

**Evaluation of EHR Training as a catalyst to achieve clinician  
satisfaction with technology in acute care setting**

By

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MBBCh, Ain Shams University, 1993  
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## **Supervisory Committee**

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## **Abstract**

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Training for Electronic Health Record (EHR) has been recognized as a key facilitator to ensure optimum use and satisfaction with technology. However, research on the ways in which training can promote user satisfaction with technology and a smooth transition to EHR is lacking. This study aims to expand the available literature on the delivery of effective EHR training. End-users may still not perceive the values that EHR can bring to healthcare by improving quality of care and streamlining the delivery of services, although these values are well established. Several barriers can account for the lack of perception, including limited resources, lack of organizational support, and poor clinical ownership of technology. Training provides an excellent tool to communicate the initiatives behind technology implementation, to help users understand the benefits that EHR can bring, and ultimately to improve the satisfaction of the end-users with technology and enhance their adoption. The organizations implementing EHR need to focus on delivery of effective training by allocating sufficient time and resources to training. Trainers need to link with users by understanding different learning styles and adult learning principles, and practicing these principles to support different training methods.

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## List of Abbreviations

<b>C&amp;W</b>	Children and Women's Hospital
<b>CIS</b>	Clinical Information System
<b>CPOE</b>	Computerized Provider Order Entry
<b>DI</b>	Diagnostic Images
<b>EHR</b>	Electronic Health Record
<b>HCO</b>	Healthcare Organization
<b>HIMSS</b>	Healthcare Information and Management Systems Society
<b>HIT</b>	Health Information Technology
<b>ISD</b>	Instructional Systems Design
<b>IT</b>	Information Technology
<b>PHSA</b>	Provincial Health Services Authority
<b>RIS</b>	Radiology Information Systems
<b>VIHA</b>	Vancouver Island Health Authority
<b>BCCH</b>	British Columbia Children's Hospital
<b>BCWH</b>	British Columbia Women's Hospital
<b>BC</b>	British Columbia
<b>EVE</b>	Electronic Viewer for Everyone

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## **Dedication**

To the soul of my mother, to my family and my best friend Khaldoun

## Chapter 1: Introduction and Problem Statement

It is hard to imagine a modern healthcare system without information technology. An EHR that supports an organization's mission by sharing relevant patient information among caregivers is one of the most important initiatives an organization can undertake. The Institute of Medicine has published two separate reports stating that having an effectively structured EHR can improve patient safety, clinical efficiency and quality of care (Institute of Medicine *To err is human*, 2000, Committee on Improving the Patient Record, 1991).

The goal of EHR is to facilitate health information sharing between multiple authorized custodians across the healthcare continuum, health care organizations, and geographies in support of quality optimal care (Marshall, M. & Roch, J., 2006). The involvement of multiple stakeholders and the complexity of integrating technology into a vast socio-organizational environment are challenging. Therefore, despite all the potential benefits an EHR can introduce into the healthcare system, most studies show that adoption rates are less than 10% (J. S. Ash, Gorman, Seshadri, & Hersh, 2004) (Pedersen, Schneider, & Scheckelhoff, 2010)(Leapfrog group, 2012). A more recent study showed that the share of American hospitals that had adopted either basic or comprehensive electronic records has risen modestly, from 8.7 % in 2008 to 11.9 % in 2009 (Jha, et al., 2010).

In 2008 the American Hospital association conducted a wide survey to study the adoption rates of various components of EHR across American acute care settings. The results were disappointing. Only 2% of American Hospitals have a complete EHR that moved from record keeping functionality to electronic ordering of investigation and decision support tools that improve the care quality. Eighteen per cent of the American Hospitals have basic EHR functionalities and less than 17% have integrated CPOE systems (DesRoches, 2012).

Across Canadian provinces, where the budgetary system impedes EHR implementation projects by restricting financial support to a complicated procurement process, adoption rates are even lower. A study of EHR adoption in primary and acute care facilities showed that the US and Canada are significantly behind Australia, New Zealand, the UK, Denmark and Taiwan (Jha, et

al., 2008). Furthermore, the last report released by Healthcare Information and Management Systems Society (HIMSS) shows that none of the Canadian Hospitals has achieved a complete EHR implementation with Decision Support Modules, Data warehousing, and Data continuity with Emergency department, ambulatory, and outpatient care (HIMSS Analytics, 2013)

Most Norwegian hospitals have partially implemented EHR, although it may run in parallel with paper records. Denmark and Spain are currently implementing EHR by extending features of primary care systems and specialist EHR. Oman is considering the same strategy (Vedvik, Tjora, & Faxvaag, 2009).

Recent research constantly highlights the challenges to EHR implementation across healthcare organizations. Among the central factors accounting for the slow EHR adoption is poor understanding of its specific features. This results in resistance to change and impedes EHR adoption and integration in the work process (Bates 2005, Lee 2007, Simeon et al., 2007).

Deficiency in staff training has been a significant factor for resistance in many implementation projects. A classic example is the EHR project at Cedars Sinai Hospital in California, where 34 million dollars was spent on implementing an EHR in 2002. A few months later, the Hospital had to take the system off-line. An analysis of causes of project failure showed that the system was complex, the software was technically difficult, and a major change of workflows was needed. Lack of staff education and training resulted in lack of adjustment to the new system and created a sense of fear and apprehension that threatened clinical staff autonomy and resulted in system rejection and project failure. Even worse, Cedars Sinai Hospital was not ready to plan for a new system for several years after that (Connolly C. 2005).

Another barrier to technology adoption is resistance to change; EHR implementation requires change management, more than technology training, because it changes the way clinicians deliver their care (Diane, 2004). As Healthcare Organizations (HCOs) took steps to move forward and enjoy similar benefits gained by the industrial and business sectors through the adoption of technology, they began to realize that healthcare is different. The adoption of technology involves a major change of the workflow and communication among care providers. This change within the social context involves significant cultural and systemic challenges.

In addition to the fact that change can be an unpredictable and painful process, the transition from a paper record to EHR is a difficult transformation in itself. It involves all staff, including Information Technology (IT) personnel, physicians, nursing staff, ancillary care providers, administrators, top managers and other users. Although organizations work hard to manage the transition to an electronic environment, there is no guarantee that hospital staff will effectively utilize the new EHR functionalities.

There is a consensus that sociological and cultural factors beyond technology contribute to the barriers against EHR adoption. Analysis of the best practices in exemplary organizations that successfully deliver efficient EHR training reveals that consideration of the sociological and cultural factors in training design can successfully overcome resistance barriers. However, this research is not sufficient to analyze how training can overcome these barriers (Chisolm, et al., 2012).

Ignoring this change has negative outcomes. Many incidents occur in which clinicians have rejected the new system and forced organizations to take it offline with major financial losses. On other occasions, clinicians did not feel comfortable using the system because it did not meet their workflow requirements and instead of rejection, they created their own workarounds limiting the full potential of benefits and investment in the EHR.

Some HCOs have realized that it is essential to train and support staff during the change process and noticed that the link between training and successful implementation is vital. Likewise, as issues arise during system training, problems are identified and feedback is delivered to developers to modify the system and enhance the fit to workflow before training additional users. This strategy eliminates problems related to the system before “Go-live” and ensures successful implementation (Diane, 2004).

Unfortunately many HCOs underestimate training needs and under-allocate the necessary resources and time needed for effective training. Health Information Technology (HIT) implementation projects may fail because of the lack of understanding of what end-users expect from training and failure to link training to an EHR implementation business case (Christina, 2005). Unfortunately, training is one of the last phases undertaken by HCOs when time and

budget are used up. Organizations who fail to invest in this phase, risk producing inadequately trained users who do not adopt the system properly, create workarounds that limit the benefits of EHR, and may even set the organization back (Amatayakul, 2009).

In addition to managing change, clinician and organizational attitudes toward technology have been identified as a major factor for successful adoption. Likewise, organizational trends (interaction between the management and user) are fundamental in the adoption process. Attitude is defined as a predisposition to respond to an event in a consistently favourable or unfavourable manner; most studies show that physician attitude toward technology is positive (Laramee, et al., 2011).

Studies show that clinicians have successfully adopted technology, such as PDAs, in clinical settings. Resistance is only evident when clinicians feel that technology may interfere with their workflow, and there is a wide spread perception that conducting a task is slower with an EHR than on a paper chart. Clinicians may also fear that technology may take time away from patient care. In fact, technology may be slow at first; moreover, some EHR functionalities are inferior to the extent that clinicians avoid or work around the system to execute their tasks. In this instance, training plays a fundamental role in helping clinicians understand why it may take longer to execute their tasks using technology. Indeed, the tendency to focus on the task increases user perception of the time gap, even though it may take the same amount of time when the task is executed in a paper record.

Considering the crucial role-played by clinicians, organizations must be ready to support adoption of EHR through a collaborative effort between management, users and clinical leaders. In other words, adoption must be reviewed at the organizational and individual (user) level. The organization may be the initiator of the implementation process, but if it is not adopted at the individual level then the project will likely fail (Ash & Bates, 2005). At the same time, the individual's adoption of EHR is not isolated from the influence of the organization.

Effective end-user training has been cited in the health informatics literature as a key success element to improve end-user satisfaction, acceptance and adoption of both basic and advanced functionalities of EHR, such as Computerized Provider Order Entry (CPOE), Radiology Information Systems (RIS), and electronic documentation (Edwards, Kitzmiller, &

Breckenridge-Sproat, 2012).

The crucial role of training in the acceptance and perception of technology in healthcare is evident in a number of studies. In 2004, Lee et al. reported that the perceived usefulness of technology in nursing improved with adequate training. Other researchers found that among different sectors of the healthcare organization (physicians, nurses, administrative, management and ancillary care staff) an adequately planned training strategy was their major concern before and after EHR implementation.

In spite of the evidence cited in numerous studies that show the importance of end-user training, a recent report from American EHR partners reveals that over 50% of clinicians did not receive sufficient training before EHR implementation. Those who did receive training for 3-5 days achieved a high level of satisfaction using the system, and their sense of autonomy and professionalism continued to grow over the 2 weeks of training. The results also demonstrated improved efficient use of both basic and advanced technology functionalities (Michael S. Barr, 2011). Others stated that inadequate training increased resistance by making clinicians feel they were not prepared to use EHR (Edwards et al., 2012).

A systematic review of EHR implementation studies concluded that the predictive factors for success include, in addition to managerial support and committed leadership, initial and on-going financial resources to support training and reduced performance in the initial phase of implementation. Thus, training policies and procedures play a major role in predicting successful implementation. The study focused on strategies to ensure successful training and adoption and formulated the following points:

- Training must be timely, adequate, knowledgeable, and tailored to clinician needs, should include simulated or real patients in a real work environment, and should provide on-site support to end-users.
- Organizations should provide protected time for sufficient training with sufficient resource to cover human resource shortage at the time of training.
- Availability of reward and incentives to motivate trainees provide motivation to learn.

- Availability of support at initial implementation, Go-live and ongoing support are critical for successful training.
- Early establishment of super or power users and their involvement in the procurement and design process are Key facilitators to successful diffusion of adoption.
- Continued monitoring and feedback from users on how the training meets user expectations (Laramee, et al., 2011).

Another study by Chisolm, et al., (2012) utilized different approaches for training and focused on providing efficient training materials with hands-on experience for clinicians to develop realistic expectations of what technology is able to offer. The study identified that effective training requires organizations to identify positive role models as power champions and spread technology through their communication channels. The study also highlighted the value and effectiveness of training when it emphasizes the learner's past experience of the organization and past training experiences.

A report released by the Health Information Management Systems Society (HIMSS) in 2011 stressed that training should be a continuous process and not stop after system deployment. In the same report, HIMSS encouraged organizations to make the training plan and manuals available from the early stages of project implementation, and the vendor should involve the super or power-users in every phase of project development through training (Jeffrey & Debra, 2011).

Feedback from super-users on system functionalities and issues related to workflow mismatch has a great impact for developers to modify and customize systems to ensure successful adoption. The vendor for both basic and advanced functionalities must train super-users. Training super-users is referred to as a "train the trainer" model. This train the trainer model provides a successful and efficient strategy to facilitate clinician satisfaction and adoption of technology. Further elaboration of the super-user model is addressed in the following chapter.

In addition, through training, organizations play a unique role in helping clinicians understand that EHR is not merely a paper replacement, but there will be a major impact on communication,

information availability, and improvement of the workflow down the line. In fact, organizations that successfully implemented an EHR announced that they would never go back to paper records for those reasons listed above (J. S. Ash & Bates, 2005).

Moreover, a major role of training is to close the gap between the complexity of technology and the cognitive capabilities of the clinicians. A well-planned training program tailored to specific clinician needs can provide a timely, efficient, effective, and enjoyable learning experience to the clinicians that in turn will ensure acceptance and successful implementation.

Unfortunately, most EHR training programs are inefficient and unable to satisfy training objectives. The reason is lack of insight into clinician expectations, capabilities and workflow needs. However, current needs assessment techniques using survey questionnaires and interviews do not adequately anticipate problems that users may encounter when using the system to execute tasks.

