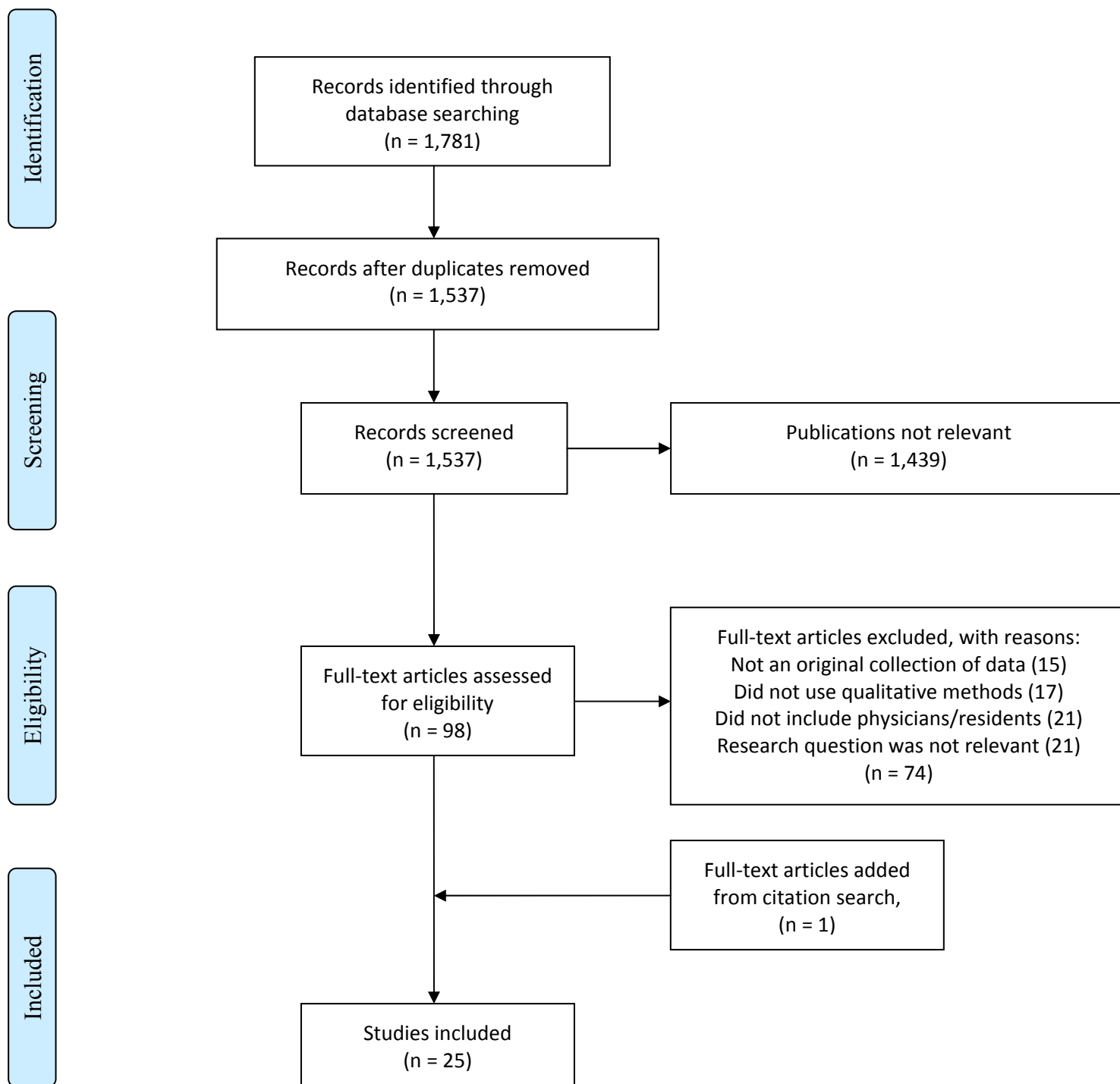
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Figure 2

Flow Diagram



Appendix A: Search strategy

Medline, EMBASE, ERIC and the Research and Development Resource Base were searched on November 5, 2010 and retrieved 719, 827, 200 and 34 studies respectively. Searches were performed with no year restrictions and limited to English language studies. The following search terms were used: online, web-based, Internet, training, learning, instruction, and eLearning.

A validated search strategy for retrieving studies of qualitative literature was applied (Wong, Wilczynski, & Haynes, 2004; Walters, Wilczynski, & Haynes, 2006). Appropriate wildcards were used in the searching in order to account for plurals and variations in spelling. Additional articles were identified through reference lists and discussions with experts.

Search strategies by data source:

Medline (OVID)

- 1 ("web based" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 2 ("computer based" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 3 (online adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 4 ("computer mediated" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 5 (virtual adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 6 ("computer assisted" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 7 (Internet adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 8 ("computer supported" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 9 ((ebased or e-based) adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 10 (electronic adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 11 (on-line adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 12 elearning.tw.
- 13 e-learning.tw.
- 14 e-education.tw.
- 15 e-instruction.tw.
- 16 einstruction.tw.
- 17 etraining.tw.

- 18 e-training.tw.
- 19 e-course?.tw.
- 20 ecourse?.tw.
- 21 e-tutorial?.tw.
- 22 etutorial?.tw.
- 23 eworkshop?.tw.
- 24 e-workshop?.tw.
- 25 or/1-24
- 26 an?esthesiologist?.mp.
- 27 anesthe?ist?.mp.
- 28 cardiologist?.mp.
- 29 (critical adj care).mp.
- 30 dermatologist?.mp.
- 31 emergency.mp.
- 32 endocrinologist?.mp.
- 33 gastroenterologist?.mp.
- 34 gerontologist?.mp.
- 35 geriatric\$.mp.
- 36 gyn?ecologist?.mp.
- 37 h?ematologist?.mp.
- 38 immunologist?.mp.
- 39 (infectious adj disease?).mp.
- 40 neonatologist?.mp.
- 41 nephrologist?.mp.
- 42 neurologist?.mp.
- 43 neuropathologist?.mp.
- 44 neuroradiologist?.mp.
- 45 neurosurgeon?.mp.
- 46 obstetrician?.mp.
- 47 occupational.mp.
- 48 oncologist?.mp.
- 49 ophthalmologist?.mp.
- 50 orthotist?.mp.
- 51 orthoptist\$.mp.
- 52 orthop?ed\$.mp.
- 53 osteopath?.mp.
- 54 otolaryngologist?.mp.
- 55 p?ediatrician?.mp.
- 56 pathologist?.mp.
- 57 palliative.mp.
- 58 perinatalist?.mp.
- 59 phlebotomist?.mp.
- 60 podiatrist?.mp.
- 61 psychiatrist?.mp.
- 62 radiologist?.mp.

- 63 respirologist?.mp.
- 64 rheumatologist?.mp.
- 65 traumatolog\$.tw.
- 66 urologist?.mp.
- 67 residen\$.mp.
- 68 clinician?.tw.
- 69 (family adj practitioner?).mp.
- 70 (general adj practitioner?).mp.
- 71 physician?.mp.
- 72 surgeon?.mp.
- 73 doctor?.tw.
- 74 specialist?.mp.
- 75 exp Medicine/
76 or/26-75
- 77 interview\$.mp.
- 78 experience\$.mp.
- 79 qualitative.tw.
80 or/77-79
- 81 25 and 76 and 80
- 82 limit 81 to english language

EMBASE (OVID)

- 1 ("web based" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 2 ("computer based" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 3 (online adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 4 ("computer mediated" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 5 (virtual adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 6 ("computer assisted" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 7 (Internet adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 8 ("computer supported" adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 9 ((ebased or e-based) adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 10 (electronic adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.

- 11 (on-line adj2 (learning or teaching or instruction or education or course? or training or tutorial? or workshop?)).mp.
- 12 elearning.tw.
- 13 e-learning.tw.
- 14 e-education.tw.
- 15 e-instruction.tw.
- 16 einstruction.tw.
- 17 etraining.tw.
- 18 e-training.tw.
- 19 e-course?.tw.
- 20 ecourse?.tw.
- 21 e-tutorial?.tw.
- 22 etutorial?.tw.
- 23 eworkshop?.tw.
- 24 e-workshop?.tw.
- 25 or/1-24
- 26 an?esthesiologist?.mp.
- 27 anesthe?ist?.mp.
- 28 cardiologist?.mp.
- 29 (critical adj care).mp.
- 30 dermatologist?.mp.
- 31 emergency.mp.
- 32 endocrinologist?.mp.
- 33 gastroenterologist?.mp.
- 34 gerontologist?.mp.
- 35 geriatric\$.mp.
- 36 gyn?ecologist?.mp.
- 37 h?ematologist?.mp.
- 38 immunologist?.mp.
- 39 (infectious adj disease?).mp.
- 40 neonatologist?.mp.
- 41 nephrologist?.mp.
- 42 neurologist?.mp.
- 43 neuropathologist?.mp.
- 44 neuroradiologist?.mp.
- 45 neurosurgeon?.mp.
- 46 obstetrician?.mp.
- 47 occupational.mp.
- 48 oncologist?.mp.
- 49 ophthalmologist?.mp.
- 50 orthotist?.mp.
- 51 orthoptist\$.mp.
- 52 orthop?ed\$.mp.
- 53 osteopath?.mp.
- 54 otolaryngologist?.mp.

- 55 p?ediatician?.mp.
- 56 pathologist?.mp.
- 57 palliative.mp.
- 58 perinatalist?.mp.
- 59 phlebotomist?.mp.
- 60 podiatrist?.mp.
- 61 psychiatrist?.mp.
- 62 radiologist?.mp.
- 63 respirologist?.mp.
- 64 rheumatologist?.mp.
- 65 traumatolog\$.tw.
- 66 urologist?.mp.
- 67 residen\$.mp.
- 68 clinician?.tw.
- 69 (family adj practitioner?).mp.
- 70 (general adj practitioner?).mp.
- 71 physician?.mp.
- 72 surgeon?.mp.
- 73 doctor?.tw.
- 74 specialist?.mp.
- 75 exp Medicine/
- 76 or/26-75
- 77 interview\$.tw.
- 78 exp Health Care Organization/
- 79 experiences.tw.
- 80 or/77-79
- 81 25 and 76 and 80
- 82 limit 81 to english language

ERIC (Ebscohost)

(KW=("web based learning" or "web based teaching" or "web based instruction" or "web based education" or "web based course*" or "web based training" or "web based tutorial*" or "web based workshop*" or "computer based learning" or "computer based teaching" or "computer based instruction" or "computer based education" or "computer based course*" or "computer based training" or "computer based tutorial*" or "computer based workshop*" or "online learning" or "online teaching" or "online instruction" or "online education" or "online course*" or "online training" or "online tutorial*" or "online workshop*" or "computer mediated learning" or "computer mediated teaching" or "computer mediated instruction" or "computer mediated education" or "computer mediated course*" or "computer mediated training" or "computer mediated tutorial*" or "computer mediated workshop*" or "virtual learning" or "virtual teaching" or "virtual instruction" or "virtual education" or "virtual course*" or "virtual training" or "virtual tutorial*" or "virtual workshop*" or "computer assisted learning" or "computer assisted teaching" or "computer assisted instruction" or "computer assisted education"

or "computer assisted course*" or "computer assisted training" or "computer assisted tutorial*" or "computer assisted workshop*" or "Internet learning" or "Internet teaching" or "Internet instruction" or "Internet education" or "Internet course*" or "Internet training" or "Internet tutorial*" or "Internet workshop*" or "computer supported learning" or "computer supported teaching" or "computer supported instruction" or "computer supported education" or "computer supported course*" or "computer supported training" or "computer supported tutorial*" or "computer supported workshop*" or "ebased learning" or "ebased teaching" or "ebased instruction" or "ebased education" or "ebased course*" or "ebased training" or "ebased tutorial*" or "ebased workshop*" or "e-based learning" or "e-based teaching" or "e-based instruction" or "e-based education" or "e-based course*" or "e-based training" or "e-based tutorial*" or "e-based workshop*" or "electronic learning" or "electronic teaching" or "electronic instruction" or "electronic education" or "electronic course*" or "electronic training" or "electronic tutorial*" or "electronic workshop*" or "on-line learning" or "on-line teaching" or "on-line instruction" or "on-line education" or "on-line course*" or "on-line training" or "on-line tutorial*" or "on-line workshop*" or elearning or e-learning or e-education or e-instruction or einstruction or etraining or e-training or e-course* or ecourse* or e-tutorial* or etutorial* or eworkshop* or e-workshop*)) and (KW=(physician* or clinician* or "family practitioner*" or "general practitioner*" or surgeon* or doctor* or specialist*))

RDRB (Research and Development Resource Base)

Available at: rdrb.utoronto.ca

(web based learning or web based teaching or web based instruction or web based education or web based course* or web based training or web based tutorial* or web based workshop* or computer based learning" or computer based teaching or computer based instruction or computer based education or computer based course* or computer based training or computer based tutorial* or computer based workshop* or

online learning or online teaching or online instruction or online education or online course* or online training or online tutorial* or online workshop* or computer mediated learning or computer mediated teaching or computer mediated instruction

or computer mediated education or computer mediated course* or computer mediated training or computer mediated tutorial* or computer mediated workshop* or virtual learning or virtual teaching or virtual instruction or virtual education or virtual course* or virtual training or virtual tutorial* or virtual workshop* or computer assisted learning or computer assisted teaching or computer assisted education or computer assisted course* or computer assisted training or computer assisted tutorial* or computer assisted workshop* or Internet learning or Internet teaching or Internet instruction

or Internet education or Internet course* or Internet training or Internet tutorial* or Internet workshop* or computer supported learning or computer supported teaching or computer supported instruction or computer supported education or computer supported course* or computer supported training or computer supported tutorial* or computer supported workshop* or ebased learning or ebased teaching or ebased instruction or ebased education or ebased course* or ebased training or ebased tutorial* or ebased workshop* or e-based learning or e-based teaching or e-based instruction or e-based education or e-based course* or e-based training or e-based tutorial* or e-based workshop* or electronic learning or electronic teaching or electronic instruction or electronic education or electronic course* or electronic training or electronic

tutorial* or electronic workshop* or on-line learning or on-line teaching or on-line instruction or on-line education or on-line course* or on-line training or on-line tutorial* or on-line workshop*) AND (qualitative or interview or experience)

OR

(e-education or e-instruction or einstruction or etraining or e-training or e-course* or ecourse* or e-tutorial* or etutorial* or eworkshop* or e-workshop*)

OR

(elearning or e-learning or computer assisted instruction) AND (qualitative or interview or experience) AND (physician or doctor or surgeon)

Appendix B: Quality assessment of included studies

Table 1

Quality assessment of included studies (n=25)

CASP Quality Dimension (<i>CASP, 2006</i>)	Allen et al.	Blumberg et al.	Brace-Govan & Gabboff	Bridgemohan et al.	Cahill et al.	Curran et al. (2000)	Curran et al. (2003)	Dunet et al.	Dyrbye et al.	Falkman et al.	Gagnon et al.	Gallant et al.	Grunewald et al.	Hardy et al.	Hughes et al.	Jensen et al.	Jokela & Karlsudd	Kelly & McKay	MacDonald et al.	Robson	Sargeant et al. (2006)	Sargeant et al. (2004)	Smith et al.	Stergiou et al.	Zisook et al.
Clear statement of the aims of the research	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Qualitative methodology appropriate	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Research design appropriate	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Recruitment strategy appropriate	2	2	1	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Data collected in a way that addressed the research issue	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Relationship between researcher and participants considered	0	2	0	0	2	0	0	0	2	0	2	2	0	0	0	2	0	0	0	0	0	0	0	2	0
Ethical issues considered	1	2	1	1	2	0	2	2	2	1	2	2	1	1	1	2	0	1	1	1	2	2	0	2	1
Data analysis sufficiently rigorous	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Clear statement of findings	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Value of the research	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Score (maximum possible score: 20)	17	20	16	17	20	16	18	18	20	15	20	20	17	17	17	20	16	17	17	17	18	18	16	20	17

2: Yes
 1: Partial
 0: No or not stated

Appendix C: Characteristics of included studies

Table 2

Characteristics of included studies (n=25)

Primary Author, Year, Country of origin	Study objectives	Participants (n= 808)	# Male	Methods
Allen (2003), CDA	To evaluate the feasibility, acceptability, effectiveness, and cost of conducting practice-based, small-group, video-conference-based CPD for general practitioners.	10 general practitioners	Not stated	Mixed methods : survey, pre-post testing, observation, interviews, focus group
Blumberg (2009), US	To design and test a web-based teaching system to support ophthalmologists' skills for diagnosing/managing glaucoma	34 ophthalmology specialists, 21 residents	Not stated	Qualitative: interviews
Brace-Govan (2004), AU	To elicit the views of primary care physicians about online education and their perception of using IT to access CME.	19 general practitioners	Not stated	Qualitative: Focus group interviews
Bridgemohan (2005), US	To explore paediatric residents' perceptions of a facilitated case discussion and computerised tutorial.	46 pediatric residents	Not stated	Mixed methods: interviews and survey
Cahill (2002), GB	To evaluate an Internet-delivered postgraduate training course in obstetric medicine and to elicit feedback about program design and satisfaction.	11 obstetrics residents	Not stated	Mixed methods : survey, activity logs, interviews
Curran (2000), CDA	To examine the association between participant and facilitator participation in online asynchronous CME learning environments.	33 general practitioners, 4 specialists	19	Mixed methods: interviews and survey
Curran (2003), CDA	To assess instructional effectiveness and participant satisfaction in a hybrid online learning program for dermatologists.	52 physicians	41	Mixed methods: interviews and survey

Dunet (2008), US	To test the effectiveness and acceptability of an online training course to address a lack of knowledge among healthcare professionals regarding the identification of patients at risk for hemochromatosis.	8 physicians	Not stated	Mixed methods : survey, activity logs, interviews
Dyrbye (2009), US	To explore the experiences of physicians pursuing a degree in higher education with online learning, including motivations for choosing this format, barriers encountered, and ideas for facilitating learning in the online environment.	48 physicians	19	Mixed methods : survey with closed and open-ended questions
Falkman (2008), SE	To implement an eLearning program for oral medicine practitioners and examine how participation in the program influenced development of a community of practice and individual practice change.	9 oral medicine specialists	Not stated	Mixed methods : survey, observation, interviews
Gagnon (2007), CDA	To identify physicians' beliefs regarding their completion of this online learning program.	35 physicians	17	Mixed methods: survey, focus groups, interviews
Gallant (2010), CDA	To develop a web-based, interactive, learning module on Head and Neck anatomy for radiation oncologists and trainees.	25 oncology residents, 2 oncology specialists	Not stated	Qualitative: interviews
Grunewald (2006), DE	To develop and test a web-based training program for medical professionals who teach radiology which addressed their learning needs and elicited preferences with regard to layout, interactivity, and content.	52 radiologists	Not stated	Mixed methods: survey, interviews
Hardy (2010), GB	To assess the experiences of respiratory trainees who participated in a web-based learning program.	26 respiratory residents	Not stated	Qualitative: interviews and diary
Hughes (2009), GB	To examine Web 2.0 use by 35 junior physicians in clinical settings to further understand its impact on their medical practice.	35 physicians	Not stated	Mixed methods: pre-post testing and interviews
Jensen (2009), DK	To examine the effect of an eLearning program as a booster of competence acquired from an online Advanced Life Support course and to identify factors related to the use of the eLearning program.	51 emergency physicians	26	Mixed methods: survey, observation, interviews

Jokela (2009), SE	To evaluate the effectiveness and acceptability of a video conference-supported course in emergency medicine.	27 emergency physicians	16	Mixed methods: survey, observation, interviews
Kelly (2003), GB	To study how an eLearning tool designed to encourage self-directed learning and practice change was used and perceived by general practitioners.	39 general practitioners	24	Mixed methods: pre-post testing and interviews
MacDonald (2008), CDA	To assess learners' reactions to an interprofessional eLearning tool better understand how the tool could support knowledge translation among pharmacists, physicians, and nurses.	51 healthcare providers including physicians (not specified)	Not stated	Mixed methods : survey, interviews
Robson (2009), GB	To determine whether clinical guidelines combined with eLearning modules could increase knowledge, result in changes in practice, and be acceptable to primary care clinicians as a mode of modifying practice.	43 general practitioners	Not stated	Qualitative: focus groups and interviews
Sargeant (2004), CDA	To explore instructor roles in enhancing online learning through interpersonal interaction and the learning theories that inform these.	41 general practitioners, 9 specialist physicians	31	Qualitative: focus groups and interviews
Sargeant (2006), CDA	To explore physicians' perceptions of and experiences in interactive on-line CME and factors influencing these.	41 general practitioners, 9 specialist physicians	31	Qualitative: interviews
Smith (2009), GB	To investigate the views of respiratory residents about implementing eLearning within their postgraduate education.	13 residents	2	Qualitative: interviews
Stergiou (2009), GR	To demonstrate successful application of traditional learning theories and methods within an eLearning program and evaluate the perceptions cytopathologists about the eLearning experience.	12 residents, 2 specialist physician faculty	Not stated	Mixed methods : survey, interviews
Zisook (2009), US	To describe the feasibility and usefulness of an eLearning module adapted from the traditional psychopharmacology curriculum and the assess the experiences of psychiatry residents who participated the program.	47 residents	Not stated	Qualitative: interviews

Appendix D: Findings from all included studies

Table 3

Findings from all included studies (n=25)

Year	First Author	Structure								Content				Media				Service				Outcomes				Other
		Learner/Cont ext Analysis	Ethics	Facilitation	Learner Assessment	Pedagogy	Interactivity	Community	Reusability	Inclusive	Authentic	Evidence- Based	Responsive	Delivery Mode	Usability	eLearning Skills	Technology	Organization	Tech. Support	Accessibility	Responsive- ness	Satisfaction	Attitude	Behaviour	Org. Change	Time
2000	Curran	•		•														•	•						•	
2002	Cahill				•			•			•	•	•								•		•			
2003	Allen	•	•	•	•																					
2003	Curran					•							•						•						•	
2003	Kelly	•	•			•												•	•	•		•			•	
2004	Brace-Govan					•			•	•	•	•	•												•	
2004	Sargeant		•	•									•	•	•	•									•	
2005	Bridgemohan			•	•	•			•	•	•	•	•	•	•	•			•				•		•	
2006	Grunewald	•		•		•							•	•	•	•			•						•	
2006	Sargeant	•	•	•		•						•													•	
2007	Gagnon	•		•		•								•	•	•									•	
2008	Dunet	•			•	•						•								•					•	
2008	Falkman	•	•			•			•	•	•	•		•					•	•			•		•	
2008	MacDonald	•			•				•	•	•	•		•					•				•		•	
2009	Blumberg		•											•												
2009	Dyrbye	•																					•			
2009	Hughes	•		•									•					•							•	
2009	Jensen	•	•			•							•	•	•	•			•				•		•	
2009	Jokela	•	•	•	•	•			•	•	•	•	•	•	•	•			•				•		•	
2009	Robson	•			•	•			•	•	•	•	•	•	•	•							•		•	
2009	Smith	•			•	•			•		•														•	
2009	Stergiou	•		•					•																	
2009	Zisook														•											
2010	Gallant			•		•				•	•		•	•	•											
2010	Hardy	•			•	•						•													•	
	Frequency/25	17	8	11	7	15	25	10	9	7	9	11	8	11	13	10	13	4	7	8	4	14	2	11	2	14

CHAPTER 3 (Article 2)

Heart Failure Bootcamp: Exploring design, development and delivery of an educational webinar series for cardiologists.

This manuscript is developed for submission to a journal such as *The Internet and Higher Education*, which is devoted to addressing contemporary issues and future developments related to online learning, teaching, and administration on the Internet in post-secondary settings.

Word limit: none specified

Abstract

Introduction: This study describes the process of designing, developing and delivering an educational webinar series for cardiologists in accordance with an instructional design framework. The aim of this study was to explore the webinar implementation process to learn about the factors that may support outcomes related to satisfaction and changes in knowledge and practice among cardiologists.

Methods: An exploratory case study was undertaken involving cardiologists who voluntarily participated in a 4-part webinar series. Implementation and assessment were guided by a constructivist instructional design framework. Data sources included email records, webinar transcripts, and surveys. Data were analyzed using qualitative techniques as the primary approach. Open- and closed-ended survey questions generated a limited number of descriptive or “quasi” statistics which lent support and context to interpretations.