Several studies advocate the inclusion of usability testing before training. Such techniques as cognitive walk-through and usability inspection could detect system problems early, as well as provide deep knowledge about clinician training needs. Feedback from users is returned to the training team to help them design the training plan, manuals, and online material to fit user needs and existing workflow (Kushinka, 2010).

Another central aspect when designing training for an HCO is to treat clinicians as knowledgeable adults. Designers should incorporate concepts drawn from adult learning theories. Since adults are effective learners, they bring their experience and knowledge to the classrooms and expect to relate this to the training. According to Walker J.M. et al., a simple demonstration of software and EHR functionalities is not enough; adults may not be interested in computers without an understanding that it will make their jobs easier and improve care quality. Trainers need to realize adult learner needs for autonomy and self-competency. Trainers should be ready for questions that adults bring while training, such as: “Why should I learn this?” and “How will I use this?” (2005).

When applying adult learning theories to EHR training, training design should not only focus on

technology but also on user needs as adult learners. Several EHR training modalities lend themselves to adult learning. For example, e-Learning (web-based) is learner-centred; it fits learner autonomy and self-competency and allows the learner to control his or her education at an individual pace.

### **Study objectives:**

The current training will allow clinicians at BC Children's and Women's Hospitals to develop the skills and competencies necessary to adopt Cerner Millennium functionalities into the hospital workflow and perform their tasks to deliver high quality patient care. A survey study conducted at PHSA after the implementation of the first phase of this project showed an increased interest among the users for more training hours and focus on post Go-live support. These concerns call for in-depth study that aims to:

1. Explore the clinician expectation and perspective on EHR training in an acute care setting within the PHSA
2. Explore the challenges and opportunities associated with the current EHR training from the trainers' perspective
3. Identify how training changed clinicians' perceived usefulness and attitude towards EHR.

### **Research questions**

The research questions are designed around above objectives about EHR training. This is a new approach because the study of EHR training with inclusion of adult learning theories is lacking in informatics literature. The specific questions to answer in this research are:

- What are the clinician expectations of EHR training?
- What are the challenges and opportunities involved in the incorporation of concepts from adult learning theories within the EHR training strategies?
- How does training change the clinician perceived usefulness and attitude towards EHR?

## **Chapter Conclusion**

The dissemination of new information to clinicians and its incorporation into clinical practice in the form of electronic charts, documents, digital images, and decision support tools is a major challenge. Despite all the benefits an EHR can bring to healthcare, adoption rates are low.

Among all the barriers to the diffusion and optimum use of technology in healthcare, training has been understudied. Organizations and designers tend to focus on updating healthcare with the best technology to improve the quality of care disregarding how clinicians will develop the skills necessary for optimum use of the technology.

Many concerns exist among clinicians for the future of EHR; computer usage seems boring and repetitive, there are risks of breach of confidentiality, increased workload, threats to professionalism by technology, and dealing with computers could take time away from patient care. These concerns exist among all clinical disciplines and account for more than 50% of failed EHR implementation projects.

Understanding how clinicians feel about technology can enable an implementation team and trainers to structure communication, reframe misperceptions, and create new perceptions and knowledge among clinicians that can be communicated through training (McLane, 2005).

In addition, health information is relatively new and evolving making it difficult to define a guideline tool for training. Educators and trainers realize the significance of training as an effective tool to transfer knowledge to clinicians, however, it is difficult to define a curriculum and achieve consensus for a training strategy (Mantas, 2007).

Effective utilization of available resources, creating a well-planned, clinician-centred training strategy that incorporates concepts from adult could help clinicians develop a positive attitude towards technology, a determinant factor for successful implementation.

## **Chapter 2: Literature Review**

### **A- Adult Learning**

#### **Introduction:**

Many HCOs began implementing EHR to gain the benefits of technology, despite the huge cost that reached, on some occasions, 60,000 dollars per physician. These activities carried the promise of savings in the long term, which would more than offset the initial investment.

Shortly after the momentum to implement technology, almost 50% of the organizations were forced to give up, pressurized mainly by the hefty costs and multitude of hours needed. Comparable to the countless failed IT projects in other business domains, the reasons were poor buy in, insufficient training, and too slow Return of Investment (ROI) to justify the initial and on-going investment (Thompson, 2011).

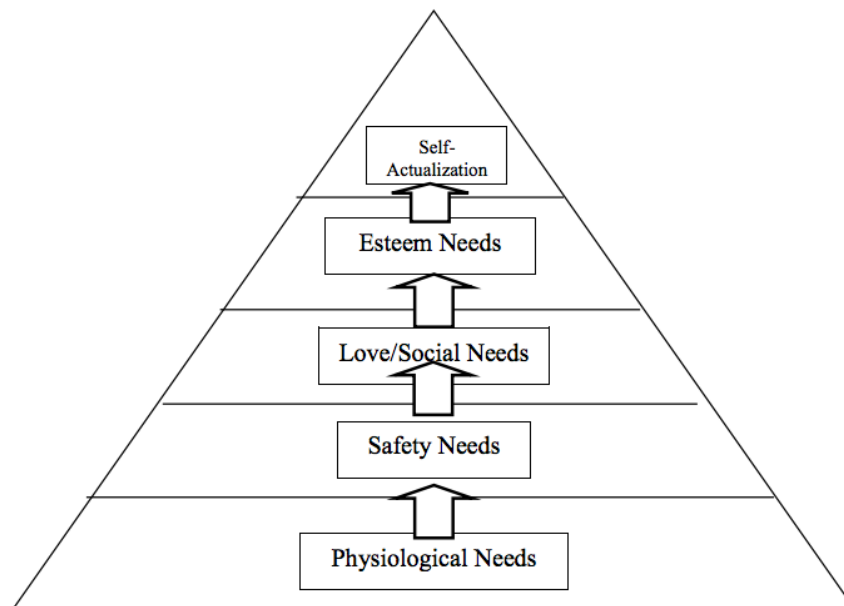
Only recently have scientists called for research to focus on evidence-based theories and rigorous theory-driven work for training design. Before that, designers reverted to non-experimental comparisons, case-oriented studies, and anecdotal perspectives of historical training methods. Most of the former training designs did not rely on scientific evidence to explain why some training approaches were successful while others were not. In the following section relevant theories are summarized in relation to this study.

#### **2.1 Motivation theories and relevance to training research**

Early research on human motivation focused on non-cognitive behaviour, and defined motivation as the drive that creates tension and forces an individual to pursue certain behaviour in order to satisfy that tension and resume a resting state (Hull, 1943).

The drives theory was expanded to include Maslow's fundamental needs for existence. Maslow defined a hierarchy of five basic physiologic and psychological needs for healthy existence (physiologic, security, belongingness, self-esteem, self-realization and self-

actualization) (figure 1). Both the drives and needs theories identified factors that play a role on the subconscious level to motivate an individual and explain his or her behaviour (Hull, 1943; Maslow, 1943).



**Figure 1:** Maslow's hierarchy of needs, (Adler, S., 1977)

### **2.1.1 Social cognitive theory**

Behaviourists identified external stimuli that motivate behaviour, and referred to them as classical and operant conditioning. In classical conditioning the behaviour is related to external stimuli; in operant conditioning, external reinforcement can change behaviour and the individual will adapt his or her behaviour in order to gain or avoid certain outcomes (Skinner, 1972).

Cognition as a third factor that motivates behaviour was identified by researchers such as Locke & Latham (2002), who identified the organizational factors influencing behaviour. They stated that an organization would motivate behaviour by setting goals, provided that

these goals are specific, achievable, and time bound. Adams (1963) introduced equity theory, in which the individual sets another referent person in the organization as a comparison for contribution and rewards, and the results of the comparisons then influence that individual's behaviour (Adams, 1963; Locke & Latham, 2002).

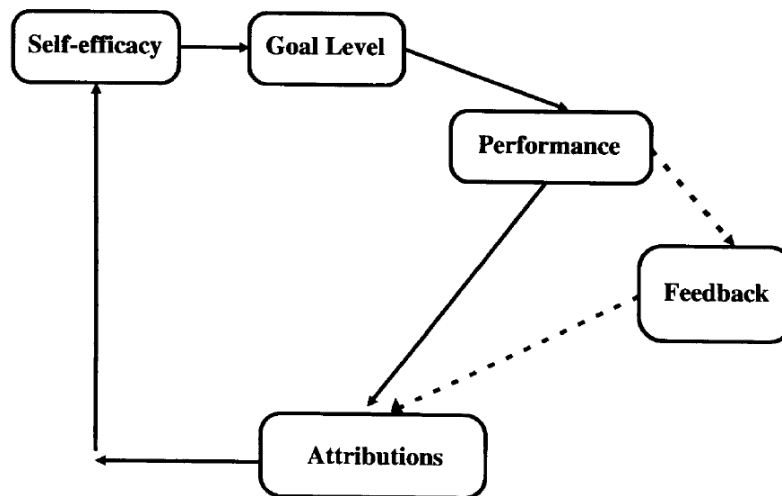
Social cognitive theory combined the three factors that motivate human behaviour (innate, external stimuli, and cognition) and introduced social learning theory, which states that human behaviour is learnt through external reinforcement and modelling (social learning) under the control of cognition, and that cognitive factors such as recall, interpretation, evaluation and control play a fundamental role in controlling behaviour. Social cognitive theory was widely validated and has received universal acceptance in learning design (Bandura, 1986).

### **2.1.2 Self as a motivator:**

Self-efficacy is defined as the belief in one's ability to perform specific tasks; self-efficacy is used in self-motivation and mastery to overcome phobias, and was also linked to performance as a motivator in self-management training such as improved job attendance and improved work productivity (Eriksen, Olf, & Ursin, 1999).

### **2.1.3 Self-regulation**

**Self-regulation** is the management of the psychological processes involved in performance. Self-regulatory hub (figure 2) is the model for self-management that shows the interaction between different variables involved in performance, although the model can start at any point, self-efficiency is usually considered as the lead point in the model since it is the most fundamental perception of the self as a performer. Within the model, self-efficacy directly influences goals since people with high self-efficacy set higher goals, and through the process of self-monitoring, goals direct attention and efforts to achieve the desired goals and thus influence performance (Locke, Frederick, Lee, & Bobko, 1984).



**Figure 2:** Self-regulatory hub,

Following performance, feedback is essential for self-regulation. Within the self-regulatory model, self-efficacy controls the feedback-attribute relationship. Attributes refer to the impact of previous and current performance. Studies show that individuals with high self-efficacy tend to shield their confidence by projecting failure or poor performance on external variables, whereas those with low self-efficacy tend to be more sensitive to early cues of failure and soon project failure on internal variables (Hmelo-Silver, 2004).

Further to self-regulatory hub, researchers found that motivation and performance tends to increase when individuals recognize that task performance is related to an acquirable skill rather than a fixed ability. In addition, when trainers expect a higher performance from trainees, the motivation and overall performance improves as a result of improved self-efficacy (Bandura, 1977).

Current work on adult learning widely acknowledges social cognitive theory, which integrates operant conditioning as a motivator for learning and behaviour and that learning occurs through a cognitive process as well as experientially. Additionally, the self-regulatory process provides a motivation that controls behaviour. Because self-

efficacy has been recognized as the fundamental predictor for behaviour in adult learning, some training designs that promote self-efficacy achieve a higher rate of success than others (Bandura, 1977).

## **2.2 Design of Human learning**

Organizations engaged in training technology should recognize the impact of human motivation on adult learning, as well as the factors pertaining to human learning when designing an effective training plan. These factors include cognitive skill acquisition, learning level, and task level.

### **2.2.1 Cognitive skill acquisition**

Anderson (1983) recognized three phases of human cognition while learning. The first is declarative knowledge, in which an individual acquires knowledge essential to perform specific tasks; this phase depends on memory and recall. The second stage is the knowledge compilation phase, in which the individual becomes more adept at recall and starts to acquire knowledge on the sequencing of tasks. Then comes the procedural phase, when task performance becomes automated with less reliance on memory. Researchers found that distraction at the declarative phase (as in the case of goal setting and self-regulation) will reduce individual performance and impact further learning phases (Anderson, 1987).

### **2.2.2 Learning levels**

Gist and Stevens proposed a learning level hierarchy (table 1) which combines the sequential cognitive skill acquisitions and increasing complexity of learning content in order to master job performance (Gist & Stevens, 1998)

**Table 1:** Learning level hierarchy,

	<b>Learning levels</b>
<b>Recall</b>	The capacity to memorize the material taught in training. Equivalent to the

	knowledge acquisition phase
<b>Comprehension</b>	Understanding the material taught and applying knowledge to contexts similar to the class environment, corresponds to the procedural knowledge phase
<b>Synthesis</b>	Cognitive application of the learnt material into different environments, corresponds to the advanced procedural phase
<b>Practice</b>	Behavioural application of the skills in a simulated environment
<b>Performance</b>	Behavioural application of skill in the natural setting, is the most challenging stage as support is minimal and the trainees start to extract from their own knowledge and face unexpected situations while applying skills

Trainees should move across different stages in sequence in order to move to the next level. At the beginning of the declarative stage, memory recall would bring numerous mistakes; only when the trainees master the declarative stage are they able to automatically recall material in order to move to the procedural stage. Also, incomplete mastery of a certain level of learning reduces performance on higher level since incorrect recall of information will yield poor comprehension.