Results: 13 cardiologists participated in the study. Needs assessment survey results informed and influenced webinar design and delivery. Outcomes included participant satisfaction and participant feedback suggested some cardiologists experienced changes in knowledge and practice. Unanticipated findings related to the use of the webinar program to support existing communities of learners within the same geographic site, and the limited use of the asynchronous webinar recordings.

Discussion: This study supported the use of an instructional design framework to guide webinar implementation. A skilled and dedicated implementation team was an asset to the webinar implementation process. Participating cardiologists found webinars to be a satisfying learning experience. The webinars may have supported changes in knowledge and practice. Real-time interaction was an important characteristic of the webinars. The detailed description of activities and findings may serve as a guide for those seeking to develop similar web-based educational programs for cardiologists.

Key words: webinar, synchronous, design, outcomes, cardiologist, physician

Physicians have the professional imperative to keep current with medical and scientific research and to practice accordingly (Institute of Medicine, 2011). With the speed and magnitude at which the knowledge base in medicine expands, keeping up to date has become increasingly challenging (Grimshaw et al., 2004; Lenfant, 2003). Evidence-based clinical practice guidelines synthesize research evidence to provide concise recommendations for patient care and are therefore a helpful reference tools to which physicians can refer to keep current (Brouwers, Stacey, & O'Connor, 2009). Continuing professional development (CPD) is one mechanism through which physicians can gain familiarity with, and knowledge of, evidence-based guidelines in support of ongoing development of professional competencies (Peck, McCall, McLaren, & Rotem, 2000).

The Canadian Cardiovascular Society (CCS) is Canada's professional association for cardiologists. The Society's mandate includes developing and disseminating clinical practice guidelines to support members in maintaining current practices. To help increase awareness and knowledge of national clinical practice guidelines for management of heart failure, the CCS delivers face-to-face workshops to promote dialogue between content experts and clinicians in support of evidence-based practice.

Workshop participants report that the experience is valuable. Of the 7 workshops delivered in 2009, 100% of survey respondents (n=258) agreed or strongly agreed that the content was relevant to their practice, 92% agreed or strongly agreed that the workshops were conducive to learning, and 100% rated the workshop learning experience as very good or excellent (CCS, 2009a). In addition, the CCS has documented a steadily increasing rate of *repeat* attendance (CCS, 2009a); in 2009, over 35% of heart failure workshop participants had attended a previous CCS workshop.

The number of face-to-face workshops the CCS can deliver each year is limited by cost. The CCS receives requests to deliver the workshop in many locations across Canada but does not have the resources to satisfy the demand. Those who cannot attend workshops can still access the guidelines in print or online, but the Society's ideal was to expand the reach of this educational program to provide more members with the opportunity to interact with and learn from national experts and other colleagues.

ELearning is defined as "the development of knowledge and skills through the use of information and communication technologies to support interaction for learning – interactions with content, with learning activities and tools, and with other people" (Rossiter, 2005, p. 5). Enabling synchronous and asynchronous⁷ learner interaction with instructors, peers, and content in an environment that can accommodate a range of learning preferences, eLearning can be a satisfying and effective learning medium (Beldarrain, 2006; Cook et al., 2008; Weeks & Molsberry, 2008).

Webinars are one medium for eLearning. Derived from two words, "web" referring to the World Wide Web and "seminar", webinars are real-time, online meetings where individuals can gather at a specific time to listen, observe, and/or participate in "virtual" seminars (Korb, 2000). Simulating the experience of face-to-face seminars, webinar participants use personal computers connected to the internet to join a host site where they can listen to a speaker, view a slide and video presentation, and dialogue with other participants via video, audio or text chat. Webinar

⁷*Synchronous* technologies such as webinars enable real-time interactions. *Asynchronous* technologies such as archived online learning programs enable any-time collaboration where users are not necessarily interacting at the *same* time (Driscoll, 2001).

technology can support real-time interaction, is low cost, time efficient, and accessible to anyone with a computer and an internet connection.

Up until 2010, the CCS had not explored webinars as a vehicle for delivering CPD programs. A CCS survey of 245 members (CCS, 2009b) indicated that 38% of CCS members had an interest in participating in webinars, but only 4% had used this medium. In addition, 81% of members place a high value on CCS clinical practice guidelines and 54% value “meet the expert” CPD programs, yet only 23% had attended a CCS guideline workshop.

This gap between the high levels of interest in the workshop and webinars and the lower levels of participation in both provided the incentive to explore adapting the face-to-face workshop format for a webinar format. A first foray into webinars, the CCS was eager to learn how to develop webinars that would be appealing and satisfying to cardiologists and could support professional development. The aim of this study was to explore the webinar implementation process to learn about factors that may support outcomes including satisfaction and changes in knowledge and practice among participating cardiologists.

Theoretical Background

Constructivist learning theory provided the pedagogical foundation for the study. It guided the selection of an instructional design framework and the process for webinar design, development and delivery.

Constructivist Learning Theory

Constructivism is a multi-dimensional theory of learning characterized by active inquiry, construction of ideas based on past experience, self-regulated learning, and development over the lifespan (Merriam, Cafarella, & Baumgartner, 2007; von Glaserfeld, 2005). Social interaction between learners is an important facet of constructivism (Palincsar, 1998) as is coaching or

facilitation by mentors or senior content experts (Schon, 1983). Through interactive dialogue with self, others and texts, collaborative groups may experience more learning success than individuals working alone (Beldarrain, 2006; Loyens, Rikers, & Schmidt, 2006; Tan, Amin, & Khoo, 2007). With a goal of providing a forum for participants to engage in knowledge construction through expert-facilitated interaction, constructivist learning theory was well suited as a pedagogical foundation for the design of the webinar series.

Program design based on a chosen pedagogy has been linked to the success of eLearning programs (Hung & Der-Thanq, 2001; Inan & Lowther, 2007). Constructivist design frameworks are well suited for eLearning, enabling self-directed learners to interact to construct knowledge (Cook, Gelula, Dupras, & Schwartz, 2007; Mason & Rennie, 2006). Since this eLearning intervention sought to foster interaction and co-construction of knowledge, a constructivist design framework was chosen to guide webinar design and delivery.

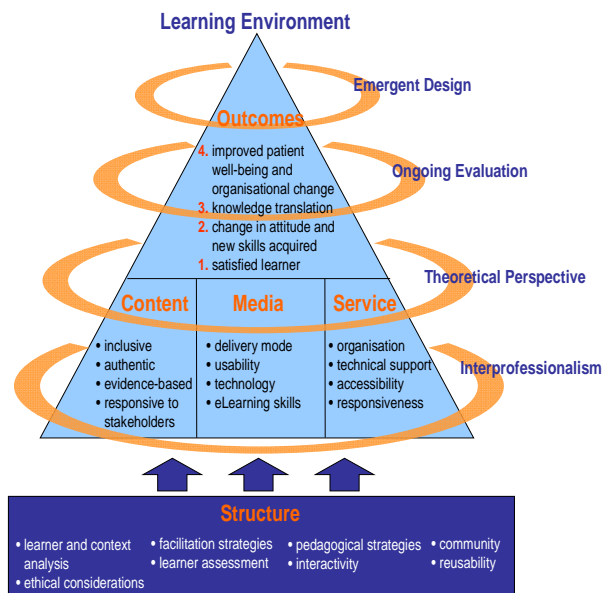
The W(e)Learn Framework for Online Education

An instructional design model "helps to ensure that students will achieve the desired learning outcomes by providing a tool that makes planning for instruction more systematic and thorough" (Dean, 2004, p. 93). While numerous constructivist eLearning design frameworks exist (Inan & Lowther, 2007), W(e)Learn was selected to guide this study because it is uniquely a constructivist framework developed for use in eLearning design within a healthcare milieu. W(e)Learn has been validated and has been applied in eLearning studies and programs (Halabisky et al, 2010; Puddester, MacDonald, Archibald, Sun, & Stodel, 2010). As a study interested in exploring physicians' experiences in a webinar series designed in accordance with best practices, W(e)Learn was a suitable choice as an instructional design framework.

Depicted in Figure 1, W(e)Learn specifies four critical program design domains: structure, content, media, and service.

Figure 1

The W(e)Learn Framework



(MacDonald, Stodel, Thompson, & Casimiro, 2009)

W(e)Learn includes four levels of outcomes including the following: 1) learner satisfaction; 2) changes in attitude or development of new knowledge or skill; 3) changes in learner behaviour⁸; and, 4) organizational change and improved patient health. As described by the architects of W(e)Learn (Casimiro, MacDonald, Thompson, & Stodel, 2009), this hierarchy of outcomes was derived from a framework developed by Barr, Koppel, Reeves, Hammick and Freeth (2005) who drew upon original, frequently-cited work on evaluation of learning outcomes

⁸W(e)Learn defines “Knowledge translation” as a change in learners’ behavior (MacDonald et al., 2009). This study is interested in behaviour related to clinical practice, therefore, the term practice is used herein to describe behaviour-related outcomes.

done by Kirkpatrick (1967). This study's focus was an exploration of how webinar participation influenced Levels 1-3 outcomes. A case study served as the qualitative method of inquiry.

Methods

In this exploratory case study, a small group of cardiologists participated in a 4-part webinar series designed in accordance with a constructivist instructional design framework. Interested in a contemporary phenomenon in its real-life context, a single case study with embedded units of analysis derived from multiple data sources was a suitable approach (Yin, 2009).

Data were analyzed using qualitative techniques as the primary approach. Open- and closed-ended survey questions generated a limited number of descriptive or "quasi" statistics (e.g., demographic data, numbers of participants, numbers of responses, etc.) which informed the findings and lent support and context to interpretations (Maxwell, 2005).

The study was approved by the University of Ottawa's Social Sciences and Humanities research Ethics Board. Consent letters, disseminated to all potential study participants, provided details about the study and offered the choice to participate or decline to participate in the study.

Researcher's Dual Role

As both researcher and project manager, I held a position of influence that could introduce bias. I managed this by acknowledging my role and thinking through ways my presence could influence the study (Baez, 2002; Maxwell, 2005). To help build a relationship of trust and ensure participants could freely make an informed decision about participation, I exposed my position as a researcher and project manager (Pitts & Miller-Day, 2007). A benefit of my dual roles was that it allowed me privileged information about the case which enabled a deep understanding of the inner workings of webinar implementation (Labaree, 2002).

Study Participants

The study involved two consented participant groups including cardiologists and an Implementation Team.

Cardiologists. Webinar participants were Canadian cardiologists recruited via email through the CCS membership database. All cardiologists who registered for the webinars were invited to participate in the study. However, only those who voluntarily completed a demographic and needs assessment survey and provided written consent were included.

The Implementation Team. A team with the necessary project management, technical and content expertise was assembled to implement the webinars. A virtual group distributed across five cities in three provinces, the team included a project manager/researcher, an eLearning design specialist, a web specialist and three cardiologists. The cardiologists were heart failure guideline authors who also acted as the webinar facilitators. The Team met weekly by teleconference and corresponded routinely by email.

Data Collection

Team Email (collected weeks 1-16)

Throughout the webinar implementation process, email messages between the Team members were captured. These data provided insight into implementation processes from the perspective of the involved designers, technical specialists and facilitators. All team members were aware that data capture was part of the study, and each consented to participate, acknowledging that data would be collected, analyzed and reported.

Needs Assessment and Demographic Survey (collected weeks 3-7)

Developed by the Implementation Team, the needs assessment and demographic survey consisted of 28 open- and closed-ended questions that captured basic demographic data and

inquired about participants' learning needs and preferences relative to each of the W(e)Learn domains: structure, content, media, and service. Due to time constraints, the survey was not pilot tested.

Webinar Recordings (collected weeks 9-15)

Webinars were recorded and professionally transcribed to capture information about the webinar experience with a focus on the nature and amount of interaction. Data such as text chat and results from live audience-response polls (multiple choice questions the facilitators posed during each webinar) were included. A recording of each webinar (audio recording synchronized with the corresponding PowerPoint slides) was generated and posted on the CCS website following each webinar. Visitors to the website could download and view the webinar at their leisure. The number of downloads and duration of views of these asynchronous files were captured.

Post-Webinar Feedback Surveys (collected weeks 9, 11, 13, 15)

In accordance with W(e)Learn Framework, participants were asked to voluntarily complete an anonymous feedback survey following each webinar (MacDonald et al., 2009). The survey consisted of open- and closed-ended questions about the webinar experience (i.e. structure, content, media and service) and outcomes related to satisfaction, and perceived knowledge gains or practice change. This feedback was collected to guide ongoing modifications to program design, and delivery to improve subsequent webinars in the series.

The electronic data collection system could not link feedback data to individual respondents. As such, we could not track trends over time at the individual level. We did not create mandatory fields to collect person-identifiable data such as names or email addresses.

Reminders and a link to the feedback survey were sent by email following each webinar and at two points in the following week. Data were reviewed seven days following each webinar to allow one week’s time to use the feedback to inform adjustments in preparation for the next webinar.

As a pilot effort in developing and delivering webinars to cardiologists, we sought to observe whether a webinar series would attract cardiologists and, if so, whether webinars might satisfy learners and potentially support changes to knowledge and practice. Based on the findings of this study, a longer-term vision of the CCS was to follow up with a future, more in-depth study of webinar effectiveness.

The Intervention

The intervention consisted of a 4-part webinar series on the topic of heart failure clinical practice guidelines. The target audience was cardiologists. The team implemented the webinar series over a 16-week period. The W(e)Learn framework was used as a quality standard and process guide. The activities and timelines to implement the webinar series are shown in Table 1.

Table 1

Steps and timelines for webinar design, development and delivery.

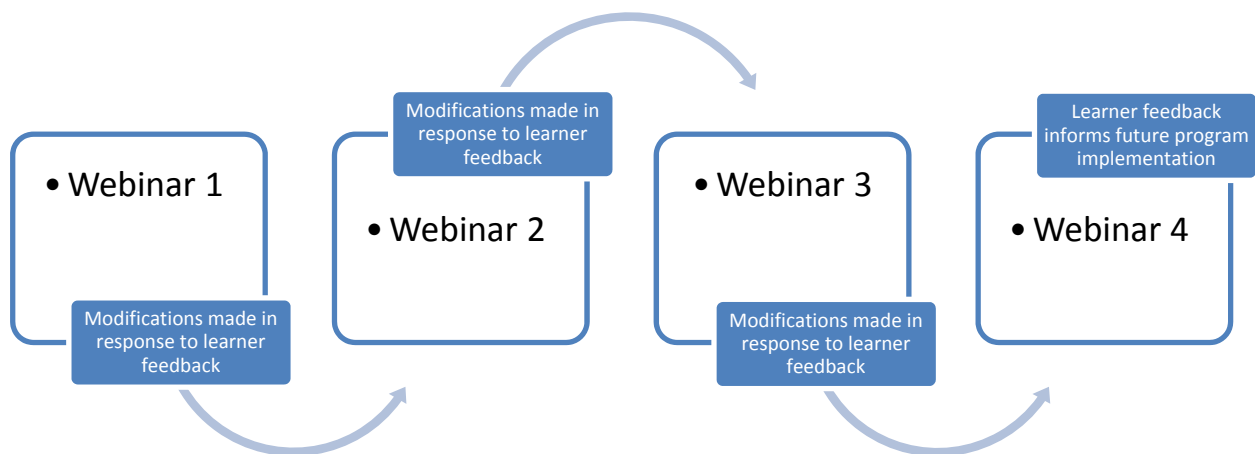
Timing	Activity
Week 1	Implementation Team assembled, consent obtained.
Week 2	Survey instruments developed. Host website developed and launched.
Weeks 3-7	Concurrent program promotion, participant registration, and receipt of demographic & needs assessment surveys and consent.
Week 6-8	High-level webinar outline developed followed by detailed content development informed by survey results.
Week 9	Webinar 1 delivered.
Week 10	Webinar 1 feedback reviewed and adjustments made for Webinar 2. Webinar recording and supporting material for subsequent webinar posted on website.
Week 11	Webinar 2 delivered.
Week 12	Webinar 2 feedback reviewed and adjustments made for Webinar 3. Webinar recording and supporting material for subsequent webinar posted on website.

Week 13	Webinar 3 delivered.
Week 14	Webinar 3 feedback reviewed and adjustments made for Webinar 4. Webinar recording and supporting material for subsequent webinar posted on website.
Week 15	Webinar 4 delivered.
Week 16	Webinar 4 feedback reviewed. Webinar recording posted on website.

Webinars were delivered bi-weekly over seven weeks. One week following each webinar, the team reviewed feedback surveys, discussed observations and implemented improvements for the subsequent webinars. This routine aligned with W(e)Learn which suggests ongoing program refinement in response to learner feedback (MacDonald et al., 2009). Figure 2 illustrates how webinar development and delivery was influenced through learner needs assessment and ongoing collection and review of participant feedback.

Figure 2

Ongoing monitoring and response to learner feedback throughout program delivery.



Data Analysis

Data collection and analysis went hand in hand. Guided by Maxwell (2005), Merriam (2001) and Yin (2009), the qualitative data were subject to an interpretive analysis to understand the meaning of the feedback from and actions taken by participants. Email records, webinar transcripts and survey data were uploaded to Atlas.ti which supported coding. Data were read and re-read to glean meanings, disconfirming instances and alternative explanations. Guided by the W(e)Learn domains (e.g., structure, content, media, service and outcomes), data were coded and grouped into “Families”, which is the Atlas.ti term for “themes”.

Thematic analysis was a process of understanding the data and systematically identifying key concepts and linkages. Atlas.ti supported analysis by enabling ease of searching, graphic representations of relationships between units of data, and generation of frequency counts by code, source, Family, etc. Analysis was a careful and creative process that attempted to understand a range of descriptions, experiences and observations, asking “What’s happening?” “How does this work?” and “What does this mean?” (Wolcott, 1994). Descriptive statistics such as demographic data, frequency counts, and rankings of preferences were calculated from the survey data to more fully inform the findings and add support and context to interpretations.

Results

Fifty cardiologists registered to participate in the webinars and 13 voluntarily consented to participate in the study. A flow chart (Figure 3) in Appendix A illustrates webinar and study participation.

The majority of cardiologists included in the study were between the ages of 41-50 years. Two participants were over the age of 61. Eight were male. Ten worked in an urban setting in an academic practice. Three were from smaller, community-based settings. None were from a rural

setting. Six participants resided in Alberta, six in Ontario, and one in New Brunswick. The most common range for number of years of practice was 11-20 years. Tables 2 and 3 in Appendix B summarize demographic and needs assessment data.

The aim of this study was to explore the webinar implementation process to learn about the factors that may support outcomes related to satisfaction and changes in knowledge and practice among cardiologists. Results are discussed as they relate to: needs assessment results and how this influenced webinar design and delivery; outcomes of the webinar series as understood through the feedback surveys; and observations about individual learners versus communities of learners, and the use of asynchronous webinar postings.

How Needs Assessment Results Influenced Webinar Design and Delivery

Use of CCS guidelines as a primary reference source was cited by 9/13 cardiologists. Seven cardiologists indicated that general interest in the topic was the primary motivation for participating in the webinars. The most commonly cited topics of interest were device therapies and cardiomyopathies, results of recent clinical trials, heart failure prevention, transfer of care, and end-of-life care.

General comments from cardiologists characterized the motivating factors: “I wanted to see what Justin [facilitator] had to say (Anonymous survey feedback, December, 2009), and “[It was] organized by others in the hospital and it was heart failure which is my area so when I heard about it I was interested” (Anonymous survey feedback, December 2009).

Twelve of thirteen participants indicated a preference for synchronous, interactive programs and 12 indicated an ideal program would be between 30 to 60 minutes in length. Eleven indicated a strong preference for content to be delivered by a key opinion leader. Ten reported a

preference for case studies, discussion, and multiple short sessions, as opposed to lectures. Five had prior experience with eLearning.

W(e)Learn encourages ongoing responsiveness to learner needs throughout program design and delivery (MacDonald et al., 2009). The needs assessment provided important information to the team about cardiologists' preferences in support of webinar design and development. Table 4 lists the domains and elements of W(e)Learn and describes how each was addressed in the webinar design, development and delivery process.

Table 4

Addressing W(e)Learn domains and elements in webinar design, development and delivery.

W(e)Learn Elements	Implementation Team Activities
W(e)Learn Domain: Structure	
<i>Learner and Context Analysis</i>	Webinar registrants were sent demographic and learning needs assessment surveys and study consent forms to voluntarily complete and return. Data were reviewed by the Implementation Team and used to guide program structure, content, media and service. Webinars scheduled bi-weekly at 1200 hours Eastern Daylight Time to take place during regular business hours in all Canadian time-zones. Bi-weekly scheduling was chosen to strike a balance between time commitment and content retention.
<i>Ethical Considerations</i>	Registrants informed about study and option to voluntarily participate in the study.
<i>Facilitation Strategies</i>	Subject matter experts with experience in CPD program design and delivery recruited to facilitate.
<i>Learner Assessment</i>	Participant feedback survey developed to inform ongoing program improvement in response to participant feedback.
<i>Pedagogical Strategies</i>	Case-based pedagogical design selected based on needs assessment results.
<i>Interactivity</i>	Interactivity fostered through active facilitation and use of tools, including audio and text chat and polling. Amount and nature of interaction

	monitored and feedback about interactivity sought from participants.
<i>Community</i>	Strategies selected to engage participants and encourage discussion including active facilitation, audio and text chat, and creation of a Virtual Classroom with a chat room and posted resources.
<i>Reusability</i>	Webinars recorded and posted for later viewing. Monitored the extent files were accessed following the webinars.
W(e)Learn Domain: Content	
<i>Inclusive</i>	To achieve balance in content between generalists and specialists and to keep participants engaged, cases were designed to progress from common scenarios to more challenging and ambiguous clinical situations.
<i>Authentic</i>	Cases designed to highlight key recommendations and practical tips from the guidelines and to align with participants' stated interests.
<i>Evidence-Based</i>	Webinar content derived from peer-reviewed, evidence-based guidelines. Supporting materials sourced from peer-reviewed journals.
<i>Responsive to Stakeholders</i>	Based on needs assessment data, webinar content developed to progress as follows: <ul style="list-style-type: none"> • Webinar 1: assessment and diagnosis of heart failure • Webinar 2: managing common complications • Webinar 3: managing chronic, progressive heart failure • Webinar 4: transfer of care and end-of-life issues
W(e)Learn Domain: Media	
<i>Delivery Mode</i>	Developed "Heart Failure Bootcamp" website to post supporting materials. A "virtual classroom" containing key articles and information, webinar login coordinates, archived webinar recordings, CCS contact coordinates, etc.
<i>Usability</i>	Selected user-friendly webinar platform based on industry reviews and experience.
<i>eLearning Skills</i>	Conducted live rehearsal with facilitators one week prior to first webinar to ensure facilitators had the skills and comfort required to control slides, polling system, and chat room from remote locations. Provided user-support before, during and after each webinar.
<i>Technology</i>	Reviewed three standard commercial webinar platforms.

	<p>Adobe Connect Pro selected because of features such as audio integration, video conferencing, meeting recording, screen sharing, online chat capabilities, user management and reporting, and live audience response (polling) capabilities.</p> <p>Software rights purchased for two months for \$100/month.</p>
W(e)Learn Domain: Service	
<i>Organization</i>	<p>Webinar series supported and promoted by the CCS. Program accredited by the CCS in accordance with RCPSC accreditation requirements.</p>
<i>Technical Support</i>	<p>Provided written login instructions via email and website. Instructions included a hyperlink to the webinar website, and 1-800 telephone number to access the audio. Website link went live one hour before each webinar. Web specialist contact information supplied in case of technical problems.</p>
<i>Accessibility</i>	<p>Access to the webinars and all resources was simple and required no passwords.</p> <p>Feedback surveys designed to be user-friendly. Used Adobe LiveCycle Designer to develop electronic, interactive Portable Document Format (PDF) forms which could be sent by email and posted on the website. Data converted to Extensible Markup Language (XML) and imported into a database. Feedback was voluntary and anonymous.</p>
<i>Responsiveness</i>	<p>Responded to all inquiries and requests for support within one hour of receipt.</p>
W(e)Learn Domain: Outcomes	
Level 1: Satisfaction	<p>Assessed via voluntary feedback survey.</p>
Level 2: Change in skills/knowledge	<p>Assessed via voluntary feedback survey.</p>
Level 3: Change in behaviour	<p>Assessed via voluntary feedback survey in reference to “changes in practice.”</p>
Level 4	<p>Not assessed within the scope of this study.</p>
Ongoing Assessment	
<p>Understanding and improving the webinar experience was an ongoing and continuous process facilitated by the needs assessment and feedback surveys.</p>	
Emergent Design	
<p>Ongoing; informed by needs assessment and feedback surveys. Modular course design enabled modifications and just-in-time changes.</p>	

Table 5 outlines how the needs assessment informed webinar design.

Table 5

Cardiologists’ learning needs and preferences and related webinar design decisions.

Identified learning need or preference	Webinar design decision
Gain knowledge	→ Content derived from current national Heart Failure Guidelines.
Topics of interest: Cardiomyopathies, Heart failure prevention Recent clinical trials, Device therapies Transfer of care End of life care	Topics addressed as follows: → Webinar 1: <i>“Making the diagnosis”</i> → Webinar 2: <i>“Emerging therapies”</i> → Webinar 3: <i>“Transition to home”</i> → Webinar 4: <i>“Managing chronic HF”</i>
Synchronous, interactive learning	→ Webinar platform selected to enable synchronous interaction between facilitators and participants. Interaction supported by tools and technology including live audio, live audience response polling, and text “chat” capabilities.
Case studies	→ Pedagogical approach: case studies.
Discussion	→ Open-ended questions, informal atmosphere, live audience response polls, text chat used to promote discussion and interaction.
Multiple short sessions	→ 4-part webinar series scheduled bi-weekly; content progressed from early to late- stage heart failure.
Content delivered by key opinion leader	→ Leading national experts/guidelines authors recruited as facilitators.
Learning supported by “what they read”	→ Relevant pre-reading materials circulated and posted in a web-based Virtual Classroom.
Program length 30-60 minutes	→ Balance struck between content delivery and interactive discussion within 60-minute program. Facilitators would prompt discussion through use of polls and open-ended questions throughout webinars.

Table 6 in Appendix C summarizes webinar content, key observations and program changes made as the webinar series progressed. A sample patient case is provided in Appendix D. Table 7 in Appendix E summarizes webinar participation data.

Results from Feedback Surveys

Feedback surveys informed understanding of how the webinar experience supported satisfaction and changes in knowledge and practice among cardiologists. Feedback from the individual webinars is summarized in Appendix F. Response rates to the post-webinar feedback surveys are shown in Table 14.

Table 14

Survey completion (%) per webinar

Site	#Unique logins (each login may represent multiple individuals at same site ⁹)	# Feedback Surveys Submitted (% response)
Webinar 1	27	9 (33.3%)
Webinar 2	24	9 (37.5%)
Webinar 3	25	9 (36.0%)
Webinar 4	21	11 (52.3%)
Total	97	38 (32.2%)

⁹Several registrants indicated they had registered on behalf of a large clinical team, therefore, some single registrations represented many individuals participating from a single site. For example, one registrant from Alberta wrote: “I have been able to secure a classroom so that all 10 of our cardiologists and residents can view the webinar together on a projection screen” (Anonymous personal correspondence, January 6, 2010).

Satisfaction. Participant satisfaction appeared consistent between webinars. For all webinars combined, 35/38 responses received (92.2%) indicated that overall, the webinars were very good or excellent. Webinar format was rated as very good or excellent in 34/38 (89.5%) of responses received.

The strongest trend across all webinars was all survey respondents indicated the webinars met expectations and learning objectives, were satisfactorily interactive, and were well-facilitated. An unprompted comment posted in the virtual classroom was “I participated in the heart failure webinar series, session #1, yesterday and found it extremely informative and very well presented. Several of my colleagues also listened in and found this webinar very valuable” (Anonymous personal correspondence, Jan 13, 2010).

The satisfaction ratings were consistent between webinars. The most common satisfaction rating was “very good” for the webinars at large, the webinar format, and the quality of the audio-visual technology. Table 15 summarizes satisfaction for all webinars.

Table 15

Satisfaction ratings of the webinars (N = 38, all feedback surveys combined)

Item	poor	satisfactory	very good	excellent
Webinars, overall	0 (0%)	3(7.9 %)	27 (71.1 %)	8 (21.1 %)
Webinar format	0 (0%)	4 (10.5 %)	25 (65.8 %)	9 (23.7 %)
Audio-visual presentations	0 (0%)	5 (13.2%)	24 (63.2 %)	9 (23.7%)

Change in knowledge. Following webinar 2, three respondents indicated the webinar had affirmed their practice as opposed to supporting an increase in knowledge. Some team members initially interpreted this feedback as a sign that the webinars were not leading to increased

knowledge, but the facilitators pointed out that practicing cardiologists *should* already know the guidelines, so confirmation that practice was in adherence with guidelines was also a good result. This suggests an alignment with the data from the needs assessment survey which indicated that a primary motivation for participation was “professional interest” as opposed to “increasing knowledge”.

Change in Practice. Interestingly, whereas for webinar 1 there were no comments submitted about intention to change practice, and feedback from webinar 2 included one comment about confirmation of practice, webinar 3 generated five detailed comments about specific, intended practice changes. Sample comments were as follows:

I will attempt to more closely monitor patients upon transfer to ward from CCU, identify patients with other unresolved conditions (depression, infection, fall risk, etc.) which could lead to ‘discharge failure’ and communicate with primary care physician, and/or assigned hospital or community pharmacist for follow-up. (Anonymous survey feedback, February 10, 2010)

and, "I will contact Health Records to ascertain our readmission rate for heart failure patients and advocate for funding a pharmacist on our institution's Heart Function Clinic" (Anonymous survey feedback, February 10, 2010).

Between webinars 1 to 4, there was a steady upward increase in the number of survey responses reporting intentions to make changes to practice and providing descriptions of intended changes (from 1/9 responses following webinar 1 to 6/11 responses following webinar 4).

Ongoing Improvements to Webinar Implementation

In accordance with W(e)Learn, feedback surveys provided an ongoing process for understanding and improving the webinar experience for participants. Key areas where program

refinements were made as the webinar series progressed included fostering interactivity between facilitators and participants and adjusting the webinar pacing to encourage interactivity.

Fostering interactivity between facilitators and participants. Strategies to foster interaction included selecting knowledgeable, credible, skilled and experienced facilitators and using tools such as live polling, and audio and text chat capabilities (Clegg & Heap, 2006; Landay, 2009). The team monitored the amount of interaction during each webinar and strategized how to encourage dialogue. There was only a small amount of interaction in webinar 1 (5 questions posed by participants), therefore, deliberate efforts were made to increase interactivity in webinars 2-4. Strategies included ensuring facilitators posed open-ended questions and increasing the number of polling questions to generate avenues for discussion. In response to low feedback ratings about the adequacy of “support resources”, the team asked facilitators to supply more optional pre-reading materials for participants to review prior to webinars 2-4. Feedback for this item improved between webinars 1-4. As shown in Appendix E, interaction between facilitators and participants was low in webinar 1 but gradually increased over time.

Adjusting pacing to encourage interaction. A relationship between pacing and interactivity became apparent during webinar 1. The webinar was lengthy and facilitators were rushed. Feedback indicated pacing and interactivity were unsatisfactory. In response, we shortened the scope of content planned for webinar 2, added polling questions to stimulate discussion, and coached facilitators to speak at a slower pace.

These strategies appeared to be effective: in webinar 2, 15 minutes were dedicated to discussion, and dialogue increased in response to open-ended questions. A target of a maximum of 45 minutes of content delivery was maintained for webinars 3 and 4. Feedback surveys

indicated that interaction with facilitators was feasible, there was sufficient time for interaction, and the webinars were well paced.

Individual Learners versus a Learning Community

While we focused on and expected individuals to register for the webinar series, in numerous instances, many participants joined the webinars from one site where a local team of practitioners already existed. One site in Alberta is a good example of this. There, a group comprising a multidisciplinary heart function team (physicians, nurses, therapists) joined each webinar via a single login. In another site, 10 cardiologists at one site registered under a single name and participated in the webinars as a group.

This study did not inquire about the formation of enduring networks beyond the webinar learning experience. There was no overt indication during the webinars, through the needs assessment, the webinar feedback, or through the virtual classroom chat room, that enduring professional relationships were forming between participants at different sites.

Use of the Asynchronous Webinar Recordings

W(e)Learn considers “reusability” as an important design element (MacDonald et al., 2009). This framework element prompted us to develop an asynchronous version of each webinar to post in the virtual classroom. The notion was that an archived version of each webinar would be available as a helpful resource to anyone who could not participate in a webinar in real-time. All registrants were sent email reminders about these resources as they were posted. These files were not accessed following webinars 1 or 2. Files from webinars 3 and 4 received only 2 and 3 brief viewings (<5 min.) respectively.

Discussion

This study explored the webinar implementation process to learn about the factors that may support satisfaction and changes in knowledge and practice among cardiologists. Key findings for discussion include: the use of a design framework, the role of the design team, the outcomes of the webinar series, and observations about how cardiologists interacted in real-time throughout the webinar series.

Use of a Design Framework

The design framework provided a useful process guide and quality standard for webinar implementation. W(e)Learn was adaptable to the webinar context, and prompted informed decisions about structure, content, media, and service. The elements within each domain were comprehensive and relevant and helped ensure we addressed the range of variables that could affect the success of the program. For newcomers to design and delivery of webinars, the detailed description of each element of the framework prompted considerations about which we may not otherwise have had deliberate discussions and focused actions. For instance, our discussions about reusability prompted us to develop the archived versions of each webinar, which helped us understand cardiologists may not use resources of this nature. Our discussions about “responsiveness” cued us to ensure participants had numerous, simple avenues to reach us if they needed support; to identify and correct small problems before they compounded; and to test technology in advance of each webinar to proactively avoid problems.

The framework did not provide a specific prompt to ask participants about timing or scheduling of webinars. We defaulted to selecting a time that suited facilitators and that fell within normal business hours in all Canadian time zones. Different scheduling may have resulted in different attendance rates. In future, we would recommend exploring in greater depth

scheduling in relation to participants' preferences. As with other studies (Inan & Lowther, 2007; Leung, Pluye, Grad, & Weston, 2010; MacDonald et al., 2009), our team would recommend the use of a design framework to others embarking on a similar project. W(e)Learn, in particular, was a useful resource, and could be further enhanced through the minor addition of Time as an explicit framework element.

The Role of the Design Team

The blend of strong project management with pedagogical, technological, and medical expertise was essential to success. The absence of any of these would have created gaps in structures, content, media and/or service. For an initial experience with webinar implementation, the partnership with an eLearning specialist was beneficial. In future, with the experience gained and the simplicity of webinar technology, the CCS could likely implement high quality webinars more cost-effectively in future without third-party professional technical expertise.

The workload in designing and delivering educational webinars cannot be understated. In the eight weeks leading up to program launch, the team invested 1-2 hours weekly in planning meetings, and each team member dedicated time daily to fulfill individual responsibilities. Those embarking on similar projects are advised to assemble a team with a similar complement of skills, flexibility and work ethic.

Outcomes of the Webinar Series

Along with satisfaction, outcomes of the webinar series included changes in knowledge of the webinar content, and intention to change practice. High participant satisfaction is consistent with findings from a recent meta-analysis of 51 studies (Cook et al., 2010) which found that interactivity, discussion, and audio improved satisfaction in web-based learning programs for

health professionals. This suggests webinars, like other CPD formats, can provide a satisfying CPD experience for cardiologists.

Feedback surveys suggested some cardiologists gained knowledge of guidelines content. These results mirror systematic reviews which found that computer-based learning programs can be educationally beneficial, achieving results similar to face-to-face instructional methods (Cook et al., 2010; Curran & Fleet, 2005; Wutoh, Boren, & Balas, 2004). Cook et al (2010) sought to determine what makes internet-based learning effective for health professionals and found that interactivity, practice exercises, repetition, and feedback improve learning outcomes. Our efforts to promote interactivity may therefore have contributed to the increase in knowledge. If we had also developed formal practice exercises and mechanisms for individual feedback, the knowledge gains by participants may have been higher. Having demonstrated that cardiologists can find webinars satisfying, a next step is to study the webinar experience in greater depth including using more extensive and rigorous evaluation methods to assess knowledge gains.

Feedback from webinars 1 and 2 suggested participants found that content reinforced practice. Feedback from webinars 3 and 4 included several examples of intended changes to practice. The team speculated that the cumulative effect of participation in four webinars might have stimulated deeper reflection about individual practice, potentially leading to decisions about practice changes. Webinars 3 and 4 addressed content that may be less familiar to specialists: management of chronic heart failure, and transfer-of-care/end-of-life issues, both of which are stages of care that are commonly managed by family practitioners. Possibly, this unfamiliar content highlighted areas where some cardiologists recognized a need for closer adherence with guidelines, though no explicit feedback of this nature was received

Few studies have systematically addressed outcomes of web-based CPD programs in terms of changes in skills, behaviour (such as clinical practice), or effects on patient care (Chen, Bauchner, & Burstin, 2004; Cook, 2009; Curran & Fleet, 2005). The present study adds support for further research on the relationship between eLearning (including webinars) and practice change. While this study captured feedback from some participants about intention to change practice as a result of participation in the webinar series, future studies could more rigorously assess real and sustained practice changes.

The Learning Environment: Learning Communities and Real-time Engagement

Webinars offered a learning environment where participants and facilitators could interact informally to share discipline-specific knowledge. This form of “learning community” can be useful in profession-specific programs where content is intended to help learners develop strategies to navigate ill-defined, complex understanding of key concepts and engage in knowledge building among the members (Zhu & Baylen, 2005).

The learning community formed within this webinar series appeared to be similar to but not truly a “community of practice” (CoP). Becoming a norm in many professional fields including health care (Canadian Health Services Research Foundation (CHSRF), 2006) the CoP concept is interpreted in many ways (Li et al., 2009). Within the physician learning milieu, theorists have come to agree on common elements: a shared professional field, a defined group of participants, and a goal of improving practice (CHSRF, 2006; Li et al., 2009). Learning may be applied individually by each member, but it is sustained interactions over time that is an important characteristic. Learning may be facilitated by discussions among colleagues, through participation in joint tasks, or through observing how others apply knowledge and then testing it

in one's individual context (Li et al., 2009). CoPs form through common interest and are sustained by the value that members find in learning as a group and interacting with each other.

This study did not make qualitative observations about the formation of an enduring network beyond the actual, real-time webinar series. There was no overt indication during the webinars, through the needs assessment, the webinar feedback, or through the virtual classroom chat room that enduring professional relationships were forming between participants at different sites. This appeared to be an important differentiation between this webinar series and a CoP (Cambridge & Suter, 2005; Davis & Davis, 2009). The Heart Failure Bootcamp was more a forum for disseminating and discussing information. In designing the webinar series, we provided a forum for learning but did not facilitate interaction of participants outside or beyond the webinars themselves. Our primary focus was to connect individuals within a learning program. We provided tools and resources (virtual classroom, message board, chat room, etc.) that could have supported a virtual CoP, but these resources were used very little. It was interesting to observe that, while we designed the webinars with individual participants in mind, groups that appeared to be existing communities of practice registered, viewing the webinars as a useful resource to improve practice within their setting. Offered access to information and experts, the webinar series may not have stimulated the formation of new communities of practice, but contributed to supporting learning among existing groups. This interaction could be an interesting avenue for further inquiry.

Asynchronous Resources

The lack of use of the asynchronous webinar recordings was interesting. The team had expected that offering the same webinar content, complete with audio and video functions and eligibility for CPD credits, would lead to use by those who could not attend the real-time

webinars. Registrants voted with their feet; their lack of use of the asynchronous postings reflected the needs assessment survey findings which indicated cardiologists' strong preference for live, interactive programming and minimal previous use of asynchronous eLearning programs. For this group, the real-time programming appeared to be an important element; if they could not participate in real time, they did not seek to do so on their own time later. This finding speaks further to the importance of understanding learners through thorough needs assessment. Not only does this inform design, but it prevents the expenditure of time and resources on unnecessary program features.

The use of asynchronous eLearning is increasing among physicians and many studies have demonstrated that asynchronous eLearning can be satisfying and effective (Beldarrain, 2006; Weeks & Molsberry, 2008). However, for the cardiologists attracted to webinars, the synchronicity appeared to be an important element. This preference among cardiologists for synchronous versus asynchronous eLearning programs, and design preferences specific to asynchronous eLearning, could be examined in greater depth in future studies.

Limitations

The webinar feedback strategy was simple and satisfactory for addressing the research question for this study. To facilitate replication of this study, detailed descriptions of the setting, the key implementation activities, and study participants are provided (Maxwell & Miller, 2008). That said, this study had some methodological limitations and further research about cardiologists' experiences with webinars is needed.

Trustworthiness was supported by triangulating data from numerous sources and supporting interpretations with quotations and concrete examples. For example, results related to satisfaction suggested that the webinars may have fostered changes in knowledge and practice.

For future, more rigorous outcomes assessment, additional steps and alternative methodologies are suggested. For instance, pilot-testing survey instruments would reveal potential gaps in data collection. Linking data to individual cardiologists would enable analysis of trends over time, such as changes in satisfaction, knowledge or practice, or the cumulative effect of participating in multiple webinars. This would enrich the study and increase the trustworthiness of the findings.

Non-response bias posed a threat. Providing feedback was voluntary and anonymous. Survey response rates were steady, possibly indicating that the same small subset of participants was consistently responding. The extent to which feedback was representative of cardiologists cannot be confirmed. Feedback from non-respondents might have differed from those who provided feedback. It would have been informative to receive feedback from cardiologists who registered for the webinar series but did not attend any/all webinars to gain an understanding of their reasons for not attending. However, non-attendees could not be identified.

A small convenience sample was used in this study. As such, the study is vulnerable to under-representation by cardiologists, which affects the transferability of the findings to other groups of cardiologists or specialist physician groups (Merriam, 2001). The reasons for choosing to participate in the study and/or provide feedback were not explored. It would have been interesting to examine motivations for participating in the webinars but not in the study. This issue was not addressed to avoid coercing participants into providing a justification about their chosen level of participation. There were many communications by email and on the website to encourage cardiologists to participate in the various aspects of the webinars and the study, and not participating was clearly a choice that some made. To enhance the trustworthiness of the results given the small sample size, *the* primary researcher's coding and analysis were checked by an independent researcher to confirm consistency and reproducibility. The use of Atlas.ti enabled

the generation of a data frequency tables which suggested saturation was achieved and the sample size was sufficient for the study's purpose.

Reporting of webinar outcomes was limited to self-reported examples. Seeking to explore the webinar implementation process to understand the webinar experience, the study did not objectively measure changes in attitude, knowledge or practice. Future studies interested in changes in knowledge and practice among cardiologists as a result of webinar participation could employ rigorous outcome measurement strategies such as pre- and post-webinar multiple choice tests of knowledge and/or 3-6 month follow up questionnaires about practice change.

My dual researcher/project manager roles had the potential to introduce bias (Labaree, 2002). I attempted to manage this by thinking through possible effects and taking steps to mitigate bias. I exposed my position to participants to build trust and ensure participants felt free to choose whether or not to participate in the study. Throughout the research process, I attempted to maintain researcher self-awareness about the impact I might have on the research process and outcomes. I kept researcher notes to document key decisions and questions, and performed constant comparative analysis during data analysis. In documenting my perceptions about the webinar experience, I sought to be transparent about my researcher and professional agendas (Wolcott, 1994) and to enable readers to make inferences about the data and the authenticity of my account of the webinar experience.

Conclusion

The aim of this study was to explore the webinar implementation process to learn about the factors that may support outcomes related to satisfaction and changes in knowledge and practice among cardiologists. Findings suggest there is value in using an instructional design framework such as W(e)Learn to guide webinar design and implementation. A skilled and

dedicated Implementation Team was an asset to this complex and time-consuming process. Webinar participation feedback was limited; however, findings suggest the webinars were a satisfying learning experience that may have supported changes in knowledge and practice. Real-time interaction was a key characteristic of the webinars; identical asynchronous posting of the same programs were not used. This study was designed for individual practitioners and did not appear to foster the formation of an enduring, new community of practice. The detailed description of key activities and findings may serve in future as a guide for those seeking to develop similar CPD programs for cardiologists. Based on the findings of this study, future research could address how and when to use webinars within the cardiologist population, effectiveness of webinars in supporting practice change, transferability of findings to other medical disciplines, and differences in webinar design preferences based on sex and age.

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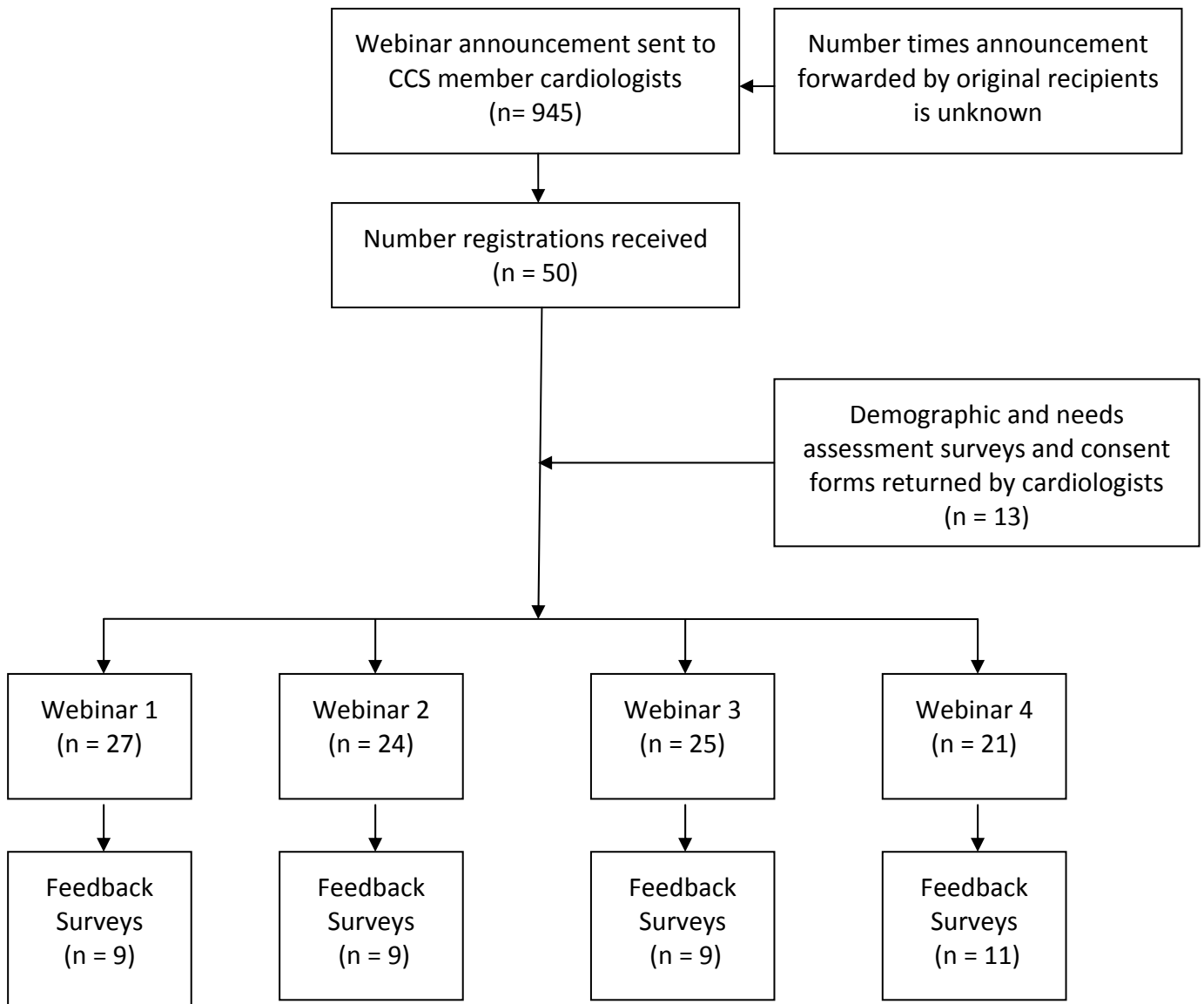
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Appendix A: Flow diagram of webinar series participants

Figure 3



Note: Feedback surveys were collected electronically and in a non-person-identifiable format. Data could not be linked to individual respondents.