### **2.2.3 Task level:**

When designing training, attention should focus on the level of learning required for each type of task. For mental tasks (e.g. financial operation) a focus on cognitive learning is required. To master the procedural phase, mental rehearsal would be sufficient; in such a case, written assignments would be effective to promote automatic recall and develop comprehensive cognition.

A challenging situation is faced when designing training for tasks involving motor or interpersonal skills. In such cases mental rehearsal is not sufficient to simulate the natural setting, and mental representation may not develop the skill level, stamina, and coordination that the learner needs to relate a cognitive skill to motor and behavioural performance.

In the case of interpersonal performance, trainers need to focus training on the synthesis phase. It is the phase in which trainees apply cognitive learning skills to complex and unexpected situations that require more than motor performance. This phase needs to be extended, and trainers should ensure that trainees have mastered this phase before moving to practice. The organization may have to consider which individuals would fit which roles and select them for training.

To summarize, three factors should be considered when designing training:

1. The domain of the task to be performed, whether factual knowledge, motor performance or interpersonal skill.
2. The level of performance to be achieved, whether comprehension, synthesis, or demonstrated behaviour.
3. The phase of learning to be mastered, although declarative learning is mandatory to be mastered in class and the procedural and knowledge compilation phases are assumed to be developed by the learner during practice, the trainer may need to extend training into the compilation phase in some situations where successful performance is mandated.

### **2.3 Adult learning theories for trainers**

In addition to the organization's role to design effective training, the trainers need to understand the adult learning process. Adult learning is a distinct branch of educational theory that emerged in the second half of the previous century. Two early pioneers of adult learning who established foundational concepts were John Dewey and Paulo Freire.

John Dewey is an American philosopher, psychologist and educator who believed that education is essential to create an informed populace for a fully functioning democracy. Being a proponent of hands-on education, he led an approach that engaged his students to draw from their experience and bring this into classroom learning (Dewey, 1916).

Paulo Feriere is a Brazilian curator who studied law and philosophy, he taught Brazilian language to illiterate adults and children during a time when literacy was a requirement for voting. Feriere had his own experience with poverty, and he strongly argued that education is a universal requirement. He also argued that education should be aligned to the learners' experiences and needs and that instructors can learn from students just as students learn from educators (Feriére, 1970).

The influence of Dewey's and Feriere's work led to a reform in adult learning, often referred to as "coaching engagement," and paved the way for other scholars to integrate theories from other resources into the new concept. Two theories are particularly applicable to coaching engagement: the concept of Andragogy, pioneered by Malcolm Knowles, and Learning Styles by Kolb Boyatzis (Bolton, 2010a).

### **2.3.1 Andragogy**

**Andragogy** is defined by Knowles as "The process of adults gaining knowledge and expertise" and has been considered a core concept for adult learning for over 30 years. Knowles set up the following 6 main principles of Andragogy:

1. Adults learn best when they know that they need to learn.
2. Adults have developed self-competency; they learn best when they feel control over their own learning.
3. Adults are problem solvers; they will be motivated to learn when they feel that learning is life, problem, and task oriented rather than content centred.
4. Adults are motivated to learn when they realize that learning will support their desire to grow and self-develop.
5. Adults' own experiences are a rich source for learning content.
6. Adults need to see the practical application of what they learn. It will make their work more efficient (Reischmann, 2004).

Incorporating concepts of andragogy into the coaching plan will ensure:

- 1) Understanding of the learning and behaviour change while training, this will be

the basis for mutual respect and agreement between the instructor and the trainee

- 2) Participation in training is voluntary; even if training is imposed by the organization, the trainer should help the trainee understand that training is an opportunity for learning and growing
- 3) Andragogy strengthens the learner experience. This reinforces the learners' agenda in terms of needs, responses and experience rather than that of the trainer
- 4) Engagement of the trainees; when facing issues during training the trainer will focus on the learner experience as a source of knowledge.

### **2.3.2 Learning styles**

Building on the work of John Dewey and Kurt Lewin, psychologist David Kolb (1984), along with his associate Roger Fry, introduced a model to explain how adults learn from experience and process their experience in different ways. According to Kolb, adults learn by experience. Then, adults use that knowledge to adapt to a situation as it unfolds. Therefore, training must involve interaction with the topic being learned. The process of learning by doing involves four steps:

- 1) Concrete experience: direct experience and action
- 2) Reflective observation: reflecting on the effects of the action
- 3) Abstract conceptualization: understanding the principles that affect the action
- 4) Active experimentation: testing, adjusting, and planning a new course of action

The learner might enter at any of the four steps according to his learning style preference, and reflect, understand and gain experience before moving to another step. Learning and development is completed after achieving the four steps, so that when the learner encounters a similar experience he or she will conceptualize, reflect and react in a more developed manner. In this way, learning occurs in a spiral model, with improvement of learning experience every time the learner moves through the cycle.

The Kolb Experiential Learning Model can often guide the training process. For instance, the GROW model maps directly onto the cycle (Kolb, 1984). Similarly, Whitmore's establishment of "goal setting" equates to an actual or proposed concrete experience; the exploration of "reality" is equivalent to reflective observation; "options" involves abstract conceptualization; and "What will you do?" suggests active experimentation (Whitmore, 2009).

Kolb's learning model is not rigid; he identified that individuals are capable of creating their own learning preferences. Based on the above-mentioned learning steps, he built four combinations of styles that identify learners' interest in learning and the best approaches to develop successful changes in behaviour:

- 1) Diverger/reflector. Strong in imaginative ability, good at generating ideas and seeing things from different perspectives; the person with this preferred style is interested in people and has broad cultural interests.
- 2) Assimilator/theorist. The person with this preferred learning style has a strong ability to create theoretical models, excels in inductive reasoning, and is concerned with abstract concepts rather than people.
- 3) Converger/pragmatist. Strong in practical application of ideas, the person with this learning preference can focus on deductive reasoning on specific problems. He or she is likely to be unemotional, with limited but often very focused interests.
- 4) Accommodator/activist. The greatest strength of someone with this preferred learning style is finding out by doing things. He or she is a risk taker and performs well when required to react to immediate circumstances, solving problems intuitively.

Honey and Mumford (1992) adapted Kolb's learning styles to a Learning Styles Questionnaire (LSQ) as a self-development tool to identify a learner's preferred learning style. Honey and Mumford's model includes four types: the Activist, who prefers doing and experiencing; the Reflector, who likes to observe and reflect; the Theorist, who wants

to understand reasons, concepts, and relationships; and the Pragmatist, who likes to try things out to see if they work (Mumford & Honey, 1992).

Concepts from learning style models cater to efficient training in the following ways:

- A. The trainer should be aware of different learning styles. There may be a need to discuss with the trainee different training options by simply explaining them and matching the best fit to his or her interests. The use of LSQ will identify his style of learning.
- B. The trainer should encourage the trainee to use different learning styles to cope with a variety of situations.
- C. The trainer should encourage the trainees to reflect on their own experience as a source of learning through questions such as, what are you learning from the situation about yourself, others, and about the situation? What went well and what did not go so well and why?
- D. In the abstract conceptualization phase the trainer should help the trainee to interpret the situation and analyze the outcome. Questions should be asked such as, what was the process? Was it expected? If not, how did you expect it to be?
- E. In the Concrete experience stage the trainer should ask the trainee speculative questions such as, could the action be done differently? What would the outcome be if it were done in a different way?

## **2.4 Advances in training design**

So far, no standard methodology has been developed to test initial skill acquisition, retention, maintenance, transference or generalization of acquired skills to other tasks or jobs. On-going research should focus on the following areas:

### **2.4.1 Initial skill acquisition:**

Initial skill acquisition refers to the short-term learning. Studies show that mental practice, or cognitive rehearsal, improves task performance overall but depending on the task complexity, length of mental practice and time interval between learning and

performance (Driskell, Copper, & Moran, 1994).

#### **2.4.2 Instructional Systems Design (ISD):**

Health information technology has an economy built on knowledge, which incorporates analysis, design, implementation, support, and services. This knowledge cannot afford financial losses incurred by inefficient training. For training to pay off the organizational expenses it should incorporate a systematic approach of analysing requirements, identifying instructional materials, and preparing the training environment to achieve the training objectives. This systematic approach is referred to as ISD. The output of ISD has the training ingredients of instructional content, methods, learning media, learning objectives, and learning outcomes.

ISD provides trainers with detailed processes and guidelines to deliver consistent and effective training. Whether in the classroom or through computer based training, ISD will ensure that learning design is sufficient to build job-relevant knowledge and skills to fulfil bottom-line organizational objectives.

#### **Summary**

Cognitive learning is considered central to computer software training. Self-efficacy in technology training is crucial since many trainees feel inadequate when facing technology. Incorporating self-efficacy principles within the training context is shown to improve software skill acquisition. With this in mind, one of the first things that organizations need to do when they design training is to identify the learning level to be achieved based on the task assigned to the learner.

Trainers also need to understand the principles of adult learning; adults are problem solvers and have skills and experience to consider during training. Identification of the different learning styles and reacting accordingly will establish a strong communication channel between the trainer and the learner that will generate engagement and facilitate absorption of complex software computer systems.

Technology has been exponentially growing over the past decade and is yielding technology-skilled end-users. In addition to the methods to deliver an effective training, trainers should incorporate details on software, business rules, and benefits from technology relevant to the system being implemented.

## **B- Learning content**

Many HCOs are implementing technology to gain the benefits of improving care quality and reduce the growing cost of healthcare. Healthcare professionals are increasingly seeking information technology to work more efficiently and effectively. It is evident, however, that most healthcare professionals lack a good understanding of the fundamentals of technology. There is an increasing demand from health care professionals as well as the organizations to enforce computer competencies among end-users. When end-users develop a sufficient knowledge level, they will be able to decide about the benefits of certain applications to their work and to express their needs in terms understandable by information system designers. Awareness of the limitations of technology should also be clear to the end-users to avoid frustrations and resistance when they develop unrealistic expectations about information systems.

In this context, it is essential that health professionals be aware of the potential changes that informatics tools may bring to the health care field. Health professionals should not only be able to critically appraise the pros and cons of these tools but also be able to influence clinical information systems design so that they can contribute to proper implementation of these systems in practice. Therefore, training health professionals should be acquainted not primarily with the technology, but also they should be trained in the principles behind these systems. Furthermore, attempts should be made to teach general principles that are applicable to most sectors in health care (Smith, A. C., & Maeder, A. J., 2010).

Given the crucial role of teaching healthcare professionals the principles behind technology and its implementation in healthcare, organizations implementing technology and planning for effective end-user training should develop a curriculum to raise information system knowledge level among healthcare professionals. High-level information drawn from the health informatics domain should be included in the training curriculum to raise the knowledge level among users, enforce their competencies and ultimately optimize their performance and satisfaction with technology.

Health informatics is the discipline at the intersection of science, computer, and healthcare. It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in healthcare and biomedicine. Health informatics domain covers the computerized and informational aspects of the process and structure in healthcare. Training curriculum that relies on the health informatics will cover all aspects of effective acquisition, storage, retrieval, and use of healthcare information and bridge the gap of limited end-user knowledge. Depending on the end-user background, motivation and readiness to adopt technology, training curriculum should emphasis on the principles behind technology that include:

**High-level functional specifications of the software**

Training that integrates the basic software design and specifications with appropriate application domains provide the end-user with the best learning experience. Integrated curricula offer educational experiences that clearly relate the basic software design to problems in the relevant domain. Integrated curricula provide experiences that help trainees learn to collaborate in a multidisciplinary setting, to integrate data of varied types and from varied sources, and to weave together varying modes of idea expression and varying modes of thinking. The following topics provide the most relevant principles training curriculum should incorporate:

- Data structures and Database design
- Evaluation/research methods
- Information retrieval
- Knowledge representation and Modeling
- Networking/architecture
- Ontology/vocabulary and health informatics standards
- Programming languages
- Cognitive/human factors and interfaces (Friedman, et al., 2004).

It should be noted that when training end-users on software, trainers should focus on role of user rather than level of knowledge, to avoid frustration when training does not contribute to their roles.

**Clinical information systems integration**

The healthcare sectors are profoundly fragmented across geographical, professional, organizational and technical boundaries. This creates a fragmented healthcare service for patients, which undermines efforts to transform organizations towards more collaborative, process-oriented modes of working. Ultimately, this threatens ongoing efforts to increase the efficiency and effectiveness of healthcare delivery (Boochever S., 2004).

Training curriculum should discuss the values of integration in eliminating problems that fragmentation produces, i.e. duplication, non-consistency and redundancy. End-users should be able through training to understand the values of integrated information systems as a solution to these concerns, in addition to efficiency gains and quality improvements (Davenport T. H., 1998).

**Business rules in health information systems**

Business processes that are computerized without careful analysis and redesign can lead to inefficiencies and work-arounds, with potential loss of patient safety. On the one hand, well-designed health care processes reduce inefficiencies and make complexity manageable (for example, by supporting communication and coordination), both improving safety and reducing operating costs. Total quality management is associated with improved business performance (Carayon P., et al., 2007).

Implementation of clinical information systems in health care organizations involves transformation in the business process within the organization. CIS implementations can be intended strategically to transform the organization, and the technology can be allowed to grow along, gradually becoming the basic organizational work routines (Berg, M., 2001).

To deliver better health care at a lower cost, health information technology (IT) should be redesigned to support improved, patient-centered care and not the isolated tasks of physicians and clinicians. This new approach has major policy implications: health IT can help mitigate the worsening shortages of physicians; it will require managers,

clinicians, and patients to learn new skills and behaviours; it will increase the need for clinically astute systems analysts, business-process managers, and human-factors engineers; and it will highlight the need to pay for process improvements and improved patient well-being rather than the mere purchase of health IT (Walker J. M., & Carayon P., 2009).

This can be assured when end-users who use this technology are aware of the business rules that aim to influence or guide information and workflow in the organization. These business practices and rules should be well known and treated as a valuable asset to end-users. In this context, training should involve discussions and explanation to cover the business process and align this process with organizational initiatives such as business process reengineering (Steinke G., & Nickolette C. 2003).

#### **Clinical information systems and patient outcomes**

Clinical information systems have long been promoted for their potential to improve the quality of health care, and improve patient outcomes. Computer-based decision support systems (CDSSs) can generate patient-specific information, perform complex evaluations, and help clinicians to make evidence-based clinical decisions in a timely fashion. Examples include drug allergy alerts, CDSSs designed to recommend appropriate drug doses, to provide immunization reminders, or to provide a diagnosis for certain medical conditions (Dereck L., et al., 1998).

Medical errors cause at least 44,000 deaths annually in the United States. These deaths largely result from process errors, or the failure to provide recommended treatment (Kohn LT, et al. 1999). Health information technology has the potential to improve quality while reducing medical errors. In particular, they are designed to improve communication among the disparate providers within a health care organization. Furthermore, these technologies facilitate the implementation of care guidelines and decision-support tools, which may be particularly valuable in preventing process errors.

Moreover, a systematics review that examined one hundred studies to assess the impact of clinical information systems on healthcare showed that practitioner performance has

improved after implementation of technology 64% of the studies and was related to improved clinical decisions due to better diagnosis, reduced errors with reminder systems and better drug dosing with prescribing systems (Garg A. X., et al., 2005).

Another growing role of technology is in chronic disease management. The ageing population worldwide is increasingly acquiring multiple chronic diseases. The complex management of chronic diseases could be improved with electronic health records (EHRs). A key aspect of chronic disease management is that it takes place over long periods. Technology holds the promise to provide clinicians with a longitudinal view of relevant patient information, provide trends and indicators for patient progress, and ultimately enable clinicians to provide care in a more efficient and effective way (Samal L., et al., 2011).

A vital part of the training curriculum is to explain the values of implementing technology in healthcare. Awareness of the end-users about the benefits of technology will act as a catalyst to motivate healthcare professionals to adopt the information systems to gain their benefits. Healthcare organizations has gained many benefits by implementing technology, however, the training curriculum should incorporate those benefits that are relevant to the system being implemented.

To summarize, today there is a clear understanding that health professionals should be aware of the impact that ICT has and will have on health care. Moreover, it has been acknowledged that these professionals should be able to use information technologies in an appropriate and responsible way.

The past decades, health informatics training has indeed been introduced into an increasing number of medical and other health related professional training. Technology training should incorporate a more detailed and context relevant software design principals including system architecture, data structure and database design, as well interface design.

Training curriculum should also include description of the business process within the

organization and its fit to technology, particularly when technology implementation involves business process redesign.

Training curriculum that incorporates explanations of the benefits of technology implementation in terms of reduced errors, improved performance, better care quality and improved chronic disease management will motivate healthcare professionals to adopt CIS in order to achieve such benefits.

### **C- Training Methods**

One of the greatest pitfalls an organization may suffer when implementing technology to improve work efficiency is to focus only on technology while disregarding the fundamental role of training. Although an infrastructure such as hardware, software, and networking is a cornerstone to implement technology, inefficient training may produce inadequate or sub-optimal use of technology, user frustration resulting in poor performance, and financial losses.

Training has been recognized as a key facilitator of clinicians' satisfaction with technologies such as Computerized Provider Order Entry (CPOE), Radiology Information systems, clinical documentation, and Decision Support Systems (DSS). Different categories of hospital staff (including clinicians, administrators, and managers) identified training as a major concern for successful system utilization. Among different sectors of healthcare, such as primary or acute care, training users for the best care practice on technology is associated with smooth transition to EHR. This finding is consistently cited in various studies (Ammenwerth, Iller, & Mahler, 2006).

As mentioned with respect to adult learning, research studies on training confirm that clinicians, as adult learners, achieve better performance when they interact and get hands-on experience with systems during training. Research also confirms that maximal achievement from training is gained when the training matches user needs. In addition to other concepts drawn from adult learning theories, the above-mentioned concepts are crucial for clinician training on technology and should be taken into account when designing a training plan for EHR.

Training should be efficient and effective, which means learners need to be adequately trained quickly and with the minimal cost. More specifically, *effectiveness* is the degree to which the objectives have met the actual desired accomplishment. *Efficiency*, means getting the most with the least energy expenditure; it is the ratio of useful work to the energy consumed. Effective learning design has standards and starts with a close partnership with the organization and end-users of technology in order to design training

that is relevant, efficient and interesting, create an atmosphere within the organization where trainees can learn through technology, as well as develop a meaningful monitoring system for the training results (Fallon & Brown, 2002).

**Training needs assessment:**

In addition to initial analysis of the needs of the users, the training team should consider variables related to the users and practice:

- 1) What is the best time for training? Typically early mornings, lunch times and late afternoons (after the clinics).
- 2) What are the appropriate training scenarios? Typically drawn from real clinical sheeting by the super-users, which offer the best content for training and exercise.
- 3) Consider users who need special help.
- 4) The reduction of patient schedule to free time for clinician training: typically 50% reduction of schedule over the first week and 25% over the following two weeks (Krum & Latshaw, 2005).

The main problem in EHR training is the lack of empirical evidence for successful training methodology, though the main focus of training is primarily to introduce system functionalities to the users, and secondarily to help users understand how to use technology to improve their performance and maximize their work efficiency. Yet, no consistent training plan is established to achieve the training goals. In general, the methods of training include:

- 1) Classroom (instructor based) training
- 2) Web-based (e-Learning, online training)
- 3) Blended learning
- 4) Paper-based (training manuals)
- 5) Computer-based (using CDs)

- 6) Audio and video (multimedia) based training
- 7) Mobile training
- 8) Training wheels

The following will focus on a discussion of the first three training methods applied in the current project under study.

### **Classroom (instructor) based training**

The instructor starts with guided observation of the system functionalities and key elements of the application, he also draws the trainees' attention to the most important characteristics within the system.

In order to maintain data safety and integrity, training cannot be conducted in the production environment. Instead, a mirror environment to the real practice is created with mock data to train users. This can be refreshed after each session. The training environment provides an excellent opportunity for users to practice safely and learn by trial and error. In some cases, the training environment needs to be synchronized with the production environment by software developers, which carries additional cost.

### *Role-based training*

The special technique and content of role-based training tailors EHR to the specific functions end-users will perform on daily basis. Referred to by the informatics literature as most effective for the clinical environment, the user will be most attentive and motivated when the material and trainer have great credibility among clinicians. Customized training materials are developed after the system has been configured to fit the organization workflow, rather than using the generic workbooks offered by the vendor, and delivered by super-users, as they are familiar with the organization clinical process and social structure. Moreover, they can answer specific questions about documentation, CPOE, viewing and other EHR specific functionalities. This is a technique of training in which training sessions are structured according to user specific contents (Sweatt, Longenecker Jr, & Sweeney, 2006).

### *Process-based training*

Introducing technology induces changes in the workflow. Although role-based training ensures efficient use of technology by providers, the change process will impact other system users, and they also need to be trained for the new process. Process-based training updates and standardizes policies to make sure that all elements of the workflow are captured and all users efficiently trained to their updated jobs.

Instructor-based training remains the gold standard for all training programs. Although many organizations have moved toward online training courses that are more cost and time efficient and suit many of the user schedules, classroom training still has its principle role of bringing trainers and learners together in a collaborative environment where they learn, exercise, and solve problems as a team. Therefore, classroom training is not going to disappear. Along with online training, it is going to reform in a way that facilitates social interaction among trainees and the instructor and prepares learners to adequately utilize online modules.

### **E-learning**

Creating an online training module starts from the instructor-based classes. They need to ensure a smooth transition to the web-based learning. Simple transfer of the classroom content and exercises into the online module does not work; although the principles and content from the classroom are the core of the online module, designers must include interactive learning techniques, and make use of textual, visual, and multimedia tools. The main idea of the online module is to transform classroom learning into an excellent, technology driven instruction (Fallon & Brown, 2002).

The major challenge when designing online training is that it must support the organization and learning objectives to deliver the learning material through a medium with no instructor to answer learners' questions and adjust the learning content based on the expressed users' interests. The instructor has to build the learning module based on careful, advance analysis of the organization and learners' needs. Furthermore, crafting the online module has to be systematic, with creating prototypes and testing by end-users

followed by revision in cycles based on their feedback. This strategy not only ensures an efficient learning module, but also safeguards against errors discovered in the final design when the cost of repair is too expensive. In addition to training needs assessment, participation of the end-users in the design of the online module will ensure selection and inclusion of the right, relevant, accurate, complete and interesting content within the learning material (Stolovitch & Keeps, 2004).

Interactivity is the hallmark of online training, giving users hands-on experience in a simulated environment where errors carry no risks and users will learn from their mistakes. Interactive learning should start as simple well-thought out knowledge quizzes, moving to complex tasks to stimulate mental exercise and ensure knowledge retention. In cases of errors, the module should provide powerful feedback and a comprehensive model answer that helps the user identify where the problem is and remediate it in a timely way.

Incorporating human factors when designing online modules ensures enjoyability of the learning experience, as well as effective and efficient online training. From usability engineering, designers have realized that little nuances in screen designs could be the crucial factor between success and failure.

From their experience, designers of learning modules emphasize limiting distracting animation or audio-visual tools to specific learning purposes and focusing on efficient delivery of valid content to users. At the end of the session it is advisable to run an assessment test closely tied to the learning objectives and which truly measures what the user has achieved. Furthermore, studies advocate integrated support from the supervisors and knowledgeable colleagues to evaluate how trainees take what they have learnt into the job and act as coaches to support user integration of the learnt knowledge into their practice (Shrock & Coscarelli, 2007).

The best way to train clinicians is to consider human factors before organizing the training modules. Clinicians need to have training delivered in the most comfortable way. However, limited budget and overcrowded schedules make workaround difficult. In this

case, e-Learning is the most effective, flexible and accessible training method. E-Learning or electronic learning is defined as the use of computer networking to deliver instructions and information to individuals. Several techniques are used in e-Learning including multimedia, Internet or intranet distributed information in the form of bulletins, read-only documents, interactive programs and webinars. They can be asynchronous (the training material deliver to the user and given a defined time to complete the tasks) or synchronous (the trainer sets an on line meeting to conduct the training (Rowh, 2007).

E-learning has several advantages that fit busy clinicians schedules and meet their needs. Most important is flexibility; through e-Learning users are able to access training courses anytime, anywhere, at their own pace. This is of particular value to provide in-time training to minimize the amount of information lost by forgetfulness during the period between training and Go-live, when users need the information they learned (Leung, 2003).

Added to that, e-Learning can tailor training to information needs of the user. Although different clinicians use the same EHR, the needs of nurses are different from pharmacists for instance. In the classic classroom setting all users have the same training regardless of whether they need the information given or not, whereas in e-Learning, users pick the instructions they need and omit the non-relevant information. This benefit saves time and improves user satisfaction with training (Berge & Huang, 2004).

Although e-Learning is reportedly the favourite training method by clinicians in many survey studies, it should not be used a sole modality for training. According to many researchers, mixed methodology or blended training offers the best training in terms of efficiency, flexibility and user satisfaction.

As already noted, instructor-based classes are the gold standard. Learner to learner and instructor to learner training combined with e-Learning enforces user competencies and offers different ways to deliver necessary information. The ability to ask questions and get feedback from instructors and peers has a significant impact on user performance.

Furthermore, in the classroom, the instructor has a variety of ways to explain functionalities and solve problems that cannot be found in e-Learning.