Appendix B: Demographic and learning needs assessment survey results

Table 2
Gender, Age, Clinical Practice Type, Province, and Years of Practice of Participants
 (N = 13)

Gender	Count	Total %
Male	8	61.5 %
Female	5	38.5 %

Age	Count	Total %
under 30	1	7.7 %
31-40	3	23.1 %
41-50	5	38.5 %
51-60	2	15.6 %
61-70	2	15.6 %

Practice Type	Count
Urban	10
Rural	0
Academic	9
Community	0
Solo	1
1-1000 patients	2
1000+ patients	3

**multiple options may have been selected by participants*

Province	Count	Total %
British Columbia	0	0 %
Alberta	6	46.2 %
Saskatchewan	0	0 %
Manitoba	0	0 %
Ontario	6	46.2 %
Quebec	0	0 %
New Brunswick	1	7.7 %
Nova Scotia	0	0 %
P.E.I.	0	0 %
NFLD/Labrador	0	0 %
Yukon	0	0 %
N.W.T.	0	0 %
Nunavut	0	0%

Years	Count	Total %
less than 5	2	15.4 %
6-10	2	15.4 %
11-20	5	38.5 %
21-30	2	15.4 %
more than 30	2	15.4 %

Table 3

Participant Topics of Interest, Motivation for Participation, Webinar Design Preferences and Previous Webinar Experience (N = 13)

**Most Popular Topics of Interest Related to the Treatment of Heart Failure*

Topic	Count
ADHF	5
Implications of Clinical Trials	5
Prevention	2
Device Therapy	4
Cardiomyopathies	5
Myocarditis	2
End of life issues	2
Best practices in transition of care	1
Biomarkers	2
other	1

** multiple options may have been selected by participants*

Purpose of the CCS Heart Failure Guidelines

Purpose	Count	Total %
Primary document for disease management	5	38.5 %
Specific decision aid in patient management	4	30.8 %
Secondary document	3	23.1 %
Don't use	1	7.7 %

Reasons for Webinar Registration

Reason	Count	Total %
The topic looked interesting	3	23.1 %
I needed to learn more about treating patients with heart failure	5	38.5 %
The web conference format is convenient for me	1	7.7 %
Professional interest	4	30.8 %

**Preferred Format*

Format	Count
Live, face to face, didactic programs	6
Live, face to face, interactive programs	6
Live, but remote (distance), interactive programs	1
Pre-recorded, self-directed, programs available via CD, internet	1
Print material	1

**multiple options may have been selected by participants*

**Program Design (N = 13)*

Design	Count
case study and discussion	5
multiple short lectures	5
panel discussion and debate	2
single lecture	2

**multiple options may have been selected by participants*

Opportunity for Discussion between Participants and Speakers Built into a Learning Experience

Importance	Count	Total %
Not important to me	0	0 %
Somewhat important to me but not essential	3	23.1 %
Important to me	5	38.5 %
Very important to me; essential to learning	5	38.5 %

**Preferred Sources for Emerging Clinical Information and Best Practices (N = 13)*

Design	Count
The recognized key opinion leaders	9
Your local experts on the topic	1
Your immediate colleagues	0
Print material (journals, supplements)	3
The internet and online resources	5

** multiple options may have been selected by participants*

Previous Web Conference Program Participation

Prior Experience	Count	Total %
No	8	61.5 %
Yes	5	38.5 %

12/13 cardiologists were willing to spend 30-60 minutes online in one sitting participating in an educational activity

All common weaknesses were found with computer based educational programs by the cardiologists - none more than others.

**Items Most Likely to Influence a Change in Practice (N = 13)*

Design	Count
reading	10
knowledge opinion leader	6
see for myself	6
discussion with colleagues	3

** multiple options may have been selected by participants*

Appendix C: Webinar program outline and summary of observations and changes

Table 6

Webinar Program Outline and Summary of Observations and Changes

Webinar outline	Key observations	Changes implemented for subsequent webinars
<p>Webinar #1 <i>Making the Diagnosis</i> Case Presentation → <i>The Value of the History and Physical</i> → <i>Other Standard Tests</i> → <i>Practical Imaging</i> Learning objectives: 1. Understand the burden of HF in Canada 2. Learn how to diagnose HF with “basic” information 3. Learn about other diagnostic tests useful when heart failure is on the differential</p>	<ul style="list-style-type: none"> • No technical problems reported or observed • Multiple participants online at numerous sites; Audible background noise such as pagers and institutional intercom systems announcements • Lengthy case may have forced faculty members to rush; the speed of delivery and the muted phone lines may have impeded interaction. • Evaluation results suggested need for more time for interaction and need for additional learning resources 	<ul style="list-style-type: none"> • Participants requested to mute telephone lines unless they wanted to ask a question • Shorter case developed for webinar #2; faculty coached to speak at a slower pace • More polling questions added for webinar #2 to stimulate discussion • Supplementary articles sent to participants via email in advance of webinar #2, and posted in the virtual classroom
<p>Webinar #2: <i>Treatment of AHF</i> Case Presentation → <i>The goals of care</i> → <i>Do we need diuretics?</i> → <i>Other drugs we use</i> Learning Objectives: 1. Understand the goals of care for patients with acute heart failure (AHF)</p>	<ul style="list-style-type: none"> • No registrants accessed archived webinar recording prior to webinar #2 • Lead facilitator late to sign on; alternate faculty member improvised • Increased number of polling 	<ul style="list-style-type: none"> • Reminded registrants that archived recordings of the webinars were posted on the website • This complication was handled seamlessly due to the speaker’s experience and comfort with the content

<ol style="list-style-type: none"> 2. Understand the pharmaceutical options to treat AHF 3. Learn about emerging therapies to treat AHF 	<p>questions prompted more discussion</p> <ul style="list-style-type: none"> • Increase in spontaneous questions asked participants over the telephone and through the chat feature • Less content to cover; faculty was not rushed leaving more time for discussion 	<ul style="list-style-type: none"> • Continue with the increased number of polling questions • Supplementary articles sent to participants via email in advance of webinar #3, and posted in the virtual classroom • Continue to deliver a maximum of 45 minutes of content to maximize opportunity for discussion
<p>Webinar #3: <i>Transition to home</i> Case Presentations → <i>Case #1: A stitch in time saves nine</i> → <i>Case #2: Don't you forget about me!</i> → <i>Case #3: Home remedies</i> Learning Objectives:</p> <ol style="list-style-type: none"> 1. Understand the goals of transition of care for patients with HF. 2. Understand the importance and impact of a transition of care plan for health care professionals as well as for patients and their families. 	<ul style="list-style-type: none"> • Several brief viewings of archived recordings from webinar #1 and #2; durations < 5 minutes • Integration of video files into the presentation to show implanted cardiac devices in vivo. Upon testing, the video files took a long time to upload and play. • Facilitator briefly lost connection to the webinar due to the institutional firewall at his site • Similar amount of interaction between faculty and participants as per webinar #2 	<ul style="list-style-type: none"> • Reminded all registrants about archived recording of the webinars • Video files were compressed and re-uploaded which corrected the problem • Was quickly able to re-sign in, and second faculty members kept the presentation going • Continue with the increased number of polling questions • Continue to deliver a maximum of 45 minutes of content to maximize opportunity for discussion • Supplementary articles sent to participants via email in advance of webinar #3, and posted in the virtual classroom
<p>Webinar #4: <i>Chronic HF management</i> Case Presentations → <i>Case #1</i> → <i>Case #2</i></p>	<ul style="list-style-type: none"> • Several brief viewings of archived recordings from webinar #1-#3; durations < 5 minutes • No additional changes made to webinar 	<ul style="list-style-type: none"> • Reminded all registrants about archived recording of the webinars

<p>Learning Objectives:</p> <ul style="list-style-type: none"> • Understand the goals of optimal care for patients with chronic heart failure. • Understand the importance and impact of intercurrent illness on chronic heart failure management 	<p>format; no videos used</p> <ul style="list-style-type: none"> • No technological problems reported by faculty of participants • Amount of interactivity similar to webinar #2, #3: numerous questions posed verbally and in writing • All interaction was between the faculty and individual participants as opposed to between participants 	
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Appendix D: Sample case content for a CCS heart failure webinar

Notes

- The case content will be presented in PowerPoint slide format during the web conference.
- A telephone audio connection will enable open discussion between all participants.
- All participants may also submit comments and questions in text format.
- The facilitator will be able to conduct anonymous polls in response to multiple choice questions. Polling results (generated instantly and automatically and displayed for participants to review) will provide stimulus for discussion.

Case 1

An 86 yr-old male is hospitalized with abdominal pain and distension. His past history includes a previous MI, CABGx2 (1998), EF 40% (2006), type 2 diabetes, hyperlipidemia, AFib, chronic renal failure, previous hernia repair and cholecystectomy.

At hospitalization, he presents with ascites from right-sided heart failure (1.5 litres drained, no malignant cells), LVEF 25% and regional wall motion abnormalities.

Following diuresis, he is gradually able to walk up 24 steps and do laps around the ward.

He is discharged two weeks later with prescription for home care (PSW), bedside commode, shower bench and walker, a list of approx. 13 medications and a referral to heart function clinic 1 one month.

At the heart function clinic visit, he presents with significant decline since discharge. His wife reports that he has had increasing fatigue and weakness (walks up 6 steps with difficulty), has been in bed most of the time since discharge, and has lost 5-6 kg. His BP is 90/45 sitting, radial pulse is barely palpable standing, HR is 55 – A. Fib, heart sounds and chest unremarkable, JVP is flat, mucous membranes are dry, no ascites. His labs confirm: creatinine 385, urea 61.3, Na 131, Cl 90, K 5.1, digoxin 2.6 mmol/L, CBC, calcium, albumin normal, CXR – nothing acute. His wife is frail and finds it difficult to help him dress and has insufficient time for daily household issues. She also mentions that he has had some memory loss for the past 3-5 months and has experienced low mood and passive death wishes. They live in a side-split – 6 steps up and down. They are isolated with a son living 1.5 hours away.

Key Questions for Discussion:

- *What are the most important things that should have been done with this gentleman?*
- *What test should you order? Why?*
- *What are the next steps in the clinical work-up?*
- *Whose job is it to coordinate this patient's outpatient care?*
- *What can you do to make a difference?*

Appendix E: Summary of webinar participation data

Table 7

Summary of Webinar Participation Data

	Webinar 1	Webinar 2	Webinar 3	Webinar 4	All
# unique logins ¹⁰	27	24	25	21	97
# questions/comments made by participants over telephone line	2	5	8	7	22
# questions submitted by participants via the chat feature	3	5	3	5	16
Total # telephone and chat question/comments combined	5	10	11	12	38
# post-webinar visits to archived asynchronous webinar recording	0	0	2; < 5 minutes in duration	3; < 5 minutes in duration	5

¹⁰ During all webinars some sites had multiple individuals participating using the same telephone line and internet login. As such, the total number of *individual* participants during each webinar is unknown and only the number of unique logins is reported.

Appendix F: Feedback survey data from webinars 1-4

Table 8

Feedback Survey Response Rates

Survey response rates	Webinar 1	Webinar 2	Webinar 3	Webinar 4	Total
	9/27 (33.3%)	9/24 (37.5%)	9/25 (36.0%)	11/21 (52.4%)	38/97 (39.1%)

Table 9

Feedback about Webinar Characteristics, Results Weighted and Aggregated

	Webinar 1 (n=9)	Webinar 2 (n=9)	Webinar 3 (n=9)	Webinar 4 (n=11)
Webinar addressed the stated objectives	6.7	7.8	8.5	8.5
Webinar met my expectations	6.7	7.4	7	7.6
Webinar met my learning needs	6.7	7.4	5.6	7.3
Webinar format was conducive to learning	5.9	6.7	7.3	7.4
I can apply what I learned to my practice	5.6	7	5.9	7
Timing of the webinar was convenient for me	5	7.4	5.2	5.6
Format made interactions with faculty possible	7.4	7	7.4	7.6
Webinar was credible and non-biased	7.4	7.8	8.1	8.3
Adequate time for presentations	7	7	7.9	8.1
Adequate time for interactions	4.4	3.7	6.3	6.3
Adequate support resources were provided	4.4	5.6	7.8	7.3
I had the technical support I needed	6.3	8.1	7.4	7.6
Chair had the expected level of knowledge	8.5	7.8	8.5	8.9
Chair was an effective facilitator	8.3	7.8	8.1	8.1
My questions were addressed in a timely manner	4.8	6.1	7.4	7.6

Table 10

Pre-/post-webinar Change in Awareness of the Guidelines

	Weighted and Aggregate Ratings Scale of 1-4: Low = 1, High = 4			
Awareness of the CCS Heart Failure Guidelines	Webinar 1 (n=9)	Webinar 2 (n=9)	Webinar 3 (n=9)	Webinar 4 (n=11)
pre-workshop	28	22	29	33
post-workshop	28	29	30	38
Relative change pre-/post-webinar	0	+7	+1	+5

Table 11

Pre-/post-webinar Change in Knowledge of the Guidelines

	Weighted and Aggregate Ratings Scale of 1-4: Low = 1, High = 4			
Knowledge related to the CCS Heart Failure Guidelines	Webinar 1 (n=9)	Webinar 2 (n=9)	Webinar 3 (n=9)	Webinar 4 (n=11)
pre-workshop	23	23	26	30
post-workshop	27	30	29	38
Relative change pre-/post-webinar	+4	+7	+3	+8

Table 12

Satisfaction with Webinar Overall, Webinar Format, and Webinar Audiovisual Technology

	Weighted and Aggregate Ratings Scale of 1-4: Low = 1, High = 4			
Satisfaction	Webinar 1 (n=9)	Webinar 2 (n=9)	Webinar 3 (n=9)	Webinar 4 (n=11)
Webinar experience overall	27	28	28	36
Webinar format	26	30	28	35
Audiovisual presentations	25	28	29	36

Table 13

Number Respondents Commenting About Post-Webinar Practice Change

	Webinar 1 (n=9)	Webinar 2 (n=9)	Webinar 3 (n=9)	Webinar 4 (n=11)
Yes, I will... <i>specify change(s)</i>	1	2	5	6
<i>No, this has confirmed my current practice. (no changes needed)</i>		3	4	1
<i>No, I am not yet convinced of the need to change</i>	2			

CHAPTER 4 (Article 3)

Cardiologists' perceptions and learning outcomes from an interactive, case-based webinar series

This manuscript is developed for submission to a journal such as *The International Review of Research in Open and Distance Learning* (www.irrodl.org), a refereed, open access e-journal that disseminates original research, theory, and best practice in open and distance learning.

Word limit: should not exceed 7,000 words.

Abstract

Research problem: A qualitative study was undertaken to explore the perceptions and learning outcomes of cardiologists who participated in an interactive, case-based webinar series. The study explored the characteristics of program structure, content, service, and media that influence cardiologists' learning experiences. The study also probed outcomes including satisfaction, and changes in knowledge and practice. Key program characteristics and outcomes were defined in accordance with the W(e)Learn instructional design framework.

Methods: Semi-structured interviews were conducted with cardiologists who participated in an educational webinar series. Interviews took place between two and seven weeks following a 4-part webinar series.

Findings: The strongest drivers of program participation were topic relevance and professional credibility of the physician facilitator. Important characteristics of the webinar structure were pedagogical design (case-based learning), degree of interactivity, and program scheduling. Cardiologists indicated the webinar series was a satisfying learning experience. They provided examples of how the webinars could support individual changes in knowledge and behavior.

Conclusions: Webinars that present professionally relevant content and are facilitated by credible content experts may appeal to cardiologists. Cardiologists prefer case-based design and synchronous eLearning programs because of the opportunity for live interaction. Webinar scheduling is important; however, if the content is of high interest and the program enables direct access to a leading content expert, cardiologists may make attendance a priority over other time demands. Webinars can be effective in supporting knowledge gains and fostering practice change among cardiologists.

Keywords: cardiologist, learning, preferences, synchronous, webinar

Introduction

A component of a larger body of doctoral research, this article describes the perceptions and learning outcomes of cardiologists who participated in an interactive, case-based webinar series. This research builds on findings from a systematic review of physician eLearning preferences (Pullen, Perrier, & Hayes, n.d.) and a case study of cardiologists learning experiences in an educational webinar series (Pullen, & Hayes, n.d.).

The previous articles discussed physician eLearning¹¹ preferences including interactivity, high usability, and customized, evidence-based content. The case study suggested webinars can be satisfying learning experiences and may support changes in knowledge and practice. Real-time interaction appeared to be an important factor for cardiologists. The case study also found that a design framework can be a helpful tool to support webinar implementation. A skilled and dedicated implementation team was an asset to this process.

Seeking an in-depth understanding of the webinar experience through the voice of participating cardiologists, this article addresses the following specific questions:

1. What are the characteristics of program structure, content, service, and media that influence cardiologists' perceptions about learning as participants in a webinar series?
2. What are the learning outcomes for cardiologists who participated in a webinar series?

Study Background

Continuing professional development (CPD) is one mechanism for supporting physicians in learning and ongoing development of professional competencies (Peck, McCall, McLaren, & Rotem, 2000). Specialist physicians in Canada such as cardiologists must complete 400 hours of

¹¹ For the purpose of this review, eLearning is defined as "the development of knowledge and skills through the use of information and communication technologies (ICT) to support interaction for learning - interactions with content, with learning activities and tools, and with other people" (Rossiter, 2005, p. 5).

CPD over each 5-year cycle (Royal College of Physicians and Surgeons of Canada, 2011).

Presently, cardiologists in Canada accumulate most credits through attendance at meetings (Canadian Cardiovascular Society, 2009), which often requires being away from work and home.

Web conferences or “webinars” offer a practical alternative to face-to-face meetings. Able to support real-time interaction among participants, webinars are low cost, time efficient, and accessible to anyone with a computer and an internet connection. Among healthcare providers, web-based CPD programs including webinars have been shown to have positive outcomes, including high satisfaction (Chumley-Jones, Dobbie, & Alford, 2002) and an increase in knowledge (Casebeer et al., 2004) that can be at least equal to that of face-to-face programs (Cook et al., 2010; Wutoh, Boren, & Balas, 2004).

The Canadian Cardiovascular Society (CCS) is Canada’s professional association for cardiologists. The CCS supports its members in their professional development by offering relevant accredited CPD programs, typically in the form of conferences and meetings. A cornerstone of the CCS CPD programs is a face-to-face workshop based on the national heart failure clinical practice guidelines. The purpose of the workshop is to raise awareness among cardiologists about the Canadian heart failure guidelines and to support cardiologists in learning the latest evidence-based recommendations for heart failure care.

CCS program evaluation data indicate the workshop has been well received (CCS, 2011). Of the 258 workshop evaluation surveys returned in 2009 (27% response rate), 82% of respondents rated the workshop as “very good” or “excellent” and 90% agreed that the workshops were conducive to learning. Over 56% of respondents had attended a previous CCS heart failure workshop to learn about the annual updates to the guidelines, indicating that many

cardiologists actively seek to attend these workshops year over year (CCS) because they find them to be useful.

Data from a CCS (2009) member survey suggested the need to explore webinars as an alternative medium for CPD programs. The survey revealed that while 81% of members placed a high value on CCS clinical practice guidelines and 54% valued “meet the expert” CPD programs, only 23% had attended a live, expert-led CCS guidelines workshop. Furthermore, while 38% of CCS members indicated an interest in participating in webinars, only 4% actually had used this medium. This feedback stimulated a study to understand the acceptability of offering the live, expert-led heart failure guidelines workshop to cardiologists through a webinar format. If found to be a satisfying learning medium for cardiologists, the initiative could make a sought-after CPD program more accessible. A well-implemented webinar program could help the CCS support members in their professional development, and assist members in maintaining work/life balance through reduced time away from work and home.

The CCS developed and delivered a series of four accredited, bi-weekly, case-based webinars on the topic of Canadian heart failure clinical practice guidelines. The target audience was cardiologists. The webinar medium enabled live interaction between participating cardiologists and national content experts through audio discussion, a simultaneous electronic chat room, and electronic polls conducted at key decision points in each webinar. The goal of the webinar series was to enable participants to have dialogue with experts about evidence-based treatment of heart failure, without the requirement to travel to attend a program in person. Project management and webinar implementation were carried out by a team which included a researcher/project manager, an eLearning design specialist and a web coordinator. Content experts were three cardiologists who acted as the program facilitators.

Each one-hour webinar in the series was designed as a clinical case discussion addressing key considerations in the diagnosis and treatment of heart failure. Striving to espouse best practices in eLearning design (Cook, Gelula, Dupras, & Schwartz, 2007; Inan & Lowther, 2007), design, development, delivery and evaluation of the webinar series was guided by W(e)Learn, an eLearning design framework developed for use within a healthcare milieu (MacDonald, Stodel, Thompson, & Casimiro, 2009).

W(e)Learn specifies four critical program design domains: structure, content, media, and service. The framework includes four levels of outcomes including the following: 1) learner satisfaction, 2) changes in attitude or development of new knowledge or skill, 3) changes in learner behaviour¹², and, 4) organizational change and improved patient health. As described by the architects of W(e)Learn (Casimiro, MacDonald, Thompson, & Stodel, 2009), this hierarchy of outcomes was derived from a framework developed by Barr, Koppel, Reeves, Hammick and Freeth (2005) who drew upon original, frequently-cited work on evaluation of training outcomes conducted by Kirkpatrick (1967). In reference to the framework, this study explored cardiologists' webinar experiences through the lens of the W(e)Learn domains and levels 1-3 outcomes.

Methods

Study Design

This qualitative study focused on describing, understanding and explaining the common and unique experiences (Maxwell, 2005) of cardiologists who participated in a heart failure

¹² W(e)Learn refers to Level 3 outcomes as changes in learner behavior (MacDonald et al., 2009). This study is interested in behaviour related to clinical practice, therefore, the term practice is used herein to describe behaviour-related outcomes.

webinar series. The data source for this study was focused, semi-structured interviews with participating cardiologists. Ethics approval was granted by the University of Ottawa.

Participants and Recruitment

Thirteen cardiologists consented to participate in a previous case study which explored their experiences as participants in an educational webinar series. All 13 cardiologists were contacted by telephone by the researcher following the webinar series to invite them to participate in an interview. No incentive was offered for participation. Seven cardiologists accepted the invitation to be interviewed.

This convenience sample included six males and one female. The majority of participants were between the ages of 41-50 years. Six participants worked in an urban setting in a university hospital-based practice while one was from a smaller, community-based setting. Five of the cardiologists resided in Alberta, one in Ontario, and one in New Brunswick. The majority of participants had been in practice for 11-20 years. As illustrated in Figure 1, cardiologists interviewed were a representative sample of webinar participants and the CCS membership overall (Canadian Cardiovascular Society, 2009), and so were well-positioned to provide insight into the webinar experience for cardiologists (Maxwell, 2005).

Interview Design

Semi-structured telephone interviews were conducted between three and seven weeks after the webinar series. The interviews explored in depth individual perceptions and experiences and provided a format for open discussion (Rice & Ezzy, 2000). Interviews varied in length from 25 to 60 minutes.

Interview questions were open-ended and aligned with the key domains of the W(e)Learn framework. Questions addressed motivation to participate in the webinar series, and insights

about and experiences with domains such as webinar structure, content, media, service and outcomes. Three levels of outcome were explored: 1) learner satisfaction, 2) changes in attitude or development of new knowledge or skill, and 3) changes in practice. The Interview questions are shown in Appendix A.

Interviews were recorded and professionally transcribed. Participants were assigned a number for reference in the transcripts to protect anonymity and were offered the opportunity to verify the transcripts.

Data Analysis

Thematic analysis of interview transcripts was a process of understanding the data and systematically identifying key concepts and links. The process followed was influenced by Maxwell (2005) and Merriam (2001) whose extensive work in qualitative research methodology guided the methodology and data analysis strategies used. Analysis was a critical and creative process that attempted to interpret a range of descriptions, experiences and observations.

Analysis focused on finding common themes and relationships. The transcript from each interview was reviewed and re-reviewed to identify potentially relevant data, questions, and possible interpretations and connections. Transcripts were uploaded into Atlas.ti, a qualitative data analysis program, and coded using broad descriptive codes. Then, sub-codes which described the data in more detail were added. W(e)Learn provided a base lexicon of codes; however, additional codes were developed where a unit of text seemed important but was not captured within the lexicon. Examples of codes not included in the W(e)Learn lexicon include “scheduling” and “credibility”.