Most of the studies recommend starting with instructor-based training followed by e-Learning. User acceptance and performance is empowered when users are able to contact their instructor and peers face-to-face during the sessions (Aronauer, 2006).

The design of e-Learning has to be learner centered rather than merely information on web pages or documents. The use of learning management systems adopted from accounting, monitoring, and tracking disciplines helps designers to develop e-Learning modules that focus on user needs (Magnussen & others, 2008).

### **Blended learning**

Traditional blended learning is the combination of instructor and online learning modules. By moving learning content to online modules, training classes can take less time, be more flexible for learners, and offer the instructor more space to focus on teaching advanced system functionalities as well as engage trainees in interactive and hands-on exercises. Blended learning has been recognized as an effective training method in many HIT projects. Being cost effective, it delivers high quality training, allows learners to learn at their own pace, and offers an exciting opportunity for classroom trainees to engage, practice, and experiment with the instructors and other trainees as a team, thereby changing classroom training from a passive lecture to a highly active learning environment (Rozenblum et al., 2011).

The following chapter outlines the research methods used in this study to demonstrate how training design concepts that incorporate adult learning principles could be adapted to suit the specific case of EHR training in Acute care Facilities within the Provincial Health Services Authority (PHSA).

## **Chapter 3: Research Methods**

### **Research Setting**

PHSA is one of six BC health authorities, which together with the other five health authorities (Vancouver Coastal Health Authority, Vancouver Island Health Authority, Northern Health, Interior Health, and Fraser Health) serve the geographic regions of BC. PHSA's primary role is to ensure that covered residents have access to a coordinated network of high-quality specialized health care services (BC Children's Hospital; PHSA). BC Children's and Women Hospitals and Health Centers are the major areas served by PHSA, based on the number of staff and population served (Provincial Health Services Authority (B.C.), 2010). BC Children's and Women Hospitals are considered the busiest centers in Canada; there are more than 196,000 patient visits to BC Children's Hospital, including 8,700 child surgeries and 43,100 emergency-department visits, annually. As well, approximately 7,000 babies are born at BC Women's Hospital every year, making it one of the busiest maternity centers in Canada (BC C&W redevelopment, 2012).

Within the PHSA 2010-2013 strategic plan, a strong focus on technology adoption for Improving Quality Outcomes and Better Value for Patients is noted. For example, Strategic Direction # 1 aims to provide seamless patient-centered care through implementing the foundational elements of a Clinical Information Solution (CIS), and Strategic Direction # 1.3 aims to increase the application of evidence and leading practices. Empowered by provincial initiatives, the Executive Leadership of PHSA has identified technology enhancement through implementing an efficient CIS and replacement of the out of date legacy system as a primary strategic goal (Provincial Health Services Authority, 2010).

### **Project Summary**

#### **1. Background**

Since 2005, BC Children's Hospital (BCCH) (including Sunny Hill Health Centre), and BC Women's Hospital and Health Centre (BCWH) have used the Electronic Viewer for

Everyone (EVE) system to support clinical processes, including viewing laboratory results, medical images, transcribed DI reports, patient medical profiles, and document sign, edit and forwarding.

EVE is based on the PHSA Cancer Agency's legacy system. The system is over 15 years old. It is difficult and expensive to maintain and enhance. This technology cannot support the future demands PHSA will place upon its clinical information systems to support the following requirements:

1. Enhanced clinical functions such as structured clinical documentation that provide tools for safe, efficient and consistent communication among clinical professionals.
2. Integrated processes like CPOE and closed-loop medication ordering and administration that will enhance patient safety and quality of care.
3. Interoperability demands among multiple PHSA agencies, Lower Mainland Consolidation participants, and BC provincial-wide agencies and care providers.
4. Automated support requirements that will arise from the Women's and Children's Hospitals Redevelopment Project.
5. Transition from a paper patient chart to an electronic patient chart.

## **2. Purpose**

The purpose of the eChart project (the Cerner PowerChart application that supports a wide scale of EHR functionalities within one application or screen) is to enhance services provided to the patients at C&W (Cerner website). This is a very big project divided into 2 phases. The main objectives of the Stage One of the eChart Project are as follows:

- Establish a technical and functional Clinical Information Systems foundation upon which to build a fully electronic patient record and automated clinical processes.
- Replace the existing EVE Clinical information system completely and in a timely manner.

- Leverage existing infrastructure at VIHA to improve interoperability and interconnectivity with other information systems within PHSA and with the Lower Mainland.

This project will optimize workflow processes across the participating agencies. It will establish a governance framework for on-going system maintenance and enhancements within the shared PHSA/VIHA. In addition, the project will enhance clinical workflow in the following ways:

- The addition of Laboratory and Radiology results to eChart will enhance the clinical value of the Cerner ED system for Clinicians by providing result alerts on the ED Tracking Board.
- Cerner Patient Management will populate eChart automatically reducing duplicate data entry or interface requirements.
- Scheduling can be integrated with other clinical processes to improve process efficiency and enhance patient satisfaction.

Most essential are eChart positions: PHSA should meet current and future demands with a vendor-supported, scalable, and integrated clinical information system.

### **3. Training Plan**

PHSA identified effective and efficient training of the end-users as a key facilitator for smooth transition to CIS, optimum use of technology, and end-user satisfaction. In the very early stage of planning, PHSA focused on a strong strategic plan based on careful assessment of the training needs, concepts adopted from adult learning theories, and the best training methods to fit the busy schedules of C&W employees. This plan outlines the learning activities required for end-user competencies for Go-live.

#### 4. Training Objectives

The goals for training related to C&W are:

- 1) C&W personnel will complete the training, and successfully pass the post-training assessment, for specific functions / processes based on their job functions.
- 2) C&W personnel will adopt the technology and processes related to their job function(s).

The primary objective is to deploy eChart functionality to replace the current functionality offered through EVE. The functionality includes:

- 1- Viewing of:
  - Order status
  - Laboratory results
  - Diagnostic Image reports
  - Transcribed reports
  - Select clinical documentation
- 2- Order Entry for:
  - Clinical Documentation

A careful needs assessment uncovered the following gaps in training as a pre-emptive step to plan mitigation strategies:

- 1) Limited classroom space for training & testing; furthermore, C&W does not have a formal education role for clinical system training
- 2) Limited number of Trainers available from C&W
- 3) Compressed timeline to establish a dedicated training environment; in addition training time will take personnel away from clinical responsibilities
- 4) Poor class attendance due to absenteeism, no shows, competing clinical priorities, patient safety, etc.
- 5) A significant number of personnel do not meet pre-requisite training requirement

## 5. Training Strategy

After training needs assessment was completed, the target population for training and available resources were identified. Trainers had a clear vision to establish a solid strategy for training. This would ensure effective and efficient delivery of training to yield competent clinicians who are capable of taking the knowledge they developed via training into their jobs successfully.

For effective super-user training, the training team identified 134 super-users or power champions. They are mainly clinicians and administrative staff who are familiar with the local workflow, have strong communication channels with their peers at work, are motivated to adopt technology and have enthusiasm for the move to EHR.

Super-user selection has its roots in the diffusion of innovation theory by Rogers discussed in the previous chapters. They are the early adopters and innovators, who adopt technology very early and participate in the diffusion of innovation within their communities through the strong communication channels they have established.

Major advantages of selecting super-users to be effectively trained are:

- Super-users were involved in the CIS procurement process; based on familiarity with the hospital workflow and previous exposure to technology, their training would be more effective, and their capabilities while training would smoothly flow from initial skill acquisition to the procedural knowledge and knowledge compilation stages.
- Within the structure of in-class training, super-users would be more familiar with technology, allowing trainers to allocate more time to advanced functionalities and interactive and hands-on experience rather than basic descriptions of system functions and operations. Depending on the learning styles identified by the trainers, more space can be allocated to allow super-users interact with the system and reflect on their past experiences to the class, which is a fundamental adult learning concept that facilitates effective knowledge translation into practice.
- Super-user feedback on system functionalities and training design is further

recycled to improve system and training design before final release to the end-users. This strategy helps uncover system and training defects early in the initial stages of the project life cycles that are easier to rectify without major financial losses.

- Through peer to peer support, in-class training would focus on super-users allowing 80% of the training activities to be moved to the online module, which will not only solve the limited resources but also offer training that fits the busy schedule of C&W staff.

Strong organizational sponsorship was identified as a crucial step for implementation; creating an innovative environment that facilitates end-users' understanding that CIS implementation is not just the elimination of paper files. Rather, significant values will be realized down the road as timely availability of relevant information to the point of care and decision support tools that streamline the workflow, improve work efficiency, and eliminate redundancy.

Organizational support extends to cover financial losses of backfills, slow work flow at the early stages of Go-live, and ensures efficient backup for scheduling resources, training material and environment. A non-production environment or training environment supported by the organization will be available for all training before Go-live, with sufficient data drawn from real (but de-identified) patients, allowing users to practice in a safe environment with on-site trainer availability to guide and support trainees and help them learn from errors.

It was recommended that training should begin as close to the implementation / activation date as possible. The online modules were available to end-users for 4 weeks, and in-class training occurred for 2 weeks before Go-live. The organization also mandated that all super-users complete the online module before in-class training for better utilization of in-class activity. This would provide more focus on interactive training and allow the instructor to answer questions raised by super-users while conducting the online training.

The number of end-users totalled 3,200 among different healthcare provider categories (including physicians, physicians assistants, nurses, laboratory, DI technicians, social workers, and clinical administrators), of whom, 134 super-users were carefully selected across healthcare domains. One instructor per classroom was designated, with a maximum of 15 super-users per session and one instructor per drop-in session.

When training objectives focused on behavioural learning, such as document signature and forwarding, one to one sessions on the trainee's work site were conducted to ensure an adequate skill level was achieved to perform the needed tasks.

## **Data collection**

A mixed research methodology was adopted to conduct the research, incorporating both quantitative pre and post-training survey questionnaires and qualitative research methodology using interviews and focus groups. The interviews and focus groups were semi-structured in nature to ensure the most relevant topics were covered, while allowing for some flexibility. With permission from the participants and the project manager, they were recorded for the researcher to review using a digital voice recorder. During the interviews, the researcher took separate notes to focus on the key points during data analysis. Immediately after each interview was completed, the researcher reflected on the interview and wrote more detailed notes. Additionally, the researcher transcribed and reviewed the recorded sessions to produce more comprehensive notes.

The main topic of the interview was the challenges and opportunities within training to smooth the process of EHR adoption from the interviewee perspective. The researcher clearly demonstrated the voluntary participation and the confidentiality safeguards to protect the privacy of the participants. This was important to provide a neutral atmosphere and ensure that participants are not to be judged by their opinions.

Interview questions addressed the research objectives, the participants were not given the questions in advance to give a space for the researcher to probe the participants and draw answers from participant perspective rather than pre-set answers.

Since baseline questionnaire preceded the interviews, research could reflect initial results during the interview to solicit explanation and feedback on the questionnaire results.

The fundamental reason for including quantitative research method into the study is to understand the expectations of the users from training, the value of implementing the new system and the organizational momentum and support behind the change through the pre-training survey questionnaires. The post-training survey questionnaire aimed to explore how these variables have evolved after training and use of the system. In addition, using

pre and post-implementation surveys allow the researcher to quantify and compare the results of the study, which provides a more comprehensive understanding of the phenomenon under study and allows the researcher to explore the evolution of clinicians' attitude towards technology as training proceeds.

So conducting different research methods that focus on the impact of training on user satisfaction with technology can provide "corroboration" which means having superior evidence for the result. Other important reasons for conducting mixed research are to complement one set of results with another as in the impact of computer literacy on training that emerged from the trainers' interviews on the research methods and the impact of the same factor (computer literacy) on user appreciation of organization support after training that resulted from the survey questionnaires. In this way mixed research methods allowed to expand the set of results, and to discover something that would have been missed if only a quantitative or a qualitative approach had been used (Tashakkori & Teddlie, 2002).

## Data analysis

The researcher conducted data analysis for the data collected through both quantitative and qualitative researches. For the qualitative data, the researcher utilized exploratory grounded theory to analyze the collected data. Grounded theory is now among the most powerful and leading methods of qualitative research where the research is limited and when the researcher is interested in understanding how individuals interact, engage and take actions in response to a phenomenon (which is technology integration into the workflow in the current study) (Strauss A. L., 1999).

In grounded theory a priority is focused on analysis before data collection, they run simultaneously. The researcher in grounded theory performs line-by-line analysis of data, focusing on the action and process, breaking data into specific types of action, which will be coded by investigator. This is the initial coding stage of data analysis.

Codes that belong to similar concepts are grouped into larger amounts of data called categories, this stage of data analysis is defined as focused coding, and the process of analysing dimensions of a category is referred to as axial coding. The next step is identifying the underlying social process or the core variable that focus on the theory, which explains the phenomenon under study (Charmaz K., 1990).

Exploratory-grounded theory is an inductive research method that provides a flexible methodology for collecting, conceptualizing, and analysis of qualitative data. The process is systematic, but fluid, which allow the researcher to respond to new concepts that emerge from data (Shaffir, Prus R., and Dietz M.L., 1994). The power of grounded theory in creating theory and in depth study of the social phenomena lies in: (Charmaz K., 1990).

- A flexible guideline for collecting and analysing data
- Rigorous methodology for correcting errors and omissions
- Provides tools for studying a social phenomenon in a natural setting
- A distinctive feature of axial coding of the collected data through:
  - Simultaneous data collection and analysis
  - Reliance on comparative study

- Early development of categories
- Strong focus on building theory
- Eliminate bias by delayed literature review instead researcher relies on a broad and general question.
- Careful sampling

The process of data analysis ran in parallel and comparing the data collection process, in other words, once data collected from the interview or the focus group, the researcher immediately transcribes the interview, the patterns are identified from the transcripts, this is the first level of coding (Corbin, 1990).

Level two coding was accomplished using an open coding data analysis where the researcher utilized the notes taken during the interview to isolate similar themes and consolidate the codes abstracted from level one into categories (Corbin, 1990).

Level three coding was achieved by further analysis of the categories revealed in level two and identifying the core variable or the conceptual element that accounts for the pattern of behaviour under study and most relevant to the involved population under the study and involves both the psychological and social processes (Jackson, 1999).

Following concept development, concept reduction was performed, through selective sampling of literature review. In the current study, the researcher conducted initial literature review to explore research gaps. A second round literature review was performed after identifying key variables to identify the properties of the main variables, ensure saturation of categories and further develop the hypothesis statement. The theory is surfaced after selective sampling through reviewing literature relevant to the topic and informing the emerging core concept (Jackson, 1999).

Theoretical coding was adopted in order to strengthen concepts. In this process, the missed or misaligned concepts identified during data collection and analysis are reintroduced into the identified categories, analyzed and compared (Corbin, 1990)

Using pre and post-implementation surveys allows the researcher to quantify and compare the results of the study, which provides a more comprehensive understanding of the phenomenon under study and allows the researcher to explore the evolution of clinicians' attitude towards technology as training proceeds.

## Ethics Approval

An application for ethics review was submitted to the University of Victoria's Human Research Ethics Board on Oct 11, 2012. The ethical approval was obtained Oct 23, 2012. In order to carry out the research at Children and Women Hospital application for ethics review was submitted to the University of British Columbia Ethical Review Board on Oct 10, 2012. The notice of ethical approval was obtained November 13, 2012 just prior to data collection activities (Appendix D)

The following table (table 2) shows a summary of the study timing:

**Table 2: Timing summary,**

<b>Date</b>	<b>Research stage</b>
June – August, 2012	<ul style="list-style-type: none"> <li>Literature reading and preparing literature review</li> </ul>
September, 2012	<ul style="list-style-type: none"> <li>Preparing proposal</li> </ul>
October - December 2012	<ul style="list-style-type: none"> <li>Ethics approval obtained</li> <li>Data collection: Baseline survey questionnaires, interview and focus groups</li> <li>Data Analysis</li> </ul>
Mid December 2012 till Mid-January 2013	<ul style="list-style-type: none"> <li>Post-training survey questionnaires</li> <li>Data Analysis</li> </ul>
January-March 2013	<ul style="list-style-type: none"> <li>Final analysis and conclusion</li> </ul>

## **Chapter 4: Results**

This chapter discusses the results of the survey questionnaires sent to the super-users and the interviews with the trainers.

This study explores current training challenges and opportunities by understanding the adult learning concepts utilized in training, and gaining insight into end-user expectations of training and how these expectations evolved after training and system use. Identifying both areas will help organizations implementing HIT to effectively conduct training that will enhance users' satisfaction with technology and improve adoption. Because a limited number of subjects responded to the post-training survey, the research team attempted to overcome this limitation by including interview questions to the trainers to solicit their feedback from end-users on the training and the application being implemented. These questions were designed to cover any gaps in the survey questionnaires.

### **Pre and Post-training Questionnaires**

Pre-training questions explored the end-users' expectations of training. Specifically, the questions focused on the organization's support, resource availability, co-worker and manager's support in attending the training classes, and the end-users' understanding of the organization's responsibility to the patients as well as other organizations within the province. Questionnaires also looked at users' expectations of various system functionalities and the suitability to their workflow. The research team included questions to explore the computer literacy level among end-users, as well as their previous experience with the electronic health record (EHR).

The post-training survey posed similar questions to explore how training changed the users' expectations, particularly their satisfaction with technology.

Pre and Post-training questionnaires were given to the super-users attending the training classes for the e-Chart module over a period of two weeks. This deviated from the initial study design, in which the intent was to recruit end-users through an invitation email and

by using an electronic survey tool. It was determined by the project manager and the change management leader that the timing of the electronic survey might not best serve the end-users. They were concerned that the surveys may overwhelm the end-users, as they were already busy learning the application functionalities and using the online module.

As a result, instead of circulating questionnaires to end-users via email, the trainers distributed paper questionnaires to the super-users who were attending the training classes. The questionnaires were handed to the super-users at the beginning of the class and collected before the teaching session started. Two weeks after Go-live, the super-users were contacted by email to respond to the post-training survey.

### **Limitation**

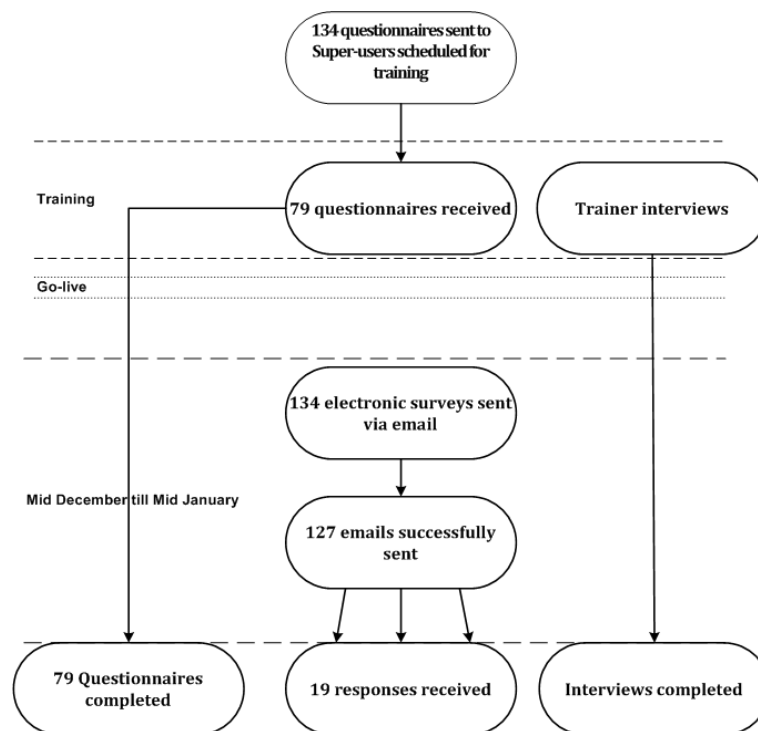
By changing the study participant population, the focus shifted entirely to pre-selected super-users. These super-users are select PHSA staff who is familiar with the work environment and the PHSA culture. This limits the ability to generalize the results. However, the super-users were not selected for their computer or clinical information system experience; instead the focus was on their familiarity with the workflow and social links with their peers. The super-user list was created by the department managers and included a mix of clinical and administrative staff. In addition, the recruitment successfully achieved a high respondent rate.

### *Questionnaire Response Rate*

A total number of 134 super-users, who were scheduled for classroom training sessions, were given pre-training questionnaires. However, only 79 super-users (59%) responded to the survey. The post-training survey was sent to the 134 super-users, but the researcher received 7 email delivery-failure notifications. This reduced the total number of potential participants for the post-training questionnaire to 127, resulting in a response rate of 4.5% (figure 3). When reviewing the literature, studies examining the response rates of health care professionals on internet-based surveys found response rates between 9% and 94%

(Braithwaite, Emery, De Lusignan, & Sutton, 2003). Therefore, comparing response rates to other studies is difficult.

The results of the survey questionnaires were further validated using Cronbach's Alpha, as will be discussed later in this chapter. Results came out as valid and representative of the users' population.



**Figure 3: Flow diagram showing participants recruitment**

### *Questionnaire Respondents' Demographics*

The super-users demographics were identified through the baseline survey questionnaires. The majority were females 86% (n=66), and remained as high as 72% (n=13) in the post-training survey. Age groups varied between the pre and post-training surveys, and a majority were less than 40 years old (65%) in the baseline survey compared to higher age groups (30-50 years) in the post-training survey (77%). The difference in age groups was not statistically significant to impact the study results when using correlational statistics.

In both the baseline and post-training surveys clinical nurses were the majority of super-users (54% and 59% successively), whereas clinical administrators were more prevalent in the baseline survey (36%) compared to the post-training surveys (12%). Other clinical roles (clinicians, pharmacists and ancillary care providers) showed a higher response rate in the post-training survey (30% compared to 5% in the pre-training surveys). The higher percentage of involvement of the clinical groups in the post-training surveys added more validity and reliability to the results when validated using Cronbach's Alpha.

The following table (3) summarizes the super-user demographics identified in the baseline and post-training survey questionnaires:

**Table 3: Baseline and post-training survey questionnaire results,**

	<b>Baseline</b>	<b>Follow-up</b>
<b>Gender</b>		
• <b>Male</b>	12% (n=9)	17% (n=3)
• <b>Female</b>	86% (n=66)	72% (n=13)
<b>Age (years)</b>		
• <b>&lt; 30</b>	30% (n=23)	17% (n=3)
• <b>30 – 40</b>	35% (n=27)	33% (n=6)
• <b>40 – 50</b>	16% (n=12)	44% (n=8)
• <b>50 – 60</b>	18% (n=14)	6% (n=1)
• <b>&gt; 60</b>	1% (n=1)	0 % (n=0)
<b>Clinical Role</b>		
• <b>Clinicians</b>	1% (n=1)	12% (n=2)
• <b>Clinical nurses</b>	54% (n=41)	59% (n=10)
• <b>Clinical administrators</b>	36% (n=27)	12% (n=2)
• <b>Physician assistants</b>	5% (n=4)	0% (n=0)
• <b>Pharmacists</b>	1% (n=1)	6% (n=1)
• <b>Lab/Radiology technicians</b>	3% (n=2)	12% (n=2)

Statistical analysis of the pre and post-training survey questionnaires was conducted using the Statistical Package for the Social Sciences (SPSS), which is one of the most popular statistical analysis software packages available (Shannon, 2000). This included descriptive statistics (i.e., Mean and Standard Deviation).

The research team compared the mean rating of supporting versus opposing viewpoints regarding various knowledge elements in the pre and post-training results. For instance, in the pre-training survey questionnaires, the team compared the mean satisfaction rating (and the percentage) given to various EHR functionalities with post-training rates.

In addition, to assess the reliability of the subjects' responses to survey questionnaires concerning the satisfaction and expectations of training, Cronbach's Alpha was used to test reliability. Using reliability statistics, the alpha coefficient for the pre-training survey is 0.868 and for the post-training survey is 0.978 (table 4), suggesting that the items have relatively high internal consistency (a reliability coefficient of 0.70 or higher is considered "acceptable" in most social science research situations) (Gliem, J. A., 2003).

**Table 4: Reliability statistics results,**

Survey type	Cronbach's Alpha
Pre-training	0.868
Post-training	0.978

Descriptive statistics revealed unexpected results; for example, when comparing expectations of the users regarding the improvement of documentation when using the system, a lower percentage of them expected improvement in the post-training questionnaires. In order to explain such results, the research team included correlational statistics. By correlating different ordinals, such as computer literacy among end-users, results revealed higher expectations. As a result, the research team concluded that computer literacy among end-users was associated with higher expectations and better understanding of the documentation capabilities of the system. Therefore, correlational statistics explained unexpected results and provided more in-depth analysis of the results.

The most appropriate measure of association between ordinal variables is the Kendall's tau test. These tests range from -1 to +1, with the sign indicating the direction of the relationship. A negative result means that as one increases the other decreases. A positive result means that as one goes up so does the other, and the closer the result is to +1 or -1, the stronger the relationship is.

The value of the test provides the approximate strength of the relationship as:

- Less than + or - 0.10: very weak
- + or -0.10 to 0.19: weak
- + or - 0.20 to 0.29: moderate
- + Or - 0.30 or above: strong (Sen, 1968).

When comparing participants' ages in relation to their expectations from EHR training, a Kendall's value of + 0.092 was obtained. This means that a higher age of the super-users who participated in the surveys is associated with a very slight increased appreciation of the role of training in reducing errors and increasing patient safety. In the meantime, results were not statistically significant (p value 0.239).

The following table (table 5) shows the results:

**Table 5: Crosstab statistics results, Improved safety and reduced errors versus super-user age,**

<b>Kendall's tau-c value</b>	<b>Significance</b>
0.092	0.239

From the above table (table 5), other correlational statistics, although effective, did not fit with the study, such as Chi-square tests (needs more than 5 variable per set) and Pearson's correlations (the study does not meet the Pearson's criteria).