After coding the first two transcripts, a second researcher coded these same transcripts using the same process. This qualitative inter-rater reliability check was used to confirm the

clarity and the consistency of the coding (Maxwell, 2005). Similarities and differences in coding were compared and discussed. Where there were differences, they were reconciled through discussion and mutual agreement about the most accurate coding and whether a new code would be added to the codebook. Key decisions and questions were tracked. This coding process improved the consistency and transparency of the data analysis.

Qualitative research is concerned with meaning and not making generalized hypothesis statements; data collection and analysis continue until new data do not shed further light on the issue under investigation (Glaser & Strauss, 1967; Merriam, 2001). In the present study, data obtained through the convenience sample were reviewed and coded to the point where no new themes were identified and researchers felt saturation had been reached. Strauss and Corbin (1998) suggest that saturation is a "matter of degree" (p.136). While there is always potential for "the new to emerge" as researchers familiarize themselves with and analyze their data, they uphold that saturation should be most concerned with reaching the point where additional data will not necessarily add to the overall story.

When coding was completed, the database was searched by code so passages could be reexamined for appropriateness of coding. Atlas.ti was used to generate data summary tables (Bloomberg & Volpe, 2008). This organized the findings across themes, creating a record of who said what and how many times a particular response occurred by theme and by cardiologist. This graphic representation stimulated discussion and decisions about the dominant themes. The most descriptive examples for key themes were highlighted to provide robust support for the study's conclusions (Merriam, 2001).

Findings

Findings are reported below, in accordance with the research questions and organized by key theme. Theme names and definitions are derived from the W(e)Learn framework.

Study Question 1:

What are the characteristics of program structure, content, service, and media that influence cardiologists' experiences in a webinar series? Major themes were aligned within W(e)Learn domains of Structure, Content and Media.

Structure. Foundational elements of instructional design that gave shape to the program were coded as “Structures”. The themes that emerged within this domain related to facilitation, interactivity, pedagogical design, and timing.

Facilitation. The opportunity to interact directly with high-profile and credible Canadian content experts was a key driver of participation for all cardiologists interviewed. All cardiologists described who was facilitating the webinars as important while no one mentioned concerns about how the webinars were facilitated. As described by a university hospital-based cardiologist: “the speaker is very important, a name you know, a big name people would be interested in. Even if the topic is interesting you will look to see who is presenting” (Cardiologist 2, April 22, 2010). Cardiologist 7 who practices in a community-based setting appreciated the access to national content experts that the webinars enabled: “To get this level of expertise I would have to travel to where they are. Occasionally they come through here... Dr. H. was here once in the past four years. We would normally have to go to a national conference [to see him]” (March 11, 2010). Along with being a well-known expert, the academic credibility of the facilitators was important: “I like faculty who can put money where their mouth is. I ask [myself] what has he/she done to contribute to the literature on that?” (Cardiologist 5, April 13, 2010).

Interactivity. Interactivity refers to interaction among program participants which allows multiple perspectives on content to emerge and promotes learner engagement and higher level thinking (MacDonald et al., 2009). Live interaction was specifically highlighted by six of seven cardiologists who viewed it as a desirable webinar characteristic, helping to keep them engaged in the discussion: “I don’t tend to remember a ton from a dry talk. I sit there and I am not engaged...I prefer to be on my toes with a chance to say something...A webinar with live interaction is good” (Cardiologist 5, April 13, 2010). The opportunity to exchange and share practices and ideas was a key: “I was sometimes wondering what... is out there, what others are doing. To discuss the decision, why and what is the evidence, was good” (Cardiologist 2, April 22, 2010).

Pedagogical design. The webinar series used a case-based pedagogical approach, common and accepted in medical education (Srinivasan, Wilkes, Stevenson, Nguyen, & Slavin, 2007). Each individual webinar featured one or two clinical cases which unfolded like a story. This pedagogical approach was a preference specifically mentioned by six of seven interview participants. The case-based format contributed to continuity between webinars: “Case-based was a great way to do things. You can carry the same case or multiple cases throughout the series... Telling that story is helpful if you’re dialing in for multiple webinars, you tend to remember” (Cardiologist 3, April 13, 2010). The cases helped learners make connections between the webinar content and their practice, as articulated by Cardiologist 1: “It reminds you of a real case that you may have seen last week or last month” (April 9, 2010).

Timing. Design considerations related to time and timing were highlighted by all cardiologists interviewed. Each webinar was delivered at 1200 hours Eastern Standard Time, a time during regular business hours in all time zones and selected by the facilitators based on their

availability. The cardiologists were scattered across Canada; for some, this timing was a barrier, while for others it was a benefit. Cardiologist 2, from Edmonton, who participated in two of the four webinars stated “It was really a timing issue mid-day. That was the reason why I couldn’t join the other two” (April 22, 2010). The same time was not, however, a barrier for Calgary-based Cardiologist 4: “Lunch, late morning or early afternoon. I don’t like doing them at night or early in the a.m.” (April 12, 2010). Similarly Cardiologist 5, also from Alberta, made the practical point that “the middle of your workday means that you are not taking out of your family time” (April 13, 2010).

Cardiologist 7 stated “The time worked for me especially where we knew when all the sessions were scheduled before the first one was even launched and I could book around it” (March 11, 2010). This comment links to a related theme of prioritization. For some, the relevance of the content determined the extent to which cardiologists made attending the webinar a priority, regardless of time of day. Cardiologist 1 participated in the interview while simultaneously doing an angioplasty procedure. He responded to a question about the scheduling of the webinars by stating as follows

...I have to scrub in to do this angio...[2 minute pause]. It’s anyone who is busy. I fit it between commitments. The time slot can’t please everyone. I thought it was OK. ...Live is probably a little bit better than just having an eLearning tool because it forces you to prioritize, not procrastinate. I prioritize based on content and say “ok on this date I’m going to do that” instead of putting something on the back burner that sometimes you don’t get to. (April 9, 2010)

Content. All cardiologists interviewed suggested that an essential characteristic of the webinars was the degree to which content was based on peer-reviewed research and relevant to their professional context. They also provided vivid descriptions of what constitutes challenging content that would attract them to the webinar series and compel them to stay.

Evidence-based content. The importance of having webinar content that is solidly based on research literature was articulated by all cardiologists interviewed, and they provided validation that content from this webinar series was soundly evidence-based: “Well it was definitely evidence-based. They went into some detail on specific studies to make teaching points around cases... there was no commercial bias in it” (Cardiologist 7, March 11, 2010).

Comments from all participants reflected a collective professional imperative that webinars be soundly evidence-based and transparent as opposed to being based on one person’s opinion. Cardiologist 6 provided a representative example of this perspective:

I often kid with the residents. The staff cardiologists’ [nametags] are green, and residents’ are orange. So I always say: “I have the green tag so we do it my way”. The implication of that may be that it is not always right but it’s the way I want to do it. And that is a dramatic difference from what the webinar should be. It isn’t because of the green tag that I choose to do it that way, it’s because a whole lot of expert individuals sat down and thought through it. I can accept the information and trust the information. (March 2, 2010)

Cardiologist 2 provided a specific reference to how the webinars could have a positive impact on learning and practice if the content was perceived by cardiologists to be evidence-based: “If the evidence is solid I don’t need to hear it many, many times. If it’s an interesting idea

and you see the evidence and where it is coming from, then ... we are willing to try new things (April 22, 2010).

As the heart failure webinar series was an accredited program, cardiologists could claim up to four MainCert credits for participation. However credits were not mentioned by any cardiologist interviewed as an incentive to participate. As stated by Cardiologist 7, “the CME credits were not a factor in any way” (March 11, 2010). Accreditation signifies that programs are evidence-based, needs-based, peer-reviewed, and unbiased by third-party interests (e.g., pharmaceutical companies) (Royal College of Physicians and Surgeons of Canada, 2012), which may be more valuable to cardiologists than the actual credits.

Authentic and highly tailored. The requirement for content to be authentic and reflective of cardiologists’ real day-to-day professional experience was expressed by all cardiologists. The value of the content was judged against their perceptions of authenticity in relation to their practice. For example Cardiologist 5 stated “It was very good; timely, practical and useful to what I do” (April 13, 2010). Cardiologist 3 made a similar point from the standpoint that where content was not authentic, it was not as highly valued: “The cases on acute heart failure I would see every day. They are actual real life what I do. I wasn’t as excited about the diabetes content because it is not something I focus on” (April 13, 2010).

The feedback from a pediatric cardiologist who participated in only two of the four webinars highlighted the strong need for content to be highly tailored to the audience: “The problem was...there was not a lot of discussion in this [pediatric] area. It was interesting for us to see what the adults do, but it was not peds specific” (Cardiologist 2, April 22, 2010). The lack of pediatric-specific content was an authenticity barrier, which highlights the fine balance in designing webinar content: The content must be sufficiently broad to attract a large enough

audience to achieve economies of scale, but also specific enough to a specialist physician audience with extensive sub-sub-specialty¹³ population.

Challenge. Five of seven cardiologists interviewed provided detailed descriptions of the type of content most challenging and compelling to them, and what they sought from the webinar content. Their comments reflected a strong preference for clinical cases where there is no clear answer, but considerable unresolved discussion within the field, such as a challenging application of existing knowledge or the translation of new research evidence into implications for practice. Cardiologist 3 defined challenging cases as those where “a decision has to be made in the absence of data – no clear next test, or no clear diagnostic marker, etc., – or new or rare diagnoses...where there is diagnostic or therapeutic uncertainty with potential risk on each decision arm (April 13, 2010).

While the challenge of uncertainty in the face of a required decision was highlighted by Cardiologist 3, Cardiologist 5 added that the more challenging cases reflected the realistic complexity presented by the patients she sees “on a day-to-day basis – like the [patient] I saw ... who not only has aortic stenosis but has a vascular necrosis of her hip and I am suspicious she has lung cancer – a challenging case with no clear answer, and many opinions” (April 13, 2010). She described how these types of cases lead her to want to learn more and work out how she would manage such a case herself. Cardiologist 4 contributed that he enjoyed cases that involved “state of the art data... which has been recently published or not yet published, and presented to challenge or reinforce existing paradigms and to identify areas for future study” (April 12, 2010).

¹³ Cardiology is a sub-specialty of internal medicine. Within cardiology, there are numerous sub-sub-specialties including interventional cardiology, echocardiography, electrophysiology, pediatric cardiology, etc. Some sub-sub-specialty disciplines have fewer than 100 specialists practicing in Canada (e.g., pediatric cardiology).

Cases that address ambiguous or complex clinical challenges and which provide novel information are thus compelling for the cardiologists.

Media. Of the seven participating cardiologists, none had previously participated in a webinar and none reported experiencing technical problems using the medium. All reported favourable opinions about webinars as a CPD medium, based on a positive experience in this program. “You could download and view the slides very easily” (Cardiologist 5, April 13, 2010). Cardiologist 1 contributed: “I think it is a good direction. Always good to hear a voice. When you read a guideline you fall asleep, when you have audio visual it is more appealing” (April 9, 2010).

Four cardiologists suggested that technology should be optimized to enhance the learning experience, such as by adding live video of the facilitator. Cardiologist 4 made the following suggestion for increasing the likelihood that the webinar would hold his attention: “You know when you go to a hockey game and there is so much happening after the whistle, cleaning the ice, etc.?... Have something happening all the time” (April 12, 2010).

To summarize the findings related to research question #1, cardiologists provided rich descriptions of the characteristics of program structure, content, service, and media that influenced their webinar experiences. Their comments suggested consideration should be given to selecting credible, expert facilitators; ensuring a high degree of interactivity; and employing an acceptable pedagogical approach such as case-based learning. While effort should be made to schedule webinars at a time convenient for facilitators and cardiologists, cardiologists were more likely to make time to participate if they perceived the content to be worthwhile: evidence-based, authentic to their professional context, and challenging. Cardiologists found webinar technology

easy to master and suggested the appeal of programs could be enhanced by making full use of multimedia technology.

Study Question 2:

What are the learning outcomes for cardiologists who participated in a webinar series?

This question focuses on the end-results or outcomes for cardiologists from participation in the webinar series. Along with satisfaction with the webinar series, key outcomes of the webinar series included attitude and behavior change among participating cardiologists, aligning with W(e)Learn levels 1-3 outcomes. Descriptions of outcomes as articulated by participating cardiologists are provided below.

Satisfaction. All cardiologists interviewed expressed satisfaction with the webinar as a CPD medium. General comments included the following: “This was my first webinar and I enjoyed it, actually. I found it quite a nice medium to work with” (Cardiologist 2, April 22, 2010), and “I like the webinar... if you miss little points of what they are saying, you have something there in front of you to go through and the ability to ask questions discreetly” (Cardiologist 7, March 11, 2010).

Satisfaction with the convenience offered by the medium was mentioned by four of the seven cardiologists, including remarks such as “it is easier to access than a traditional workshop. You don’t need to be physically there. There is no travel involved yet there is still the potential for the same interaction that takes place at a [face-to-face] workshop” (Cardiologist 6, March 2, 2010).

Attitude and practice change. Five cardiologists provided specific examples of how content from the webinar series influenced individual attitudes and practice. Cardiologist 7 had a

positive reaction to the webinar content and described how new knowledge would influence clinical decisions:

There was a trial I wasn't familiar with that said the weight loss is useful but not linked with improved mortality...I'll still look at [weight loss] in practice, but I am not going to hang my hat on it like I would with some medications that we know would improve mortality. (March 11, 2010)

Cardiologist 5 discussed how the webinar series contributed to the range of information and learning experiences that, cumulatively, had the potential to support practice change:

I always learn stuff when I go to CME [CPD]. Especially when talking about management of complex patients. I might sit there and go "isn't that interesting" and remember it... [then] I might see a patient and go "Oh I remember learning that", do a little research, and verify that what I remembered is accurate. That sort of thing may subtly lead to a change in how you manage patients. (April 13, 2010)

Cardiologist 6 described an instance when the webinar series reinforced knowledge that was relevant and applicable to practice:

When we were doing right-sided heart failure with the guidelines [webinar] I was quite excited as I saw a guy in clinic who we could have used as an example. Everyone thought he had HF right sided and he actually had constricted pericarditis and when you looked at the x-ray you could clearly see an egg shape around the heart and it was quite exciting... it was exciting to see it all come together. (March 2, 2010)

Cardiologists provided specific references to how the webinars influenced their attitude about some content, contributed to their learning, stimulated their thinking, and had the potential to influence practice. Along with being satisfied with the learning experience, cardiologists provided examples of how knowledge was reinforced or new knowledge acquired that was relevant to practice and could influence practice change. The outcomes align with W(e)Learn levels 1-3 outcomes: satisfaction, changes in attitude or development of new knowledge or skill, and changes in practice.

Discussion

This qualitative study explored the key characteristics of a webinar series that influence cardiologists' learning experiences and outcomes including satisfaction, and changes in knowledge and practice. Results indicated that the strongest driver of program participation was webinar content-relevance and the credibility of the facilitator. Important structural characteristics of webinar design were pedagogical design (case-based learning), interactivity between participants and facilitators, and the scheduling of the program. Cardiologists also suggested they had no difficulty using the webinar technology and would welcome creative use of technology and software to keep webinars stimulating and engaging. Cardiologists found the webinar platform to be a satisfying medium for CPD that could support individual changes in knowledge and practice. These results are discussed in turn below.

Content

Findings suggested cardiologists highly value webinar content that is evidence-based, authentic to their practice context, and challenging.

Evidence-based. For all cardiologists interviewed, the decision to participate in this optional, freely-accessible learning program was dependent on the specific webinar content. The

study revealed a strong imperative that webinar content be evidence-based and unbiased. This preference was not highlighted in the findings of recent syntheses of CPD research (Cook et al., 2010; Wong, Greenhalgh, & Pawson, 2010; Wutoh et al., 2004). Over the past decade there has been a growing awareness of – and strong culture shift away from – historically strong ties between the field of cardiology and the pharmaceutical industry (Mendelson, Meltzer, Campbell, Caplan, & Kirkpatrick, 2011). Cardiologists' preferences identified in this study may be reflective of this culture shift toward content that is as removed as possible from third-party influence. The cardiologists articulated a clear preference for information that is transparently evidence-based. This finding indicates that program developers must pay close attention to the sources of program content. The fact that webinar participation was eligible for CPD credits did not appear to matter to cardiologists; however, the rigor of the accreditation process may have reassured them that the content is as unbiased and credible as possible.

Authentic. Equally important to cardiologists was the degree to which content was authentic or directly related to and reflective of cardiologists' day-to-day practice. Cardiologists clearly stated that, where content was not specific to their practice, they chose to not attend the webinar. This finding is consistent with recent systematic reviews (Carroll, Booth, Papaioannou, Sutton, & Wong, 2009; Wong et al., 2010). Carroll et al. found that physicians preferred the focus of the learning experience to be “inseparable from their professional reality” (P. 240), and Wong et al. (2010) highlighted “relevance to context” (p.1) as a key criterion for effective continuing medical education.

Challenging. The description of the nature and importance of challenging content was another finding unique to this study. Cardiologists described “challenging” content as complex cases, unclear therapeutic approaches, or stimulating unanswered questions. The opportunity to

discuss nebulous research findings and complex approaches to care with colleagues and experts was highly valued. Stimulating content made attendance in the live program a priority for cardiologists, and interest in the discussions helped maintain participant engagement in the program.

This finding aligns with learning theories espoused by Piaget (2000) and Vygotsky (1978). Constructivist learning theory suggests that when learners encounter challenging new problems, they experience a sense of disequilibrium between their existing knowledge and the unknown (Piaget, 2000). To re-establish equilibrium, they make accommodations for the new experiences within their existing schema or skill sets, which equates with learning. Vygotsky's (1978) interpretation of the learning process is slightly different, emphasizing the role of social interaction in supporting or "scaffolding" learning. Vygotsky (1978) described a zone of proximal development (ZPD) as the range of mastery between what a learner can do independently (at the lower end of the range) and what a learner can achieve with the help of others (or tools). Interaction with peers and experts supports the learner in shifting his/her ZPD further along the progression towards a higher level of mastery of knowledge or skills (Vygotsky, 1978). Working as part of a social group, learners can solve problems collectively and then, if the individual learner has internalized the new concepts, perform individually and/or independently.

All cardiologists in this study described a preference for a challenging learning experience (i.e., a sense of disequilibrium). There was a clear articulation that complex and ambiguous cases were part of day-to-day patient care, stimulating curiosity and challenging their practice. Cardiologists indicated they appreciate interactive experiences which support them to progressively shift the boundaries of their learning. Social interaction is a critical element not only in keeping them engaged but also in facilitating learning.

Structure

The structural elements of webinar design that were important to cardiologists included the professional credibility of the facilitator, interactivity, and case-based design. Cardiologists in this study also commented on webinar scheduling, suggesting they valued and might prioritize a synchronous eLearning program over an asynchronous program.

Credibility of the facilitator. The choice of webinar facilitator was as important to cardiologists as was the webinar content. Cardiologists stated strongly that, to attract them to the program, the facilitators had to be well-recognized authorities on the subject with credibility and transparency regarding conflict of interest. Cardiologists' acceptance of the facilitators was moderated by the question "Do they know more than I do?" This is consistent with the findings of Wong et al. (2010) which indicated that access to hard-to-reach experts was a key motivator for physicians to participate in web-based CPD programs.

The recent systematic review by Carroll et al. (2009) found that facilitator training was a critical element in eLearning design and delivery. Of interest in the present study was the fact that cardiologists made no comments specifically about the facilitation *skills*. The cardiologists seemed satisfied with facilitation because the speaker was an expert on the subject matter, not because they were noted as skilled presenters. The fact that traditional facilitation skills (e.g., timekeeping, moderating discussions, ensuring all learners actively participate, etc.) did not arise as a key theme in this study could be because the facilitators were seasoned presenters, already experienced and skilled in the role. It is also possible that, to cardiologists, the facilitator's credentials were more important than the facilitators' communication and teaching skills.

Interactivity. The opportunity for active social engagement was perceived as a desirable characteristic of synchronous webinars by all cardiologists interviewed, differentiating webinars

from other CPD designs such as didactic lectures and asynchronous eLearning programs.

Cardiologists seemed only to associate interactivity with live or “real-time” programming. They sought a natural and immediately responsive social encounter.

The preference for interactivity among learners and facilitators, whether synchronous or asynchronous, is consistent with the findings of other systematic reviews (Carroll et al., 2009; Cook et al., 2010; Wong et al., 2010) which looked at all types of eLearning and found that interactivity was highly valued across all program types. This underscores a link between the synchronous, interactive webinar experience and Vygotsky’s (1978) social constructivist learning theory which suggests that knowledge is created when individuals engage in collective tasks, problem-solving and discussion about shared problems and tasks (Merriam, Cafarella, & Baumgartner, 2007). In this webinar series for cardiologists, scientific research was crucial for the content, but interaction is what made the experience engaging.

A recent single study found that, among physicians, efficient and brief eLearning experiences may be preferred over longer, interactive programs, especially if the content is simple and can be gleaned through simply reading text (Puddester, MacDonald, Archibald, Sun, & Stodel, 2010). These are interesting findings that could be explored in more depth in relation to the complexity of webinar content. However, in the present study, participating cardiologists were clear that they sought an opportunity to discuss sophisticated content with peers and experts. They did not indicate that shorter webinars or less interactivity would have been preferred, despite the fact that they had the option to simply read the guidelines.

Case-based design. Cardiologists also valued the pedagogical design of the program. Case-based learning helped make the content authentic by linking it to realistic patient situations. This aligns with the findings of a study by Davis et al. (1999) which found that educational

interventions “that used techniques such as case discussion...were generally more effective” (p. 870). Because the present study did not explore preferences for alternative pedagogical approaches, it is not known if another approach (e.g., problem-based learning) would have been found by cardiologists to be equally, more, or less engaging.

Webinar scheduling. Although timing was determined to be an important factor for webinar participation, the interviews provided unclear results about how best to schedule programs. All possible time slots (early morning, during the work day, evening, etc.) were cited as both preferred and not preferred. Even cardiologists in the same time zones indicated opposing preferences. It appeared to be impossible to please everyone with a single time. The webinars could reach more participants if they were offered at multiple times, but that would be very resource intensive. A logical option for maximal flexibility in timing would be to offer webinar recordings as asynchronous programs. For those interviewed, however, real-time interaction was favoured over asynchronous options despite the convenience offered by asynchronous programs. This contradicted Carroll et al. (2009) who found the convenience of asynchronous eLearning programs to be highly valued by allied health professionals including some physicians.

The question of timing raised the issue of prioritization. Cardiologists indicated that the keys to attracting cardiologists to the webinars were highly compelling content and access to a content expert, rather than structures such as timing. If the content and the speaker were sufficiently compelling, cardiologists may be more likely to deliberately make time to participate, regardless of the time. None of the systematic reviews on the topic of physicians and eLearning preferences noted a similar theme (Carroll et al., 2009; Cook et al., 2010; Wong et al., 2010; Wutoh et al., 2004). The present study was unique in that it exclusively included *specialist*

physicians with many competing priorities and limited experience with other types of web-based learning programs.

Webinar Technology

Cardiologists experienced no problems with the webinar media. In fact, they suggested the use of additional media to add further technological stimulation to the program. This finding aligns with the conclusions reached by Carroll et al. (2009) and Cook et al. (2010) in which health care providers including physicians indicated a preference for the use of a variety of media within eLearning programs. Further, a review by Lam-Antoniades et al. (2009) noted that multimedia eLearning programs are more likely to support desirable learning outcomes such as increased knowledge and behavior change.

Technology in general, including that used for eLearning, is now widespread and has evolved to be extremely user friendly. It is not surprising that cardiologists, who are already frequent users of computerized technology in clinical practice, reported no barriers related to webinar technology. In fact, they welcomed the use of a full range of media (audio, video, text chat, animation, etc.) to add interest to programs and keep the webinar experience maximally engaging. These findings are different from another single study where healthcare providers including physicians suggested they would prefer “fewer bells and whistles” in eLearning programs (Puddester et al., 2010). These different findings highlight the importance of understanding learner preferences at the outset of eLearning design so programs may be customized to accommodate specified learner preferences.

Webinar Outcomes

Cardiologists indicated that they found the webinar platform to be satisfying and provided examples of how the webinar series increased knowledge of guideline recommendations or had

the potential to influence practice. These results mirror findings from systematic reviews by Cook et al. (2010) and Wutoh et al. (2004) which found that eLearning programs, including synchronous programs such as webinars, could be satisfying and support attitude, knowledge and practice change among physicians.