### *Questionnaire Results*

Using reliability statistics, mentioned earlier in this chapter, the alpha coefficient for the pre-training survey is 0.868 and for the post-training survey is 0.978 (table 7), suggesting that the items have relatively high internal consistency.

Among the most relevant questions was the expectation that if sufficient technical IT support would be available to operate the new system, the majority of the participants agreed with their expectations and they remained high after training (42.1% in the pre-training survey and 43.8% in the post-training surveys). Also the surveys showed no significant difference in the expectation of sufficient resource availability before and after training (24.6% in the pre-training survey compared to 25% in the post-training surveys) (Table 6).

**Table 6: Sufficient technical support in results in the pre and post-training surveys,**

Survey type	Number	Percent
Pre-training	32	54%
Post-training	10	52%

Using Kendall's tau-c for assessing correlation (table 7), the result shows a weak correlation in the positive direction (0.047), which indicates the training created more understanding and appreciation of the efforts and support allocated to the users, although results were not statistically significant ( $P=0.667$ ).

**Table 7: Crosstab statistics results, sufficient technical support pre versus post-training surveys**

Kendall's tau-c value	Significance
0.047	0.667

Contradicting results were detected when analyzing other parameters related to self-support, co-worker support, and manager support. Training was associated lowered self-motivation and support for the project, perceived support from co-workers and managers

(-0.362), and the results were highly significant. Analogous results were obtained when analyzing adaptability to the new system, understanding the project initiatives and security policies awareness, and completing the online confidentiality training. These negative results were also consistent with the increased age of the users.

Interestingly, when comparing the above-mentioned results with the computer literacy and comfort using computers among users, a positive feedback was found. These findings were statistically significant throughout most of the interpretations (table 8).

**Table 8: Correlational statistics results among different ordinals in the pre versus post-training surveys**

<b>Correlation type</b>	<b>Kendall's tau-c value</b>	<b>Significance</b>
<b>Self-support (supports the organizational change to technology)</b>		
• Self-support pre versus post-training	-0.362	0.001
• Self-support versus computer literacy	0.350	0.000
• Self-support versus computer comfort	0.388	0.000
• Self-support versus prior EHR experience	0.313	0.001
• Self-support versus user's age	-0.029	0.743
<b>Co-worker support</b>		
• Co-worker support pre versus post-training	-0.331	0.004
• Co-worker support versus computer literacy	0.291	0.001
• Co-worker support versus user's age	-0.198	0.014
• Supervisor support	-0.266	0.016
• Supervisor support versus computer literacy	0.249	0.003
• Supervisor support versus comfort using computers	0.289	0.000

<b>Correlation type</b>	<b>Kendall's tau-c value</b>	<b>Significance</b>
• Supervisor support versus user's age	-0.057	0.478
<b>Easily adaptive to change</b>		
• Easily adaptive to change	-0.103	0.341
• Easily adaptive to change versus computer literacy	0.163	0.068
• Easily adaptive to change versus computer comfort	0.179	0.081
<b>Understanding the decision behind the project</b>		
• Understanding the decision pre versus post-training	-0.123	0.307
• Understanding the decision versus computer literacy	0.201	0.024
• Understanding the decision versus computer comfort	0.261	0.005
• Understanding the decision versus user's age	-0.36	0.692
<b>EHR feedback</b>		
• Positive EHR feedback pre versus post-training	0.006	0.957
• Positive EHR feedback versus computer literacy	0.100	0.274
• Positive EHR feedback versus computer comfort	0.067	0.487
• Positive EHR feedback versus user's age	-0.078	0.376
<b>Awareness of the security policies</b>	-0.191	0.077
<b>Completed confidentiality training</b>	-0.021	0.813

These findings were consistent when analyzing the role of training in improving communication within patient care services, particularly when transferring a patient within or outside of the facility. The results were statistically significant ( $P= 0.027$ ) and were consistently significant when correlated with the computer literacy results and the comfort of the users with technology results ( $P= 0.027$  and  $0.024$  successively) (table 9).

**Table 9: Crosstab statistics results, improved communication, patient transfer versus computer literacy and comfort using the computer**

<b>Correlation type</b>	<b>Kendall's tau-c value</b>	<b>Significance</b>
Improved communication (patient transfer) versus computer literacy	0.224	0.027
Improved communication (patient transfer) versus comfort using the computer.	0.250	0.024

However, when comparing survey results related to training roles in improving capability and efficiency of recording diagnosis and symptoms and those related to preparing discharge documents results that showed a significant negative impact, a statistically significant result was obtained ( $P = 0.013$ ). This indicated that after training users realized that the system would not play a role in the diagnosis and discharge documentations (table 10).

**Table 10: Crosstab statistics results, Faster recording of patient symptoms, Faster patient discharge in the pre versus the post-training surveys,**

Correlation type	Kendall's tau-c value	Significance
Faster recording of patient symptoms in the pre versus the post-training surveys.	-0.235	0.013
Faster patient discharge in the pre versus the post-training surveys.	-0.357	0.013

Furthermore, users expected that the trainer would be a clinician and a corporate member, although these results were not statistically significant ( $P=0.341$  and  $0.315$  successively) (table 11).

**Table 11: Crosstab statistics results, the role of the trainer being clinician and corporate staff in the pre versus post-training surveys,**

Correlation type	Kendall's tau-c value	Significance
The role of the trainer being clinician in the pre versus post-training surveys.	0.104	0.341
The role of the trainer being corporate staff in the pre versus post-training surveys.	0.102	0.315

A contradictory result was obtained when comparing the impact of training on understanding of the organization's plan for change and the value behind moving to the new system (Kendall's value =  $-0.362$ ), and the result of correlation between pre and post-training surveys were statistically highly significant ( $P= 0.001$ ). Moreover, when

this observation was correlated with the computer literacy and comfort results, the surveys revealed positive and highly significant results ( $P= 0.000$ ) (table 12).

**Table 12: Crosstab statistics results, supporting the organization change, supporting the organization change versus computer literacy in the pre versus post-training surveys,**

Correlation type	Kendall's tau-c value	Significance
Supporting the organization change in the pre versus post-training surveys.	-0. 362	0. 001
Supporting the organizational change versus computer literacy.	0. .350	0.000

### **Summary of survey questionnaires' results:**

Although the total number of post-training respondents was less than the pre-training survey participants, their distribution was representative of the end-users and ensured validity of the results.

Survey questionnaires showed that super-users had a low satisfaction with the system functions, which became even lower after implementation and system use. Surveys showed similar findings related to understanding the organization's mandates relating to the general population and other organizations within the province. These findings were more evident in the participants' responses in the post-training compared to the pre-training surveys.

Correlating the above results with other ordinals showed that those users who were more familiar with technology had significantly higher satisfaction with the system and a better understanding of the organization's initiatives and policies.

As mentioned earlier in this chapter, the purpose of the survey questionnaires was to explore the expectations of the end-users from EHR training, and how these expectations evolved after they received the training and started to practice using the new system.

These results were linked to the interview results to provide a more comprehensive view of the impact of training on user satisfaction with technology.

### **Interviews**

The researcher, being a Co-op term student at PHSA during the period of study, had the opportunity to communicate with the trainers on daily basis. Using both formal and informal communications, the researcher was able to recruit all the trainers in the project. The researcher was keen to keep notes during the interviews in order to eliminate possible bias from being in close relation with the project team.

A total number of seven trainers were available for the project and all of them were recruited to participate in the interviews. Five interviews and 2 focus groups were conducted over 4 weeks during the training and for two weeks after training until saturation was accomplished.

Some interviews involved more than one participant. Interviews were long and deep enough to bridge the gap of limited trainer availability. Interviews successfully covered the points and questions raised during the study.

The interview questions explored the current challenges and opportunities trainers perceive when they conduct training for end-users on clinical information systems. As the investigator conducted the interviews, new themes evolved, and the investigator, after permission from the participants that was obtained at the end of each interview, scheduled further meetings to discuss the new themes that emerged until saturation was achieved.

### **Interviewees' demographics**

The interviewee demographics were identified at the start of each discussion. The age of the trainers ranged between 26 and 47 years, with an average of 38. The total years of experience in training was between 1 to 12 years, with an average of 7.8 years. Six of the interviewees had a clinical background within PHSA, which together with the long years

of experience in healthcare contributed to the interviews being more informative, and saturation was attainable by the end of the study despite the limited number of participants.

Trainer demographics are summarized in the following table (table 13):

**Table 13: The interviewee demographics,**

	<b>Age</b>	<b>Gender</b>	<b>Years of experience in training</b>
<b>P1</b>	26	F	1
<b>P2</b>	42	M	8
<b>P3</b>	43	F	10
<b>P4</b>	45	F	12
<b>P5</b>	47	F	8
<b>P6</b>	33	F	10
<b>P7</b>	31	M	6
<b>Average</b>	38.14		7.8
<b>Mean ± SD</b>	42 ± 7.5		8 ± 3.3

### **Interview results**

Analysis of data using exploratory-grounded theory yielded several labels such as budget, schedule, attentiveness, captive audience, face to face, user's own pace, and scenarios. Those labels were grouped into codes as financial resources, communication, in-class training, and user's own experience.

The labels were further grouped into categories or subthemes as organizational support, communication opportunity, classroom training, and principles of Andragogy.

The final coding level was achieved when those categories were linked together and to the literature findings to develop the themes that explain the interview results and contribute to the final theory and recommendations.

Three main themes emerged from the interviews: 1) The challenges and opportunities in the current training for EHR in relation to technology uptake by the users. 2) Methods of

training and user acceptance of each method, and 3) The incorporation of adult learning principles and learning styles within the classroom training.

The following provides a detailed description of the themes that resulted from interview script analysis.

#### **4.1 Challenges in current training**

##### **4.1.1 Organizational support.**

During interviews participants were asked to what extent they felt the organization was supporting their training to achieve the training goals. All the interviewees addressed this question. Interestingly all the participants recognized that organization support in terms of funding, devices, and classrooms was lacking.

The following quotations from participant interviews reveal the perceived lack of support:

*“The easy answer is no, since if you look at the availability of appropriate resources in place, you do your training and you know it that you will not have everything you ask for at your disposal, so usually in terms of funding you know that you will not have enough funding”*(Participant 1, Lines 4 to 7).

*“Do we have the funding to provide every user with the devices and material to use, no, but we work with our limitations, so to answer your question, did we get enough support, no we get the minimum support we need to continue”*  
(Participant 2, Lines 14 to 16).

The participants further expressed the contributing factors to their sense of lack of support in 4 main categories:

##### **4.1.1.1 Resource availability**

All participants focused on the lack of resources to provide effective training. Trainers perceived that the organization had to ensure availability of sufficient funding, classroom

space, number of trainers, and their dedication to training. The lack of these resources was a major challenge that faced the trainers:

### Funding

All participants stated that the lack of budget allocated to training was a major challenge for on-going support and recognized that support was limited to 2-3 weeks post Go-live and added that on-site availability and support needed to extend 24/7 for 2-3 months. They also emphasized that after 2-3 weeks the support was conducted through a help desk that queued the incoming calls from users and did not provide timely support, which frustrated them. In addition, a help desk is often not fully knowledgeable about the application and may not provide an adequate solution. The participants valued the availability of on-site support for 2-3 months by the trainers and those who were involved in the project implementation. Through visibility and asking questions about the application, getting feedback and providing timely support, user satisfaction and technology uptake would be significantly influenced.

The following is quoted from participant interviews:

*“It is money for super-users for 2-3 weeks post Go-live support, because support is for 2-3 weeks post Go-live but there is no money for 2 month post Go-live support and then given to the ops and ops have their issues too, so when they have issues they are raised in a queue and users don’t have a response right away”* (Participant 5, lines 164 to 167).

*“In the previous project I was involved we did a lot of training analysis and a lot of training support for 3 weeks on-site 24/7 that was still not enough, because the staff out there still have questions and answers and support in time”* (Participant 5, lines 124 and 125).

Two participants raised the issue of budget constraints that would prevent support backfills for users and allow them to attend class sessions. They also added that although users are paid for extra time when they come to class, attendance outside working hours and during days off was inconvenient for the users.