In the present study, five cardiologists provided examples of ways the webinar content reinforced existing knowledge or influenced practice. None highlighted major changes or intended changes to practice, but rather identified subtle ways the webinar content challenged their attitude and thinking. Reviews which addressed the value of learner assessment (Carroll et al., 2009; Cook et al., 2010; Wong et al., 2010) found a preference among physicians participating in eLearning programs for ongoing feedback and/or testing. If the study were repeated, stronger evidence of practice change and impact on clinical practice could be gleaned from integrating some form of objective knowledge testing and/or structured feedback mechanisms into the program.

Limitations

This study was subject to limitations. This study involved a small convenience sample, common in qualitative research (Merriam, 2001). The primary researcher's coding and analysis was checked by an independent researcher to confirm consistency, reproducibility and saturation, indicating that the sample size was sufficient for the study's purpose. The use of Atlas.ti enabled the generation of data summary tables. The data tables helped demonstrate that saturation was achieved.

This study relied on information voluntarily provided by seven individuals. Interviews captured retrospective accounts of the webinar experience which are subject to the problems inherent to memory (Fraenkel & Wallen, 2006). To counterbalance this potential bias, the most

appropriate participant sample consisting of individuals who best represented the research topic was sought. The same interview guide was used with all participants, ensuring sufficient data to account for all aspects of the experience were obtained and saturation was achieved (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

Studies involving interviews rely on truthful responses from participants to draw meaningful conclusions. Socially desirable responding is the tendency for participants to present a favourable image or supply responses which conform to socially acceptable values (Johnson & Fendrich, 2002; King & Brunner, 2000). In this study, cardiologists may not have wanted to disclose gaps in knowledge of heart failure guidelines. This potential bias was mitigated by triangulation of data sources and methods of analysis, and by assuring interview participants that responses would be kept anonymous.

The trustworthiness of qualitative studies is enhanced by credibility of the data. (Lincoln & Guba, 1985). Credibility was strengthened through review of coding and analysis by independent researchers. Readers can further assess credibility based on study methods which were simple, transparent and reproducible: a detailed description of the study setting was provided; interviews were recorded, transcribed by verbatim and reviewed by participants; a codebook was developed through consensus between researchers; and comprehensive quotes from participants provided support for the interpretation of the findings.

The researcher, who was also the interviewer, may have introduced a self-fulfilling prophecy bias to the findings by anticipating certain responses based on familiarity with the literature and the study participants (Yin, 2009). This effect was moderated by having coding checked by an independent researcher and through deliberate attempts to maintain researcher self-awareness by keeping a researcher journal to document key decisions.

Conclusion

Seven cardiologists participated in this qualitative study that explored the key characteristics of a webinar series that influence learning experiences and outcomes. Results highlighted that the quality and authenticity of the content were highly important, as was the credibility of the facilitators. Important structural elements included a case-based design, the opportunity for participants to interact in real-time, and the scheduling of the program. Cardiologists found the webinar platform to be a satisfying medium for CPD that could support individual changes in knowledge and practice.

The strongest driver of program participation was the topic and the professional credibility of the facilitator. If the content was of high interest and relevance, and the facilitator was highly respected, cardiologists could be attracted to the program. The next most important characteristics were the pedagogical design (case-based learning), the degree of interactivity to keep participants engaged, and the timing of the program. Cardiologists indicated they found the webinar series to be a satisfying learning experience and provided examples of how the webinars supported changes in knowledge and practice.

The perceptions and learning outcomes reported by the cardiologists were generally aligned with the literature. New findings which differed from the extant literature included the importance to cardiologists of the professional credibility of the facilitator and a preference for real-time programs over asynchronous eLearning programs. The study results expand our understanding of optimal webinar design for cardiologists.

The study responds to a call from Cook et al. (2010) for qualitative studies that clarify program characteristics and address how best to use internet-based programs for professional development. No comparable studies of cardiologists have been identified in the literature. This

study's contribution lies in its unique findings. When compared with the findings of studies involving eLearning preferences among allied healthcare providers, cardiologists suggested some distinctive preferences (e.g., the professional credibility of the facilitator and a preference for real-time programs). This study's findings suggest that design preferences may vary between groups of learners. This is echoed by Wong et al. (2010) who suggest that different modes of course delivery suit different learners in different contexts. Collectively, these studies suggest that the needs and preferences of learners must be carefully considered in instructional design to achieve the desired learning outcomes.

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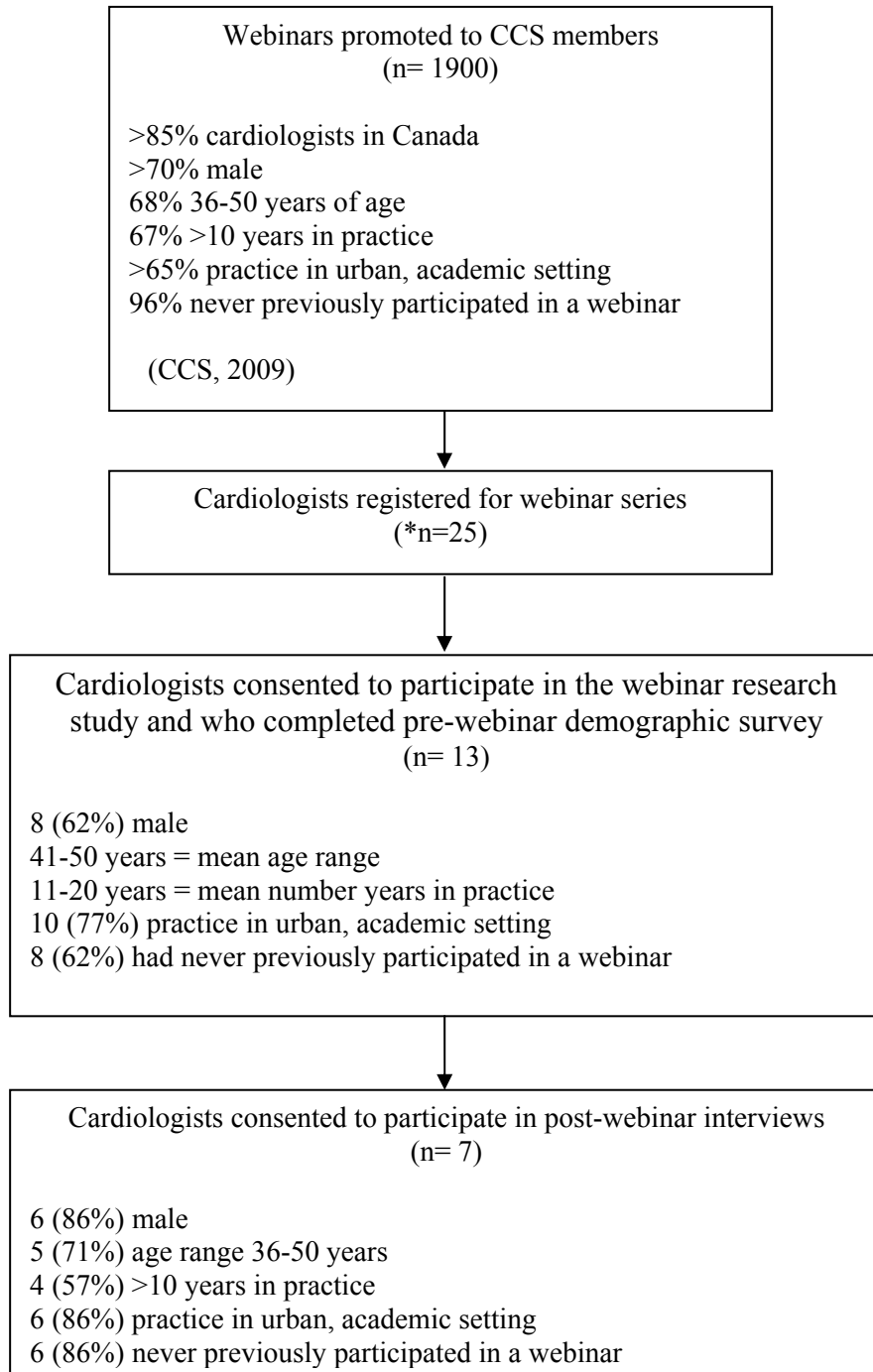
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Figure 1: Comparison of demographics

Comparison of demographics: CCS members, webinar participants and interview participants



*Demographic data not available because not all webinar participants completed a demographic survey or consented to participating in the study.

Appendix A: Semi-structured interview questions

Thank you for agreeing to participate in this interview. The purpose of the interview is to review your learning experiences and practice change as a result of your participation in the CCS heart failure webinar series. Of particular interest to me is your individual learning experience as a participant in the program and your perception of how this experience might lead/has led to changes in your practice.

This interview will be audio-recorded so that I can refer back to our discussion when I write my final report. During this discussion and when I write my report, a pseudonym will be used to protect your identity. Please remember that your participation is voluntary and that there are no consequences if you choose to withdraw. The recordings of this discussion will be stored in a safe location and will only be accessible to my supervisor and me.

<i>Domain</i>	Researcher: Summarize webinar objectives and review the experience
Motivation	Tell me about what influenced your decision to participate in the workshop.
Structure	Please describe your impression of how the webinar was designed. Did you perceive that your needs as a learner were reflected in the design? (Probe interactivity, ethics, facilitation, case-based design, community, etc.)
Content	Please tell me your impressions about the content of the program. (Probe: authenticity, inclusiveness, evidence-based)
Media	Please describe your personal experience as a technology user in the webinar series. (Probe: user-friendliness, familiarity with technology)
Service	Tell me your impressions about the level of service provided in support of the webinars. (Probe: scheduling, accessibility, responsiveness if/when technical support needed)
Change in attitude and/or knowledge	Please tell me about new knowledge or insights that you gained through the workshop series, if any. (Probe: was current practice affirmed?)
Change in practice	Please tell me about any aspect of the workshop series experience that has prompted you to make any changes to your practice.
Change in knowledge and/or practice	Please describe any changes that you have made/will make to your practice as a result of what you learned through the workshop experience. (Probe: what are some possible barriers to making/sustaining this/these change(s)?)
General	Please describe any other insights you had about the webinar experience that might help me improve future programs.

CHAPTER 5

This dissertation explored the eLearning experiences of cardiologists who participated in a webinar-based CPD program designed in accordance with an instructional design framework. Findings were presented in three stand-alone chapters. This integration chapter briefly reviews the findings presented in Chapters 2-4 and then offers insights about the collective findings. The chapter also presents the broader implications for practice and future research, and the strengths and limitations of the dissertation.

Summary of Results

Chapter 2 presented the results of a systematic review which synthesized the findings of studies that used qualitative methods to explore physician preferences for eLearning design and implementation. Chapter 3 described the implementation of an educational webinar series for cardiologists where webinar design and delivery were done in accordance with the W(e)Learn framework. Chapter 4 presented the findings from semi-structured interviews with seven cardiologists who participated in the webinar series. Research objectives and findings from chapters 2-4 are summarized in Table 1.

Table 1

Summary of findings of chapters 2-4

Research Objectives	Data Source	Findings
<p>Chapter 2: Systematic review</p> <ol style="list-style-type: none"> To examine studies that used qualitative research methods to explore physician preferences for eLearning design and implementation To assess identified physician eLearning preferences against W(e)Learn domains to suggest possible framework refinements. 	25 studies representing 808 physicians	<p>Physicians showed preferences for interactivity, strong facilitation skills and program customization in eLearning experiences.</p> <p>Physicians sought unbiased, evidence-based content and high usability, ease of navigation and assurance of confidentiality.</p> <p>The design framework captured most key preferences. The review suggests the framework could be strengthened by adding <i>Time</i> as an explicit element within W(e)Learn's domain of <i>Structure</i>.</p>
<p>Chapter 3: Case study of webinar implementation</p> <p>To explore the webinar implementation process to learn about the factors that contribute to a satisfying CPD experience for cardiologists.</p>	Email records, webinar transcripts, and surveys	<p>A needs assessment indicated that cardiologists seek webinars that are interactive, conducted in real-time, facilitated by credible content experts, and delivered in a case study format in multiple, short sessions. There was little uptake of asynchronous webinar recordings.</p> <p>Outcomes of the webinar series included participant satisfaction and the potential for changes in knowledge and practice.</p> <p>The design framework was a useful tool to guide webinar design, development and delivery.</p>
<p>Chapter 4: Interviews with cardiologists</p> <ol style="list-style-type: none"> To explore characteristics of program structure, content, service, and media that influence cardiologists' perceptions of the webinar experience. To explore learning outcomes for cardiologists who participated in a webinar series. 	Semi-structured interviews with 7 cardiologists	<p>The strongest drivers of participation were topic relevance and professional credibility of the facilitator.</p> <p>Important characteristics of the webinar structure were pedagogical design (case-based learning), degree of interactivity, and program scheduling. Cardiologists seek webinar content that is evidence-based, authentic, unbiased and challenging. Webinar were a satisfying learning experience and provided examples of how the webinars supported individual changes in knowledge and practice. Some cardiologists suggested that use of multiple media could enhance engagement in the webinars.</p>

Integration of Results

This study explored the learning experiences of cardiologists participating in a webinar series. The purpose was to gain an understanding about how to implement webinars so they provide an appealing and satisfying learning experience for cardiologists. The overarching research questions were the following:

1. What are the learning experiences of cardiologists who participate in a webinar series designed according to a constructivist eLearning design framework?
2. What factors related to webinar design, development and delivery contribute to an appealing and satisfying CPD experience for cardiologists?
3. How can an instructional design framework support the design and delivery of a webinar series for cardiologists?

By triangulating data sources, methods and findings (Moran-Ellis et al., 2006), I was able to explore, compare and contrast cardiologists' experiences to develop a credible and holistic understanding of the webinar experience. Table 2 illustrates the relationship between the overarching research questions and the results reported in chapters 2-4. Table 2 is followed by an in-depth discussion which addresses each overarching research question in turn to integrate results and present the comprehensive findings of this body of work.

Table 2

Overarching research questions and key findings from Chapters 2-4

Overarching Research Questions	Integration of Results
<p>What are the learning experiences of cardiologists who participate in a webinar series designed according to a constructivist eLearning design framework?</p>	<p><i>Case Study:</i> Outcomes of the webinar series included participant satisfaction and the potential for changes in knowledge and practice. The webinar series supported individual learners and attracted existing communities of learners, however it did not appear to foster new communities of practice.</p> <p><i>Interviews:</i> Cardiologists reported that the webinars offered a satisfying learning experience. Cardiologists provided examples of how the webinars could support individual changes in knowledge and practice.</p>
<p>What factors related to webinar design, development and delivery contribute to an appealing and satisfying CPD experience for cardiologists?</p>	<p><i>Systematic Review:</i> Physicians stated preferences for interactivity, strong facilitation skills and program customization in eLearning experiences. Physicians prefer unbiased, evidence-based content and high usability of technology, ease of navigation and assurance of confidentiality.</p> <p><i>Case Study:</i> Cardiologists sought interactive webinars delivered in real-time, facilitated by credible content experts, and delivered in a case study format in multiple, short sessions. There was little uptake of asynchronous webinar recordings.</p> <p><i>Interviews:</i> cardiologists suggested the strongest drivers of participation were topic relevance and professional credibility of the facilitator. Important characteristics of the webinar structure were pedagogical design (case-based learning), the opportunity for interaction, and program scheduling. Webinar content must be evidence-based, authentic, unbiased and challenging.</p>
<p>How can an instructional design framework support the design and delivery of a webinar series for cardiologists?</p>	<p><i>Systematic Review:</i> The design framework captured most physician preferences. Adding <i>Time</i> as an explicit element within W(e)Learn's <i>Structure</i> domain may strengthen the design process by capturing participants' scheduling preferences.</p> <p><i>Case Study:</i> The W(e)Learn framework was a useful tool to guide all aspects of webinar design, development and delivery, possibly supporting the webinars in achieving desired learning outcomes.</p> <p><i>Interviews:</i> While not explicitly asked about design frameworks, the design preferences referred to by cardiologists reflected the elements of the W(e)Learn domains.</p>

Learning Experiences

The first overarching research question asked “what are the learning experiences of cardiologists who participate in a webinar series designed according to a constructivist eLearning design framework?”. The case study and the interviews with cardiologists provided insight into answering this question.

Cardiologists’ learning experiences were captured through exploring webinar outcomes. Outcomes included satisfaction, an increase in awareness and/or knowledge of key content, and reported intentions to change behavior. Outcomes were uncovered through the webinar feedback surveys conducted as part of the case study (Chapter 3) and the interviews with cardiologists (Chapter 4). Feedback survey findings were consistent with those of the interviews.

Cardiologists found the webinars to be satisfying learning experiences, and were able to provide examples of how the webinars stimulated changes in knowledge and practice. The findings included some indications of behavior change; however, longer timelines for follow up and more rigorous study methods are needed to confirm actual increases in knowledge and changes that can be linked to webinar participation among cardiologists.

The present study involving cardiologists neither supports nor refutes the literature. Early and mid-level outcomes (i.e., satisfaction, knowledge increase) were reported. The literature suggests learning activities such as interactive workshops can have small effects on changing behavior but are unlikely to have much impact on complex behaviours (Davis & Davis, 2009; Forsetlund et al., 2009). Sustained behavior change was neither reported by cardiologists nor assessed within the present research.

The CPD literature suggests there are no presently known, consistently successful formulas or interventions for achieving changes in behavior (Davis & Davis, 2009). Individual

interventions such as large group sessions, interactive workshops, small group learning, and a broad range of eLearning approaches have been shown to have an impact on behavior (Cook et al., 2010; Davis & Davis, 2009; Mazmanian, Davis, & Galbraith, 2009). So too have combinations of approaches such as face-to-face and web-based programs, multiple exposures, multi-media approaches (e.g., print materials with face-to-face follow up), and independent and group learning activities (Carroll, Booth, Pappaioannou, Sutton, & Wong, 2009; Davis & Davis, 2009; Mazmanian & Davis, 2002; Forsetlund et al., 2009; Wutoh, Boren, & Balas, 2004; Wensing, Bosch, & Grol, 2009). There is general agreement that many approaches can be effective, particularly when tailored to address specific audience needs and interests, specific clinical problems, and/or barriers to change (Cook et al., 2010; Moores, Dellert, Baumann, & Rosen, 2009; Wensing et al., 2009; Wong, Greenhalgh, & Pawson, 2010). Choosing interventions to effect behavior change “remains an art informed by science, meaning that practice-based experience and creativity are important in selecting interventions” (Wensing et al., 2009, p. 110). The present study suggests that webinars can be an appealing and satisfying CPD option for cardiologists, and may support desirable outcomes including changes in knowledge and practice.

Important Factors in Webinar Design, Development and Delivery

The second overarching research question asked: “What factors related to webinar design, development and delivery contribute to an appealing and satisfying CPD experience for cardiologists?” The systematic review of literature, the case study, and the interviews with cardiologists contributed to answering this question.

Findings reported in chapters 2-4 underscored that participating cardiologists prefer interactive programs. The case study and the interviews highlighted the additional preference of interactivity in real-time. The systematic review discussed the preference for strong facilitation

skills. The case study and the interviews further characterized facilitation by adding a preference for facilitation by credible content experts. An emphasis on the importance of authentic, evidence-based, and unbiased content was also consistently found. The interviews added the additional element of challenge as an important characteristic of webinar content. A preference for a case-based pedagogical design was also consistently found, contributing additional insight around cardiologists' expectations of webinars. These factors are discussed below, as is the unanticipated observation regarding how the webinars appeared to support pre-existing learning communities.

Interactivity. Interactivity is a term frequently referenced but poorly defined in the eLearning literature (Wong et al., 2010). In this dissertation, interactivity referred to the dialogue learners enter into with others (virtual or real) to clarify understanding and obtain feedback during a formal learning program. Interactivity between participants and facilitators allows multiple perspectives on content to emerge, promotes learner engagement, and can foster higher level thinking (Mazmanian & Davis, 2002).

This dissertation found that cardiologists seek interpersonal interaction within the webinar experience. The potential for interactivity was a motivator for cardiologists to participate in the webinars. The systematic review (Chapter 2) found that, among physicians, interactivity is a desirable trait of eLearning programs. Cardiologists indicated in the pre-webinar learning needs assessment survey (Chapter 3) that they prefer interactive learning. During the webinar implementation, interactivity increased over the course of the webinar series, perhaps because the facilitators and participants were gradually gaining familiarity and comfort with the webinar structure, platform and tools, and with each other. Through the feedback surveys, participants strongly agreed that the level of interaction throughout the webinar series was highly satisfactory

(Chapter 3). The interviews with cardiologists also confirmed that cardiologists were satisfied with the level of interactivity in the webinar.

Some single webinar “logins” represented many participants at a single site, and side-bar discussions taking place at the single site could periodically be heard by all participants (Chapter 3). For these groups, interactivity may have been measured not only by the amount of interaction *among* sites, but also by the amount of dialogue stimulated by the webinar *within* their site. In essence, the learning opportunity could be seen as exponentially interactive – engaging learners among *and* within sites.

These findings are consistent with the literature. A systematic review of instructional design approaches in eLearning (Cook et al., 2010) found interactivity in web-based CPD was a key characteristic in achieving satisfaction and learning among healthcare professionals. Another review focusing specifically on CPD for physicians identified interactivity in web-based programs as one of three major, consistent findings about how to improve effectiveness of CPD (Mazmanian & Davis, 2002). These studies called upon educational designers to enable two-way communication among participants to support learning.

The literature also provides caveats about interactivity in web-based educational programs for physicians. A systematic review of web-based CPD for healthcare professionals found that some physicians “felt exposed and vulnerable and unable to contribute to public discussions, as they did not wish to risk looking foolish in front of their peers” (Carroll et al., 2009, p. 239). The implication is physicians may seek assurances that the learning environment is a safe and secure place where knowledge gaps can be safely revealed, openly addressed, but kept confidential within the learning experience.

Interactivity is a key characteristic that attracts cardiologists to webinars and can be successfully fostered through careful webinar design and facilitation. To attract cardiologists to a webinar medium, the opportunity for convenient and direct interaction with geographically dispersed peers and facilitators in a secure learning environment should be highlighted. Designers and facilitators should implement strategies to encourage and sustain dialogue between participants to increase program appeal by supporting interaction.

Real-time interaction. Web-based learning can be classified into three broad categories: real-time/synchronous; any time/asynchronous; or mixed synchronous/asynchronous. The webinar series in this study was a synchronous program delivered in real-time. In addition to the “live” program, each webinar was recorded. The audio recordings were synchronized with the slide presentation to create an asynchronous version of the webinar which was posted on the web for later viewing.

Major systematic reviews involving blends of healthcare professionals (Carroll et al., 2009; Wutohet al., 2004) and of physicians only (Cook et al., 2010; Mazmanian & Davis, 2002; Wong et al., 2010) cite the flexibility in timing offered by asynchronous eLearning as a widely reported advantage of eLearning. None, however, focused exclusively on the preferences of cardiologists. This is noteworthy because this study found a clear preference among cardiologists for real-time programming.

While the systematic review of literature did not highlight strong preferences among physicians for synchronous versus asynchronous eLearning platforms, the lack of use of the asynchronous webinar recordings found in the case study was interesting. In considering elements such as resource reusability and offering convenience and flexibility to learners, I had expected that the asynchronous webinar recordings would be used by some cardiologists. The case study

did not find this to be so; there were only five brief viewings of the asynchronous resource. This reinforces the findings of the needs assessment which showed a preference for live, interactive programming and revealed minimal previous experience with asynchronous eLearning among participating cardiologists. In post-webinar interviews with cardiologists (Chapter 4), there was agreement on a preference for real-time (synchronous) programming. Cardiologists described that if the content was sufficiently relevant to their practice, they would/could make attendance a priority.

Possibly, this expressed preference for real-time programming suggests an inherent bias among those cardiologists who choose to participate in a synchronous webinar series as opposed to a generalizable preference among all cardiologists. This finding reinforces the importance of understanding learners through a thorough needs assessment to inform specific preferences for asynchronous versus real-time activities. A clear understanding of learner needs can also prevent expenditure of resources on development of unnecessary program features.

Content experts as facilitators. Webinar facilitators were invited to facilitate because they are content experts, experienced educators, and interested in innovative approaches to educate the cardiovascular community about important national clinical practice guidelines. They were active participants in all webinar implementation activities. While all had delivered face-to-face heart failure workshops, none had previously planned or delivered a webinar.

Much was learned through this study about the desired attributes of webinar facilitators among cardiologists. The systematic review (Chapter 2) emphasized the importance of facilitation skills and the need for facilitator training. The findings from the pre-webinar needs assessment survey (Chapter 3) suggested cardiologists wanted webinar content to be delivered by recognized content experts. Findings from the feedback surveys indicated that webinar facilitators

were viewed as highly knowledgeable and highly effective. In post-webinar interviews (Chapter 4), cardiologists discussed how the recognized name and reputation of the webinar facilitators contributed to decisions to participate in the program. The webinar enabled valuable, efficient and direct access to leading content experts. Neither the needs assessment findings, nor the feedback surveys, nor the interviews commented on facilitation skills per se, except to confirm that webinars were thought to be well-facilitated.

The literature makes several salient comments about the role and skills of facilitators. The role of facilitators is commonly understood to be to provide information and support, and to facilitate and moderate discussion. The role supports information exchange and reciprocal learning (Carroll et al., 2009). Reviews involving multidisciplinary healthcare professionals have specifically emphasized facilitators' roles in creating dialogue and providing feedback (Carroll et al., 2009; Wong et al., 2010). Carroll et al. (2009) underline that facilitators should be trained to be effective in an online environment. Lowe, Aparicio, Galbraith, Dorman, and Dellert (2009) report that good clinical teachers are often thought of as excellent teachers by virtue of being subject matter experts. In reality, "most content experts have no formal training in educational theory or methods" (Lowe et al., 2009, p. 73S). They suggest that clinical educators and learners would both benefit if facilitators were exposed to common adult education theories and supported in integrating theory into teaching practice. Interestingly, cardiologists' stated preference for facilitation by high-profile content experts adds a dimension which was not specifically addressed in other systematic reviews.

This study clearly found that cardiologists value content expertise and solid professional reputation above teaching credentials or formal skills. Theories of social influence come to bear in this part of the discussion. Social influence theory suggests people are more likely to change an

attitude or behavior as a result of interaction with others who are perceived to be similar, desirable, or expert and when the change is endorsed by peers whose opinions they value (Rashotte, 2007). This has interesting implications for eLearning designers whose goal is to support cardiologists in evidence-based practice change.

Cardiologists are highly trained practitioners. As such, careful consideration should be given by designers to select credible facilitators who cardiologists perceive can challenge their content knowledge and impart new and novel information. Designers of webinars for cardiologists are advised to first seek the most credible facilitators. The quality of facilitation could then potentially be enhanced by offering facilitation skills training and other teaching resources.

Characteristics of program content. This study uncovered characteristics of webinar content that are important to cardiologists. The systematic review (Chapter 2) noted the importance to physicians of webinar content being evidence-based, grounded on validated empirical research, and aligned with theory and practice. Perceived high-quality content emerged as a major driver of physician participation in CPD. The W(e)Learn framework prompted the webinar designers to ensure content was authentic, evidence-based, and needs-based (Chapter 3). The pre-webinar needs assessment highlighted the value of evidence-based content in attracting cardiologists to the webinar series. Cardiologists were attracted because the webinars were based on peer-reviewed national guidelines and authentically reflected their day-to-day practice experiences. Feedback surveys revealed a high level of satisfaction with the relevance, transparency and comprehensiveness of the content. The interviews with cardiologists added a third important dimension of content: challenge (Chapter 4). Cardiologists described how they sought novel and potentially controversial content that pushed the limits of their current

knowledge, challenged existing paradigms, and/or introduced emerging research. They enjoyed addressing realistic but complex and/or unclear clinical situations that would stimulate engagement through dialogue and debate.

Systematic reviews have addressed content development in physician web-based CPD. Mazmanian and Davis (2002) discussed how assessment of learning needs, including content, is crucial in development of engaging and effective CPD, regardless of the delivery medium. They specified that physicians need both mechanisms to identify gaps in knowledge and a range of strategic educational resources to support their learning. They did not specifically address eLearning modalities or characteristics of content except to say that content should be needsdriven and strategically designed. Conclusions reached in Wong, Greenhalgh and Pawson's (2010) review of physician web-based CPD found that eLearning is context specific and should be learner driven. Webinar content likely requires customization based on individual learner groups and contexts; what works with one group may not work with another. Cardiologists' clear articulation that they seek "challenging" content was a finding unique to this study.

Pedagogical strategies. In accordance with the W(e)Learn framework, pedagogical strategies are used in learning programs to promote desirable activities such as collaboration, dialogue and critical inquiry (MacDonald, Stodel, Thompson, & Casimiro, 2009). The decision to use a case-based pedagogical approach in this study was guided by the systematic review (Chapter 2) in which the majority of studies found this to be a preference among physicians. The review also suggested that having content organized into manageable modules was desirable. The findings from the needs assessment survey (Chapter 3) corresponded with the results of the systematic review, finding that cardiologists prefer the case study format and multiple short sessions as opposed to fewer, longer (>60 minute) sessions. In response, the webinar series was

developed as four, case-based, 45-60-minute modules delivered bi-weekly over a seven-week period. Webinar content followed a realistic patient experience from detection of early-stage heart failure to the end stages of the disease. Feedback surveys indicated that this format and pacing was satisfactory and conducive to learning. Interviews with cardiologists (Chapter 4) further reinforced that case-based learning was a preferred format.

While 60% of single studies included in the systematic review (Chapter 2) used a case-based approach, the major systematic reviews on eLearning among physicians do not specifically address pedagogical approaches. Mazmanian and Davis (2002) found that, along with interactivity, programs that are offered in modules and sequenced over time may improve the effectiveness of CPD. They encourage physicians to choose learning opportunities that progress incrementally toward individual learning goals. Recent evidence-based educational guidelines released by the American College of Chest Physicians also do not comment on preferred pedagogical approaches. However these guidelines do “suggest the use of multiple exposures (sessions) to CME [CPD] content in preference to single exposure” to improve physician knowledge, skills and performance (Moore et al., 2009, p. 3S).

Expectations of and aptitude with webinar technology. The systematic review (Chapter 2) found that physicians seek rapid and seamless functionality in eLearning programs and can be deterred when they experience problems with technology. Cardiologists in this study had little or no previous experience with eLearning including webinars. They were attracted more by the potential to interact with experts than by the technology used (Chapter 3). Cardiologists reported few problems with technology and found the webinar medium conducive to interaction and learning. Interviews (Chapter 4) found cardiologists were satisfied with the technology as a mechanism for learning and would consider participating in webinars in future. Some

cardiologists suggested that making webinars a more visually stimulating experience (e.g., through the use of more videos, web cams, more live polls, etc.) would make the webinar experience more engaging.

The literature suggests that physicians are more likely to participate in eLearning if it offers advantages over other programs such as ease of access, time savings, and/or interactivity (Wong et al., 2010). Multiple media and multiple exposures are suggested as mechanisms to support learning and improve clinical outcomes (Bordage, Carlin, & Mazmanian, 2009; Moores et al., 2009). This study's multi-unit, interactive intervention aligned with this. A recent single study countered some reviews, reporting that some healthcare providers, including physicians, may prefer web-based content to be presented in as simple a format as possible so it could be reviewed quickly (Puddester, MacDonald, Archibald, Sun, & Stodel, 2010). This finding could be interpreted as content, context or learner-specific. Again, it reinforces the need for designers to conduct learner needs assessment to gain a solid understanding of learner preferences.

Learning Communities. This study did not seek to foster an enduring learning community. Nonetheless, the case study did lead to some interesting observations about learning communities. Numerous instances were observed where some participants registered en masse and participated in the webinars together from a single site. Offering access to valuable information and experts, the webinar series may have served as a helpful resource to existing communities of learners.

In future webinar implementation, if fostering formation of communities of practice was a goal, dedicated strategies could be implemented to achieve this output; the case study suggests this doesn't necessarily happen spontaneously. The recognition that webinars can be good

resources for existing groups of practitioners suggests there may be creative opportunities to attract and support these groups as part of their ongoing, team-focused professional development.

The Use of an Instructional Design Framework

The third overarching research questions asked: “How can a design framework support the design and delivery of a webinar series for cardiologists?” Program design that is grounded in theory has been linked to eLearning program success (Hung & Der-Thanq, 2001; Morrison & Guenther, 2000). In accordance, models and frameworks have been proposed to guide program design and ensure high quality standards (Cook, Gelula, Dupras, & Schwartz, 2007; Inan & Lowther, 2007; MacDonald et al., 2009). Aligning with this dissertation’s grounding in constructivism and focus on webinars and physician learning experiences, the W(e)Learn instructional design framework was used as a methodological component in the systematic review, the case study and the interviews.

The systematic review found that overall, physicians’ eLearning design preferences were comprehensively captured within the W(e)Learn framework’s domains (i.e., structure, content, media and service). The study suggested that a small refinement could be made to the framework to explicitly prompt developers to consider Time from the point of view of physician learning needs. It should, however, be noted that W(e)Learn currently encourages designers to consider Time from a number of perspectives. These include 1) the need to consider learners’ time zones, 2) the need to understand the amount of time learners have available, 3) the decision whether to offer programs in real-time, 4) the time investment required to develop eLearning programs and implement just-in-time program improvements, and 5) the ability to provide timely feedback (MacDonald et al., 2009). Time was a particularly important element to consider from cardiologists’ perspectives. Seeking to comment on and potentially strengthen the framework, it

is suggested that Time could be added as an explicit structural element to encourage a deep understanding of cardiologists needs with respect to Time, which could more fully inform the webinar design process.

The case study found the design framework to be an important process guide for webinar implementation. W(e)Learn was adaptable to the webinar context, prompting data gathering to inform decisions about webinar structure, content, media, and service. The elements within each domain were found to be comprehensive and relevant, helping to ensure that the variables which could affect the success of the program were identified, discussed and addressed. This was particularly helpful to a team of newcomers to webinar implementation. Feedback from participants suggested that webinars were a satisfying learning experience; this result may be due, in large part, to the use of the framework.

In summary, and in alignment with the findings of other studies (Inan & Lowther, 2007; MacDonald et al., 2009), this dissertation found the use of a design framework to be beneficial to webinar implementation. As a caveat, I note that the framework did not provide an explicit prompt to collect detailed input from participants about scheduling of webinars. More learner-driven scheduling may have resulted in different attendance rates. This dissertation recommends adding Time as an explicit structural element in W(e)Learn.

The interviews with cardiologists similarly suggested webinars were a satisfying learning experience which may have been supported through the use of an instructional design framework. While the interviews did not seek cardiologists' views about design frameworks, they uncovered numerous, specific preferences with respect to webinar design, which the framework prompted the design team to address. Cardiologists referred to important design preferences related to webinar structures (e.g., interactivity and credible facilitators), content (e.g., evidence-based,

authentic and challenging content), and media (e.g., use of multiple media may enhance engagement). Cardiologists also provided specific examples of how the webinars supported them in achieving desirable outcomes including satisfaction and changes in knowledge and practice. Again, these results may be, in part, attributable to the use of the framework in strengthening the webinar implementation process.

In summary, the use of an instructional design framework appeared to support webinar implementation and may have contributed to achieving desired outcomes. The particular framework used, W(e)Learn, provided a helpful framework for probing and understanding the outcomes of the webinar series and for suggesting future avenues for more rigorous research.

Implications

This dissertation highlights a number of implications for webinar implementation for cardiologists. These are discussed below as they relate to webinar design, CPD design, and supporting behavior change among cardiologists.

Implications for Webinar Design for Cardiologists

Webinars can be an appealing, satisfying CPD medium for cardiologists. Careful attention to cardiologists' learning needs and webinar design preferences may support achievement of desired learning outcomes. Understanding needs and addressing preferences can be facilitated through the use of educational design frameworks such as W(e)Learn.

This research identified preferences of cardiologists to consider in webinar design. These include preferences for interactivity, well-known and credible facilitators, authentic and challenging content, real-time interaction, case-based design, and dynamic use of technology. If webinars embody these preferences, they may be more likely to attract cardiologists to participate, to sustain learner engagement, and support learning outcomes.

The combined results from the studies also provide insight into the comprehensiveness and usefulness of W(e)Learn as an instructional design framework for webinars. This dissertation concludes that W(e)Learn can serve as a useful roadmap, prompting designers to consider key elements of program structure (including program timing), content, service and media. Through addressing key elements included in the framework, webinars may support cardiologists in achieving desirable outcomes including knowledge gains and attitude and behavior change.

Implications for Designers of CPD for Physicians

In alignment with the literature from the broader field of physician CPD, this dissertation affirmed that understanding learner needs and context is important in webinar design. When participating cardiologists found webinar content to be relevant and authentic to their practice, they prioritized attendance. As a result of their webinar learning experience, some participating cardiologists suggested that they gained knowledge and intended to implement changes to practice.

Needs assessment as a precursor to learning and behavior change has been widely addressed in the literature. Mazmanian and Davis (2002) emphasized “assessment of learning needs is crucial for effective continuing medical education [CPD]” (p. 1057). Lavis, Robertson, Woodside, McLeod, and Abelson (2003) said “the research literature makes it clear that a message’s target audience must be clearly identified and the specifics of a knowledge-transfer strategy must be fine-tuned to the types of decisions they face and the types of environments in which they live or work” (Lavis et al., p. 224). This study supports these statements.

The literature and this study suggest that “one size fits all” approaches to educational design may not be optimal for achieving desired learning outcomes. Highlighting that different medical specialties may be predisposed to distinct learning style preferences, Curry (1991) found

significant differences between learning style preferences of practicing surgeons, pediatricians and family practitioners, and further differences between those who chose community-based practice versus academic practice. Similarly, this dissertation identified eLearning preferences unique to cardiologists.

Building on Curry’s work and the broader educational design canon, this dissertation lends weight to the educational principle that educators should strive to understand learner needs and accommodate preferences through careful CPD design including authentic, relevant content. In essence, an imperative for designing eLearning for physicians, including webinars for cardiologists, is to understand the target audience’s learning gaps, motivation for learning, learning goals, learning style preferences and clinical context. Through this understanding, CPD opportunities can be customized to be relevant, authentic, and appealing.

Implications for Supporting Practice Change

CPD is heavily relied upon to inform and influence evidence-based practice among physicians (Bloom, 2005; Institute of Medicine, 2010; Jarvis-Selinger, Gullion, Lauscher, & Ho, 2007; Kilian, Binder, & Marsden, 2007; Lang, Wyer, & Haynes, 2007). While a measurable increase in knowledge is sometimes a CPD outcome, the insignificant impact on practice change remains a strong criticism (Fordis, King, & Ballantyne, 2005). Bloom noted that the least effective means for changing physician practice, i.e., didactic lectures and dissemination of printed material, were also the most widely used. Bolderston (2007) likened attendance at lectures to “stamp collecting” where academic credits are acquired but little authentic learning occurs.

In contrast, likelihood of successful integration of knowledge into practice has been found with more interactive CPD approaches, or combinations of approaches, such as tailored interactive workshops, case-based discussions, input from key opinion leaders, reminders and

outreach programs, and modular programs spread over time (Davis et al., 1999; Forsetlund et al., 2009; Lavis et al., 2003; Satterlee, Eggers, & Grimes, 2008). Grol and Grimshaw (2003) emphasized that no particular CPD approach works best under all circumstances, necessitating creative combinations of approaches tailored to address a range of contexts.

It appears there is no single approach to CPD that guarantees behavior change. Ultimately, a variety of educational approaches are needed to suit different individuals and groups, different learning preferences and contexts, and diverse content. This study suggests that while webinars may not appeal to all cardiologists, and all cardiologists who participate in webinars may not change behavior, carefully-crafted webinars can be a satisfying medium and may support cardiologists in learning and changing behavior. The concrete implication is that thoughtfully designed webinars may influence behavior and are a useful tool for educators to add to their toolbox. Webinars may not be acceptable to all learners, but for those to whom the webinar medium is appealing, webinars may support behavior change.

Implications for Future Research

Implications for future research stemming from this study relate to the following: 1) when to use webinars, 2) potential differences in preferences between cardiologists of different ages and/or sex, and 3) essential skills that enhance webinar facilitation.

Systematic reviews have found that eLearning – both synchronous and asynchronous – is neither superior nor inferior to face-to-face instruction; rather, they are different and can be complementary (Cook et al., 2010; Wutoh et al., 2004). Single and/or multi-media programs and those using multiple educational techniques can be effective in changing physician practice (Davis & Davis, 2009). A remaining research gap involves understanding how and when to effectively use eLearning (Cook et al., 2010). The present study contributes to our understanding

of how webinars can be designed and used to support cardiologists in their professional learning. Further research opportunities exist to determine when webinars could be most strategically used among cardiologists and whether findings are transferable to other groups of medical specialists and/or allied health professionals.

Newly graduating cardiologists may use technology in different ways than their more senior colleagues. The majority of cardiologists participating in this study were males between the ages of 41-50 years. As younger generations and more females enter the medical profession, it will be important to understand their needs related to eLearning format and methodology. Achieving this understanding will require research to guide appropriate use of different technologies with individuals of different ages, and with different expectations and aptitudes.

This study found a strong preference among cardiologists for facilitators who were credible content experts as opposed to individuals specifically trained as educators. As discussed by Lowe et al. (2009), while some content experts who are willing to facilitate CPD programs may be, by nature, natural educators, others might benefit from theory-informed skills training. Further research may enhance our understanding of best practices in eLearning facilitation so that this knowledge can be applied. Sargeant, Curran, Allen, Jarvis-Selinger, & Ho (2006) studied how facilitators can enhance interactivity in eLearning and how learning theory can inform facilitation practices. Similar to Lowe et al. (2009), they suggested facilitation could be strengthened through theory-based training in facilitation techniques. Where the above-cited research leaves off, other avenues for study exist. For example, approaches to providing feedback or strategies for synchronous versus asynchronous discussion facilitation present additional opportunities for research.

Contribution to CPD Research

This dissertation makes a number of contributions to the field of education and specifically to the field of physician CPD. To start, cardiologists who were attracted to participate in the heart failure webinar series indicated through surveys and interviews that they found webinars can deliver a satisfying learning experience which may influence changes in knowledge and practice. Webinars are a useful, low-cost, wide-reaching, real-time, interactive addition to the educational designer's toolbox. Webinars may not appeal to all cardiologists, but in this time where healthcare education resources may be limited, webinars offer a viable and effective CPD medium for cardiologists who seek an interactive learning experience that requires no travel and little cost.

This study contributes to our understanding of how to design webinars for cardiologists. Webinars for cardiologists should be interactive and expert-led. Content should be evidence-based, authentic and challenging. Technology should be used in novel ways to keep programs visually appealing and stimulating. Educational design frameworks can assist designers in comprehensively addressing the range of design elements that lead to strong programs. Findings may be transferable to webinar design for other physician groups and/or allied health professionals, though further research is required. Educational designers should seek to understand their target audience's specific needs with respect to webinar structures, content, media and service to offer high-quality webinar-based learning experiences.

Cardiologists are a subset of highly trained medical specialists. Few studies have examined differences in learning styles and preferences between medical specialist types. Those who have studied these differences found unique preferences and aptitudes among medical specialist groups (Curry, 1991). This dissertation identified learning preferences that may be

unique to cardiologists. Applying this new knowledge to webinar design for cardiologists may lead to CPD programs that are acceptable, satisfying and effective.

Finally, CPD resources such as time and money can be in short supply. Scarcity may create pressures to develop “one size fits all” programs to achieve efficiencies such as cost-effectiveness. This study cautions that, despite pressures to stretch CPD resources and deliver multipurpose or more general CPD programs, a certain amount of customization is necessary to address learners’ unique preferences and contexts. Programs that are too broad or general may have sound and important content, but effort is wasted if learners are not attracted to programs, engaged throughout, or more knowledgeable as a result. Educators must take care to ensure that efficiency does not undermine desirable outcomes such as satisfaction and /or changes in knowledge or practice that can be supported through program customization.

Limitations

This dissertation is subject to several limitations. These are discussed below in relation to biases inherent in the research design and those introduced by the researcher.

Research Design Biases

Individual studies included in the systematic review represented many contexts and researcher biases. Providing the quality scores for individual studies was intended to justify the inclusion of each study in the review based on research merits and relevance. Systematic methods were followed and described to achieve a trustworthy and transparent research process. Peer review was supported through the involvement of other researchers whose dual perspectives helped balance the selection of eligible studies (Malterud, 2001). Coding was guided by a published theoretical framework making this process repeatable and clear. One researcher performed the initial coding. A neutral, experienced researcher conducted an external audit to

assess the accuracy of the coding and to verify whether the findings and interpretations were supported by the data (Cohen & Crabtree, 2008).

Participation in the case study and the interviews was limited to a convenience sample of those who voluntarily registered for the webinar series at the time it was offered. There is no assurance that the participants' stated preferences or previous eLearning experiences are representative of the CCS cardiologist membership at large. Therefore, study findings are not transferable to other groups of cardiologists or other groups of learners. There is, however, no reason to expect that these results are not authentic and trustworthy; it is conceivable that findings could resonate with other cardiologists. To facilitate future replication of this study and transferability of the findings, detailed descriptions of the setting, the key implementation activities, and study participants were provided (Maxwell & Miller, 2008).

This dissertation relied on small convenience samples. The primary researcher's coding and analysis was checked by an independent researcher to confirm consistency, reproducibility and saturation and to demonstrate the samples were sufficient for the study's purposes (Merriam, 2001). In addition, data summary tables generated through the use of Atlas.ti illustrated that saturation had been achieved.

Non-response bias among study participants in the case study threatened the comprehensiveness of the feedback received about the webinar experience. Providing feedback was voluntary and anonymous, and while response rates were consistent across all webinars, the extent to which feedback was representative of a broader cardiologist population cannot be confirmed. Experiences of non-respondents may have differed from those who provided feedback. It would have been informative to receive feedback from cardiologists who registered for the webinar series but did not attend any/all webinars, to gain an understanding of their

reasons for not attending. However none who consented to participate in the study but did not attend webinars agreed to be interviewed.

Interviews to capture retrospective accounts of the webinar experience relied on information voluntarily provided by numerous individuals and are subject to the problems inherent to memory (Fraenkel & Wallen, 2006). To counterbalance recall bias, the most appropriate participant sample of individuals who best represented the research topic was sought. The same interview guide was used with all participants, ensuring sufficient data to account for all aspects of the experience were obtained and saturation was achieved (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

Researcher Bias

Research can be biased by researcher preconceptions and motivations (Cohen & Crabtree, 2008; Malterud, 2001). The systematic review was subject to reviewer bias. The primary researcher was, in essence, the instrument of analysis and interpretation of the qualitative work of others. To moderate reviewer bias, independent primary and secondary reviewers participated in the identification and selection of included studies. Reviewer bias in the selection of primary studies was further mitigated by a priori statements of study eligibility criteria (Wolf, 2000).

As the researcher and the interviewer, I may have introduced a self-fulfilling prophecy bias by anticipating certain responses based on familiarity with the literature (Yin, 2009). I attempted to moderate this effect by inviting interview participants to review transcripts and by having my coding checked by independent researchers. In addition, I made a deliberate attempt to maintain researcher self-awareness by keeping researcher notes documenting key decisions and questions and by performing constant comparative analysis during the interviews and coding of transcripts.

I made additional efforts to manage the bias introduced by my dual roles by acknowledging my role and presence (Baez, 2002) and striving to make it clear to learners that study participation was a free choice. My position facilitated a deep understanding of the webinar implementation process which strengthened the accuracy of the interpretation of the data. My position also made it possible to introduce biased information stemming from my relationships with the Implementation Team members and some participating cardiologists. In accordance with an intersubjective epistemology, the data collected was thus a reflection of both the learners' perspective and my own. Committed to making the webinar experience as satisfying as possible for participants, I actively invited them to candidly share their experiences. In documenting my perceptions about the webinar experience, I sought to be transparent about my researcher and professional agendas (Wolcott, 1994) and enable readers to make inferences about the data and the authenticity of my account of the webinar experience.

Strengths

Within the qualitative research paradigm, trustworthiness is an expression of the credibility, dependability and confirmability of research (Lincoln & Guba, 2000; Shenton, 2004). In the present study, credibility, the congruence of the findings with reality, was strengthened through prolonged engagement in the study and with participants and through review of coding and analysis by independent researchers (Lincoln & Guba, 2000). Triangulation of multiple data sources and multiple methodologies (e.g., peer-reviewed literature, email records, webinar recordings, surveys, interviews, and multiple investigators) was used to form a complete and accurate account of the study findings (Yin, 2009).

The dependability of the study, the degree to which the study would be repeatable (Shenton, 2004), was supported by simple, transparent and reproducible methods which were

described in detail. For example, the systematic review methodology is described in detail and is fully replicable. The review protocol followed best practices, including 1) a statement of objectives, 2) a clear outline of inclusion/exclusion criteria for studies, 3) an exhaustive search for studies which met eligibility criteria, 4) tabulation of characteristics and quality assessment of each included study, and 4) involvement of multiple investigators at different stages of the review process (Jensen & Allen, 1996; Wolf, 2000). Rich descriptions of the webinar design and delivery process, and the interviews with cardiologists similarly enable repeating of the study and support dependability; detailed descriptions of study participants and the study setting were provided; interviews were recorded, transcribed verbatim and reviewed by subjects; and comprehensive quotes from participants were provided to support the interpretation of findings.

“The concept of confirmability is the qualitative investigator’s comparable concern to objectivity” (Shenton, 2004, p. 72). Confirmability reassures readers that results reflect the experiences of the study participants as opposed to the researcher’s preferences or biases. The detailed description of methods and supporting materials, including raw data, was included to provide observers with a clear audit trail. Triangulation of methods, data sources and investigators also supported confirmability by reducing the effect of bias introduced by a single investigator, data source, or method.

Personal Reflection

Through the doctoral research experience, I have grown as an educator and a researcher. The PhD journey has stimulated me to analyze my personal assumptions about learning and how my beliefs influence the programs with which I am involved. I value constructivist, socioconstructivist, and experiential approaches to learning, and I strive to develop learning programs that reflect this pedagogical stance. My views on learning and my desire to respect

learner preferences at times pose tension: I wish to adhere to learner-centered, self-directed pedagogy with particular focus on teamwork and collective meaning-making, yet I wonder whether I am imposing my own epistemological beliefs when I select a particular pedagogical approach. My present stance acknowledges that, ideally, the diversity of learner needs and preferences must be understood and should be supported by flexible educational design. The challenge is to deliver on this with finite resources. Fortunately, ICT appears to offer adaptable, acceptable media that can accommodate a range of learner preferences and support efficient use of resources.

As a researcher, I learned a great deal through the doctoral experience. The importance of rigorous methods, transparent relationships, as well as honest and clear, thorough yet succinct reporting became very clear to me. With respect to methods, I learned the value of careful planning, consulting broadly with experienced researchers, and pilot testing. In future research, I will continue to focus on these processes to uphold and demonstrate rigour and support trustworthiness. Throughout the study, I also questioned the extent to which my multiple roles enhanced access to people and resources and may have influenced implementation, team functioning, and findings. In future research, I may again have multiple roles. In these instances, I will continue to consider the ways my roles affect the research process and identify meaningful ways to mitigate these effects, including through disclosure and transparency from planning stages to reporting.

I began this journey with the view that a PhD is a solo challenge where external support was an optional benefit. Through the process I learned that research is a highly collaborative undertaking. Methods, outputs, and outcomes can be greatly enhanced by tapping into the experience and knowledge of others, and through accessing key resources. Research is a science

and an art, and through these past years I have learned experientially the importance of these complementary dimensions.

Conclusion

This dissertation explored the eLearning experiences of cardiologists who participated in a webinar-based CPD program designed in accordance with an instructional design framework. Cardiologists voluntarily participated in the study in which they shared observations and experiences. Findings provided a rich resource to learn about how webinars can be developed and delivered to achieve a satisfying learning experience among highly-specialized physician learners.

This study found that webinars can offer appealing and satisfying learning experiences to cardiologists. Further, this study suggests webinars may contribute to desirable learning outcomes including increased content knowledge and practice changes. Participating cardiologists suggested they would be attracted to webinars if their unique eLearning preferences related to webinar structure, scheduling, content, and use of media were reflected in webinar design and delivery.

This study also found that instructional design frameworks may enrich and structure the design process; this dissertation encourages their use. Further research is needed to test whether webinars can be effective in supporting changes in content-related knowledge and/or actual practice change among cardiologists and other physician groups.

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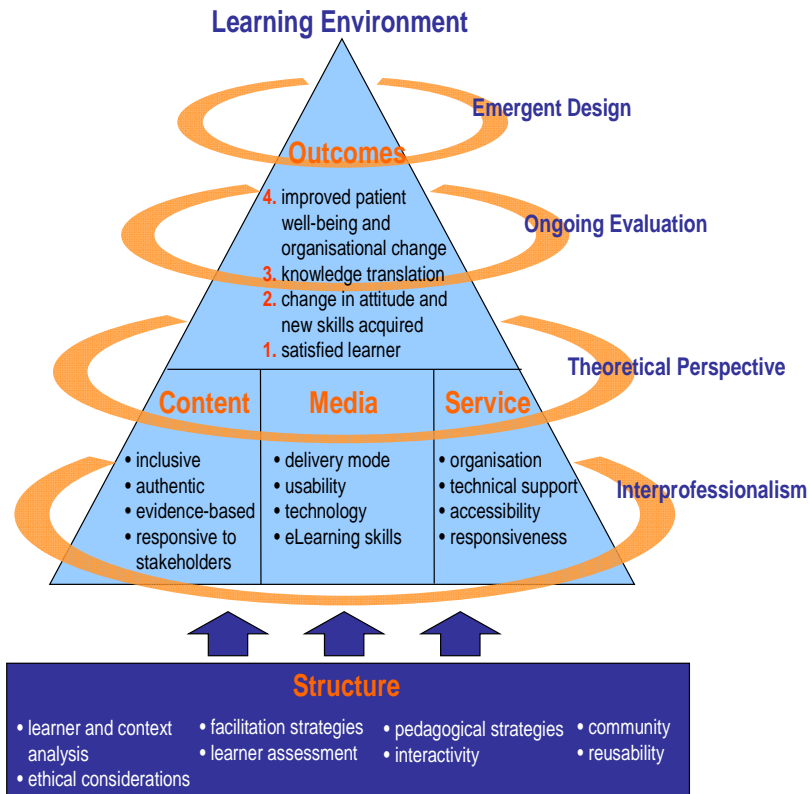
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Appendix A: ELearning Frameworks and Guidelines

Author(s)	Description
Cooper (2002)	Based on the practices of online business computer application courses, the author provides a framework of instructional strategies and management techniques for online courses. Starting from planning the online course, the author primarily portrays application of strategies and techniques for the initial classroom meeting; creating and managing interactions, providing various course materials, and student testing.
Johnson & Aragon (2002)	Discusses a conceptual framework to guide development of online courses through the synthesis of multiple theoretical perspectives. The authors provide seven pedagogical factors that the designer should consider: individual differences, motivation, cognitive overload, authentic context, social interaction, student engagement and practice, and student reflection.
MacDonald, Stodel, Farres, Breithaupt, & Gabriel (2001)	Describes the Demand-Driven Learning Mode (DDL M) for web-based learning. The DDL M provides a quality standard for web-based and is founded on customer demands for quality content, delivery, and service, designed to lead to the desired learner outcomes.
MacDonald, Stodel, Thompson & Casimiro (2009)	Introduces the W(e)Learn Framework for designing online interprofessional education for patient-centred practice within healthcare. The framework consists of five components: structure, content, media, service, and outcomes.
Zheng & Smaldino (2003)	Presents essential components of designing instruction for online learning environments. Based on pertinent instructional design frameworks, the authors identify critical elements of online learning (learner analysis, content organization, instructional strategies, and evaluation) and provide suggestions to improve the quality of online instruction.

Appendix B: The W(e)Learn Framework



(MacDonald et al., 2009)

W(e)Learn supports collaborative online and blended learning. The “(e)” in brackets suggests that web technologies can potentially bridge approaches that integrate a strong focus on both collaboration and effective learning experiences. It acknowledges that different blends of factors (delivery modes, theories, pedagogical approaches, media, environments, communication strategies, etc.) are necessary to meet the needs of various learners. Designed to be applicable regardless of the blend of these factors, *W(e)Learn*’s deliberate versatility makes it useful for developing learning programs of all types – online or face to face.

W(e)Learn was developed according to the principle that carefully designed educational programs with the appropriate blend of factors can help achieve desired outcomes and act as a mechanism for managing complex social systems (McDonald & Kay, 2006).

Theoretical Foundation

Underlying Theory	
<i>Interprofessionalism</i>	Continual learning through communication, negotiation, and consensus between team members allows team members/stakeholders to set common goals and implement intervention strategies.
<i>Social Constructivist Theory</i>	Learning is a process of meaning making, not knowledge transmission; a dialogue rather than passive; and a process embedded in social situations, not the head of an individual.
Structure	
<i>Learner and Context Analysis</i>	Designers assess learners' needs re: content, media, and service; learning styles and preferences; background experience; current knowledge; learning goals; and support. Individual factors such as program flexibility, accessibility, feasibility, and convenience are considered.
<i>Ethical Considerations</i>	Consideration is given to content-related ethical issues such as a need to protect confidentiality, security (e.g., password protected environments), and/or privacy.
<i>Facilitation Strategies</i>	A facilitator guides the learning to meet individual and collective goals. Facilitator's role varies based on the eLearning tools being used and the instructional design. Facilitator considerations include acknowledgement of perspectives, managing power relationships among participants, and ensuring that all voices are heard.
<i>Learner Assessment</i>	Assessment is integrated into the pedagogical strategies and aligns with overall learning design. Participants might choose assessment options that will be helpful and relevant to the learning experience and professional goals.
<i>Pedagogical Strategies</i>	Pedagogical strategies maximize collaboration, dialogue, and critical inquiry to support a learning community.
<i>Interactivity</i>	Online interaction can occur among users (e.g., learners, facilitators, support personnel) and between learners and the content. Interactions

	allow multiple perspectives to emerge, promote learner engagement, and cultivate higher-level thinking.
<i>Community</i>	The online community represents more than mere exchange of information. By clarifying and altering beliefs, participants make sense with and for others and for themselves.
<i>Reusability</i>	The learning resource has potential for reusability, generativity, adaptability, and scalability.
Content	
<i>Inclusive</i>	Information is presented objectively through unbiased language. Content matches learners' level of understanding and aligned with learners' professional interests and work-related requirements.
<i>Authentic</i>	Content reflects problems relevant to the workplace.
<i>Evidence-Based</i>	Content is grounded in accessible and validated empirical research that aligns with the theories, practices, and skills being presented.
<i>Responsive to Stakeholders</i>	Content reflects needs of learners, healthcare environments, and patients/families.
Media	
<i>Delivery Mode</i>	Appropriate mix of communication channels and activities required to achieve desired learning outcomes is used.
<i>Usability</i>	Learning environment is easy to navigate and provides multiple access options.
<i>eLearning Skills</i>	Learners' ability to work/interact online is assessed; activities are planned to help learners develop their technology-related skills.
<i>Technology</i>	Decisions on hardware, software, communication tools, and media are made in consideration of context, learning objectives, and practicality.
Service	
<i>Organization</i>	Organizations support learning and recognize learners' achievements and learning efforts.
<i>Technical Support</i>	Learners and facilitators have technical support provided by competent and committed technical support persons.

<i>Accessibility</i>	There is convenient access to the learning resource, support persons, facilitators, and related resources.
<i>Responsiveness</i>	Facilitators and technical support persons respond to questions and requests in a timely fashion.
Outcomes	
Level 1	Learners have a positive reaction to the learning experience: <ul style="list-style-type: none"> • enjoy the learning experience • meet accreditation and licensure requirements • receive continuing education credits • experience a sense of personal achievement and satisfaction • meet work-related expectations
Level 2	Learners modify their attitudes and develop new knowledge and skills.
Level 3	There is a change in learners' behaviour.
Level 4	There is organizational change in how care is delivered. Patients benefit and their well-being improves.
Ongoing Evaluation	
Formative and summative evaluation procedures using qualitative and/or quantitative methods are used to evaluate learning experiences. Understanding and improving pedagogical solutions is an ongoing and continuous process.	
Emergent Design	
Design is ongoing throughout the program delivery and responsive to emerging learning needs. Best practices include: collecting/acting on feedback; using modular course design to allow for quick modifications; ability to make just-in-time changes; and inviting facilitators to also contribute to design process.	

Appendix C: Demographic and Educational Needs Survey

Please complete the following questions. All responses will be kept confidential.

Part A: Demographic Survey

1. Name:
2. Email address:
3. Phone number: ()
4. Address: _____

5. Gender:
 - Female
 - Male

6. Age:
 - < 30
 - 31-40
 - 41-50
 - 51-60
 - 61-70
 - > 70

7. Practice type (check all that apply):
 - Urban
 - Rural
 - Academic
 - Community
 - Solo
 - Small to medium (1-1000 patients)
 - Medium to large (1000+ patients)

8. Province where you practice:
 - British Columbia
 - Alberta
 - Saskatchewan
 - Manitoba
 - Ontario
 - Quebec
 - New Brunswick
 - Nova Scotia
 - Prince Edward Island
 - Newfoundland/Labrador
 - Yukon Territory

- Northwest Territories
- Nunavut

9. Medical specialty area:

- General cardiologist
- Specialty cardiologist
- Specialty - other
- Internist with cardiology experience/interest
- Electrophysiologist
- Cardiovascular surgeon
- General/family practitioner with cardiology experience/interest
- Other: _____

10. How many years have you been practicing medicine?

- <5
- 6-10
- 11-20
- 21-30
- >30

Part B: Educational Needs Survey

1. In my practice, my greatest challenges in treating patients with heart failure is/are:

2. The topics related to the treatment of heart failure that are of specific interest to me include the following: *Check all that apply*

- Prevention and management during intercurrent illness
- Acute decompensated heart failure
- Myocarditis
- Cardiomyopathies
- Use of biomarkers
- Best practices in the transition of care
- End of life issues
- Device therapy
- Implications of recent clinical trials in heart failure and
- Other: _____

3. The CCS Heart Failure Guidelines provide me with: *Check one*

- Primary document for the management of a disease

- Specific decision aid in patient management
- Secondary document that allow me ready access to the key primary documents
- I don't currently refer to the CCS Heart Failure Guidelines
- Other: _____

4. What prompted you to register for this program? *Check all that apply*

- The topic looked interesting
- I needed the CPD credit
- I had a current case related to the topic
- I felt like I needed to learn more about treating patients with heart failure
- I was seeking a chance to speak with a leading expert on the topic
- The web conference format is convenient for me
- Other: _____

5. Please rank your preference of formats for educational activities.

(1 = most preferred, 5 = least preferred):

- Live**, face to face, **didactic** programs (e.g., lectures or symposia presentations)
- Live**, face to face, **interactive** programs (e.g., small groups, workshops)
- Live**, but remote (**distance**), **interactive** programs (e.g., teleconferences/ videoconferences/ web conference)
- Pre-recorded, self-directed**, programs available **via CD, internet**
- Print** material such as journal articles or supplements

6. Please rank your preferred program design. (1 = most, 5 = least preferred)

- Single, comprehensive lecture
- Multiple short lectures assembled into a lecture series
- Panel discussion/debate between clinical experts
- Case study followed by a discussion
- Other: _____

7. Please indicate the importance to you of an opportunity for discussion/questions & answers between participants and speakers being built into a learning experience:

- Not important to me
- Somewhat important to me but not essential
- Important to me
- Very important to me; essential to my learning

8. Please rank your preferred sources for emerging clinical information and best practices

(1 = most preferred, 6= least preferred):

- The recognized national/international key opinion leaders

- Your local experts on the topic
- Your immediate colleagues
- Print material (journals, supplements)
- The internet and online resources
- Other: _____

9. Have you participated in a webinar in the past?

- Yes
- No

10. How long are you willing to spend online in one sitting participating in an educational activity?

- < 15 minutes
- 15 – 30 minutes
- 30 minutes to 1 hour
- As long as the activity requires

11. Please describe two or three of the common weaknesses you have found with computer-based educational programs.

12. Please rank the items most likely to influence a change in your practice(1= most likely, 5= least likely):

- Things I read
- Things I see/hear for myself
- Things I discuss with a colleague(s)
- Things I hear from a key opinion leader(s)
- Other: _____

13. What are some of the challenges you face when trying to make evidence-based changes to your clinical practice?

Appendix D: Heart Failure Webinar Feedback Form

1. Please rate the following aspects of the workshop:

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The workshop addressed the stated objectives					
The workshop met my expectations					
The workshop met my learning needs					
The workshop format was conducive to learning					
I can apply what I learned to my practice					
The timing of the workshop was convenient for me					
The format made interaction with faculty possible					
The workshop was credible and non-biased					
There was adequate time for presentations					
There was adequate time for interactions					
Adequate support resources were provided					
I had the technical support I needed					
The Chair had the expected level of knowledge					
The Chair was an effective facilitator					
My questions were addressed in a timely manner					

2. Please rate the following according to changes in your Pre- and Post-workshop knowledge:

Pre-workshop knowledge Low.....High	Topics	Post- workshop knowledge Low.....High
1 2 3 4	Workshop Topic 1	1 2 3 4
1 2 3 4	Workshop Topic 2	1 2 3 4
1 2 3 4	Workshop Topic 3	1 2 3 4
1 2 3 4	<u>Awareness</u> of the CCS Heart Failure Guidelines	1 2 3 4
1 2 3 4	<u>Knowledge</u> related to the CCS Heart Failure Guidelines	1 2 3 4

3. Please rate the following aspects of the workshop

	Poor	Satisfactory	Very Good	Excellent
Please rate the overall workshop				
Please rate the webinar format				
Please rate the audiovisual presentations				

How will this module change *or* confirm your current practice in the evidence-based treatment of heart failure? **Choose all responses that apply.** Please provide specific examples under each applicable section.

<input type="checkbox"/> Yes, I will... <i>specify change(s) below:</i> <p style="text-align: right;">»»»»</p>	<i>Are there any barriers or problems that you anticipate? __ NO __ YES Please describe.</i>
<input type="checkbox"/> I am considering changing... (<i>specify below</i>): <p style="text-align: right;">»»»»</p>	<i>What would enable you to change your approach?</i>
<input type="checkbox"/> No, this has confirmed my current practice. (no changes needed) <p style="text-align: right;">»»»»</p>	<i>Please comment:</i>
<input type="checkbox"/> No, I am not yet convinced of the need to change. <p style="text-align: right;">»»»»</p>	<i>Please comment:</i>

THANK YOU

Appendix E: Letter of Informed Consent to the Participants

Researcher: Name, Faculty of Education, University of Ottawa
Contact Information:

The purpose of this research study, which is part of the requirements for my PhD, is to explore learning experiences and practice change among cardiologists participating in a Canadian Cardiovascular Society (CCS) webinar series on the topic of the CCS Heart Failure Guidelines. In my professional role, I develop educational programs for the CCS. Through this study, I hope to learn about CCS members' experiences in webinar-based professional development programs and apply this insight to improving CCS programs, with the aim of better supporting evidence-based practice change.

The workshop series consists of four 1-hour webinars that will take place over eight (8) weeks. Each webinar will be facilitated by authors of the CCS Heart Failure Guidelines Primary Panel, the key opinion leaders in evidence-based heart failure care and treatment in Canada. Each webinar will feature cases based on the 2009 CCS Heart Failure Guidelines Update. Webinar activities will include pre- and post-program knowledge assessments, case presentations, group discussions, and the opportunity to submit questions online during and between each webinar. Through this exercise, participant experiences will be explored to develop an understanding of the webinar learning experience and how it might support practice change.

If you agree to participate in this study your involvement will consist of completing a pre-workshop survey, attending and taking part in the webinar series, completing brief post-workshop surveys, and possibly participating in two 15- minute interviews. The surveys will be completed online prior to and following the webinar modules. The interview will be conducted via telephone and scheduled at two set points: 1) within two weeks of completing the program, and 2) three months after the end of the program. Interviews will be recorded and transcribed verbatim. In the interview we will explore your experiences in the webinar and the relationship between this learning experience and changes you might make in your practice treating patients with heart failure.

Your identity will be kept anonymous in all records of transcripts and interviews. Your name will not appear in the research or any publications or presentations resulting from the research. To ensure confidentiality all data will be stored in a secure manner and will be accessible only to me and my thesis supervisor. It will be kept in this manner for five years after the completion of this study and then destroyed.

Note that the CCS is required by the Royal College of Physicians and Surgeons of Canada to evaluate all accredited CPD programs. All evaluation is voluntary and anonymous, and any data from evaluation forms may be used in the study.

Without penalty, you may withdraw from this project at any time, refuse to participate, and choose not to answer questions. At the same time, however, your involvement in this study will enable you to reflect on your own learning and contribute to enhancing the continuing professional development programs offered by the Canadian Cardiovascular Society.

The University of Ottawa Research Ethics Board has approved this research. Any information requests or complaints about the ethical conduct of the project may be addressed to the Protocol Officer for Ethics in Research at the University of Ottawa or my thesis supervisor in the Faculty of Education at the University of Ottawa.

If you have any questions about this research now or at any time throughout the study, please email me. To indicate your decision to participate in this study, please sign this letter and send it to me via email or via regular mail using the pre-stamped envelope provided. You may also want to keep a copy of this letter for your records.

Your time and cooperation is greatly appreciated.
Sincerely,

Candidate Name
Faculty:
University of Ottawa

Thesis Advisor Name
Thesis Advisor
University of Ottawa

I, _____, agree to collaborate in the research
(participant name)

project and certify that I understand the nature of the research as described above.

Signature of Participant

Date

Signature of Researcher

Date

I wish to receive a summary of the findings of this research, which will be sent to me by the researcher. Yes No

If yes, please provide an email address: _____

Appendix F: Letter to the Canadian Cardiovascular Society Administration

CEO
Canadian Cardiovascular Society
1403-222 Queen Street
Ottawa, ON K1P 5V9

Dear Ms. X,

I am a PhD candidate at the University of Ottawa conducting research in the area of computer-mediated learning and knowledge translation. My thesis project will involve developing and evaluating a Canadian Cardiovascular Society webinar series on the topic of heart failure. The webinars are designed to promote knowledge translation in the form of heart failure practice change among participants. The use of a webinar platform as a vehicle of continuing professional development and knowledge translation will be examined, and insights into computer-mediated learning, knowledge translation and program design for continuing professional development will be developed. The content of the four webinars in the series will be hypothetical clinical cases based on frequently-occurring complications in the treatment of heart failure patients. All cases will be fictional. The evidence-based guidelines and treatment recommendations that will be presented will be based on the 2009 CCS Heart Failure Guidelines.

I am writing to request your permission for access to this CCS continuing professional development program. I have spoken with Dr. Jonathan Howlett, Chair of the CCS Heart Failure Guidelines Primary Panel, about conducting my research through the webinar series to be offered in the fall of 2009.

The participants will be required to participate in the webinar series and complete four brief surveys that will take between 5 and 10 minutes each, and possibly participate in two 15 minute telephone interviews. The surveys will be completed online at the beginning and ending of each workshop module. The interviews will be via telephone and scheduled within two weeks and within three months following the completion of the webinar series. The interviews will be audio recorded and transcribed verbatim. In the interview participants will be asked to discuss their learning experiences throughout the webinar series and any impact the experience may have on their practice in the treatment of patients with heart failure.

The information gathered through the study will be used for research purposes only. The identity of the participants will be kept anonymous and pseudonyms will be used in any direct quotations taken from either the course transcripts or interviews. Reference to the Canadian Cardiovascular Society and webinar participant names will not appear in the research or any publications or presentations resulting from the research. To ensure confidentiality all data will be stored in a secure manner and accessible only to me and my thesis supervisor. It will be kept in this manner for five years after the completion of this study and then destroyed.

Participants may withdraw from this project at any time, refuse to participate, and choose not to answer questions. However, your involvement in this study will enable participants the opportunity to reflect on their learning experience and contribute to enhancing the continuing professional development programs offered by the Canadian Cardiovascular Society.

The University of Ottawa Research Ethics Board has approved this research. Any information requests or complaints about the ethical conduct of the project may be addressed to the Protocol Officer for Ethics in Research at the University of Ottawa or my thesis supervisor who is a professor in the Faculty of Education at the University of Ottawa.

If you have any questions about this research please contact me.

Your time and support would be greatly appreciated.

Sincerely,

Name
Faculty of Education
University of Ottawa

Thesis Supervisor Name
Thesis Supervisor
University of Ottawa