The following quotations from participant interviews express the difficulties encountered with scheduling:

*“Tight schedules is a big problem, I find a lot people that are scheduled to come but they cannot especially with the clinical needs, so if someone is scheduled to come for 2 hour and his work is very busy, they cannot, other people are between meetings and they are trying to do so, may be they don't get the full benefit because they try to rush the things out” (Participant 3, lines 188 to 192).*

*“The busy schedules just can't make it, that is a big challenge, it is defiantly an organizational support, like if getting these jobs backfilled, but that if you get a back fill for 20 people for 2 hours that is going to be a lot of demand” (Participant 4, lines 194 to 197).*

### Classroom Space

Two participants explained that they did not have a classroom dedicated for training and that they had to compete with other activities for training. They expressed that a dedicated classroom could better accommodate the busy schedules of the trainees:

*“You will have trouble finding the appropriate classrooms and appropriate devices, enough desktops. In terms of resources we had one person, it would be ideal 3 Maybe 4 trainers” (Participant 1, Lines 8 and 9).*

*“We look at resource when we ask for as resources to make every one comfortable, it is considered a luxury, but what it usually comes out is usually the per minimum, we are lucky we have a classroom, but do we have a classroom at our disposal, no we are competing with other resources” (Participant 2, Lines 10 to 13).*

One participant said that if the classroom was larger, it would have accommodated a larger number of users and would have been able to cover a larger number of the end-users rather than to focus only on the super-users:

*“So I think a larger room would be nicer so we could train 20 or more people in each session” (Participant 3, lines 19 and 20).*

### Devices

In terms of devices, one user addressed the lack of a sufficient number of computers to accommodate the number of people attending the session. However, he added that there was an opportunity when a group of users worked together and provided peer support during the session by sharing the same devices.

As stated in the participant interviews:

*“What did happen a number of times, and because we were training a large number of students, we ended up having to share some computers. A number of times we had, like, 15 people”* (Participant 3, lines 15 to 17).

### Trainers

All the participants identified the limited number of trainers and their involvement in other project activities. One participant said that she had different roles within the project in addition to training; at some point she was pulled out from training to conduct other tasks.

The following quotation from participant interviews expresses the impact of limited numbers of trainers:

*“I want to add something, when participant 1 said we only have one trainer in the time we need 3 here, I can also add one trainer was away from the communication for so much time, it has fragmented the team so if I had more people it would be one who was away, since it would be a burden to have him catch up. So if one of the team was away and have the job split between resource it would be easier to arrange”* (Participant 2, lines 18 to 22).

*“I found this has been challenging that I had to wear multiple hats in the project, so that has been challenging, it would be better to be focused on training”* (Participant 6, lines 96 and 97).

#### 4.1.1.2 Management support

Management support was raised by one participant who identified that the organization should encourage a culture of innovation and change and ensure that users understand the benefits of technology. He added that the trainer should be able to identify these initiatives and to include them within the training as an example that the organizational benefit is to improve patient safety. The trainer should be able to demonstrate the safety advantage of technology up-front when conducting training sessions.

As noted in participant interviews:

*“When it is organizational priority at the clinical side, I find it is a gap I noticed over the years”* (Participant 7 lines 28 to 30).

#### 4.1.1.3 Ownership by the clinical leaders

One participant identified a lack of clinical leadership support as a major challenge. He also added that despite that the project had support from the stakeholders, the clinical leaders did not have enough uptake. The reason, he stated, was the limited functionality of the applications offered to clinicians at this phase.

On the topic of limited functionality, five participants also commented that availability of the legacy application that ran in parallel with the new application limited motivation to adopt the new system. Although this method helps to support smooth transition and eliminate the risks of workflow disruption, users were not forced to use the new system and viewed the application as luxury in some cases.

They further explained that the organization was pressured to implement limited functionalities at this stage. The reason was part of the lower mainland consolidation initiative mentioned in the previous chapter. This implementation plan will align the provincial initiatives and maintain exchange of patient information among other health authorities that still use the legacy systems.

The following is quoted from interviews:

*“Because I think that there is a gap when training is not supported by the clinical leadership, because I think that clinical leadership has to be really on board, otherwise your participants don't show up or they show up and pay no attention”* (Participant 7 lines 26 to 28).

#### 4.1.1.4 Readiness for change

The change team was composed of a change leader and change agent (six out of seven trainers were change agents within the same team). The change management team was responsible for reducing the behavioural resistance among users to the new technology, in order to achieve a more rapid and productive introduction of information technology.

Participants recognized that an effective change strategy requires converting a

technology-centered tension into welcome opportunities. Such opportunities enhance the sense of ownership among the users. When users develop such a sense of ownership, the transition to the new system will be smooth and successful.

Within the current phase of the project, achieving a blend of good behavioural change and technical skills is difficult in the absence of the clinical ownership. The change management team recognized that it is a fundamental role for the trainers to convert negative points into positive emotion like optimism, creativity, desire and motivation to adopt technology.

The following quotation from participant interviews summarizes this point:

*“It is not a product issue, it is an organizational readiness to implement a lot of new functionalities, not just a lot of new functionalities but also the slow move for example lab, there has been a lot of change of the Go-live date, and the lab were not really on board at the start of the project, not really keen to do this work anyway, so it was a sort of kinda drag their feet into the project. That is my high level analysis of the project uptake” (Participant 7 lines 71 to 76).*

The following figure (figure 4) summarizes the factors contributing to the lack of organizational support as raised during the interviews with the trainers:



**Figure 4: Subthemes contributing to organizational support,**

#### 4.1.2 Limited clinical functionalities and availability of the legacy system use in parallel

All participants expressed clinicians' lack of motivation and ownership of the new system because they see the clinical value of the product as limited, such as laboratory and microbiology viewers, which are already available with the legacy system (EVE).

As mentioned, PHSA had to stage the implementation of the product to align with the lower mainland consolidation initiatives. When the full vision of the lower mainland consolidation project "One patient, One record" is accomplished, different organizations will have an interoperable EHR that can exchange and use patient information.

Participants conveyed that despite highlighting these provincial initiatives through training and in the classroom, users did not have the motivation to use the new system.

However, the trainers assume that with further projects that incorporate more clinical functionalities clinicians will develop this sense of ownership.

The limited clinical functionalities impacted the managers as well, as they rated the project as low risk, a factor that limited funding and support. They also identified that the limited functionality attributed to lack of buy-in from the clinical leadership.

#### 4.1.3 Limited engagement of the super-users

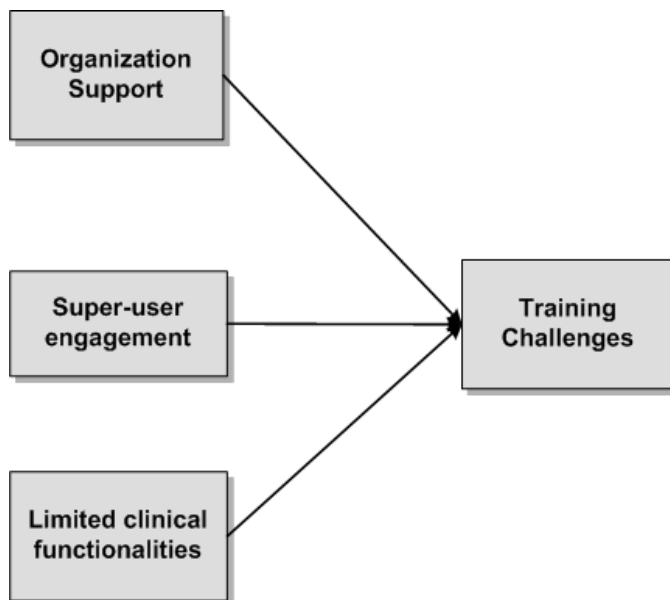
The training team anticipated these challenges and was keen to identify the super-users early in the project and engage them in different project life cycles. This strategy allowed them to understand the value of the product and the provincial initiatives. Those super-users were considered the power-champions who would transmit information throughout the organization and provide the on time and ongoing support for their peers.

The strategy appeared successful, however, engagement and rewarding of the super-users was limited, so by the time the project was going live, super-user role was limited.

Suggestions from participant interviews indicated a desire for more follow-up with super-users:

*“For pulling people to do it, so they have to have an incentive to do it, I think the idea of retreat cards [is] a good idea”* (Participant 4, line 24 to 26).

To summarize (figure 5), the participants identified three major challenges faced while preparing and conducting training. The limited organizational support in terms of resource availability, limited clinical functionalities, and limited super-user engagement were the main challenges to achieve the training goals.



**Figure 5: Training challenges,**

Although other challenges have been discussed in the health informatics literature, participants focused on the above-mentioned challenges as the most prominent within their work environment.

With those challenges in place, the trainers were keen to identify opportunities that training could provide to the users. The following will discuss in detail the opportunities for training that might help to bridge the training gaps and help trainers to achieve their training goals.

#### **4.2 Opportunities in training**

From the interviews, the participants identified that training provides a good communication tool that can be used to convey the provincial initiative. They also noted the enhanced computer expertise among the end-users who were more motivated to adopt and learn advanced system functionalities than in past training programs

Training as an opportunity for effective and optimum use of technology:

##### **4.2.1 Opportunity to convey the provincial initiative**

One participant identified training as an opportunity to convey the provincial initiative, and promote the project, since training, and in particular classroom training, has a captive audience.

The following is quoted from participant interviews:

*“For me what I see is to work on-site to build a relationship and so independent of this project there could be a scope of branding or getting the word out”*

(Participant 6, lines 79 and 80).

##### **4.2.2 Excellent communication tool**

Other participants identified training as an excellent communication opportunity with the users. One participant identified that while conducting the classroom training the trainer is able to get a “pulse” by checking with the users how they navigate, how they feel about the application, and their perceived ease of use.

Trainers also probe super-users for questions to get feedback, including the organization's feedback. Through this strong loop of communication with the users, the trainers would be able to identify the positive and negative points within the implementation. Trainers can also identify issues such as problems concerning the fit of the application to the workflow and functionalities that users appreciate the most. The feedback is communicated to the project and change management team in order to enhance implementation and manage issues before the final release and Go-live.

The strength of this communication loop can be seen in the valuable feedback given in participant interviews:

*“Yeah, I mean the training has a captive audience like the classroom training, I would agree personally I am a communicator more than like a trainer, so personally I like to check with every one and get their questions and feedback during training. Inevitably we are going to get a pulse, how people are able to navigate, how people feel about it, how people are keen about it, are just coming and bounce off or they are really keen, and how is the organization is responding to the project as well as the product, so yeah you can take that information from your training classes back into the project planning through the communication person, so that's why the training and communication people, I think that relationship is really strong, so did the change management team which consists of training, communication and myself as a deployment lead, so that loop is very strong in this project, so you have to take what you get from participants and do something with it ideally” (Participant 7 lines 102 to 113).*

*“I think that meeting with people that will be supporting the application is good because you make that contact, so in my role as a support person when you get a call from a person or you see his name in a ticket, I know that person, I have taught him in class, so I tell him, so you got a better means of communication that way, same thing when we are going to floor support meeting those people that joined the sessions face to face, so when we Go-live and get the calls and go to their locations, then it gets thing easier and on the right flood. So knowing lot of people will be great benefit also after Go-live and during support” (Participant 3, lines 199 to 206).*

*“For me what I see is to work on-site to build a relationship and so independent of this project there could be a scope of branding or getting the word out” (Participant 6, lines 79 and 80).*

#### 4.2.3 Enhanced user readiness for technology

All users also identified that the advancement of technology and its use on a daily basis has eliminated the problem of computer illiteracy among users to a great extent. One participant noticed that users are more familiar with technology and they come to class already excited about the use and integration of technology into their practice. This is also reflected in the training design. The trainers were able to proceed more quickly to training users on advanced system functions rather than spending time on basic computer skills as one participant stated:

*“Nowadays they do things as they go to school on computers, so they have the basic knowledge, the training is moving more away from self-paced booklet training to online tutorials” (Participant 1, lines 105 to 107).*

Furthermore, through training, the participant identified that clinical “keeners,” or those having interest in technology and able to come up and share information with their peers, could encourage other users to adapt the application to their workflow.

As noted in the participant interviews:

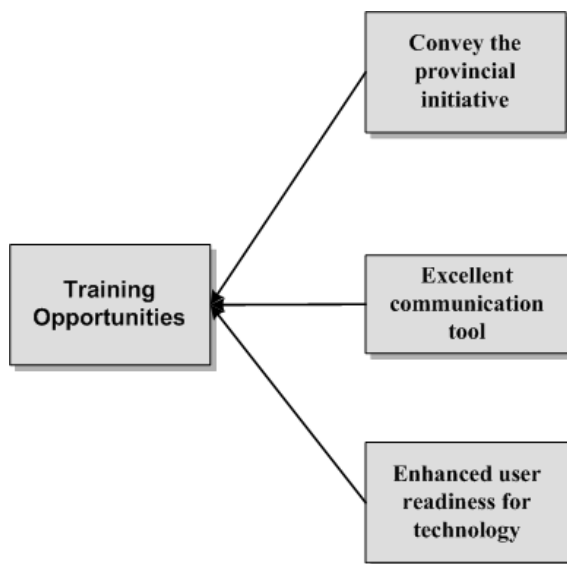
*“I would agree it is really within the clinical area to help support each other like lunch and learn, or hey let’s spend 15 minutes how to create, you really need that kind of person who has that, for example, my older works in a clinic as a mammography technician and she figured out how to set up some different lists and stuff because it seems that every one having a trouble matching previous films, so figured out how to sort these things so it visually very effective, and she showed everyone how to do it including the radiologists, so that was a keener, who stepped up and shared the knowledge, that kind when it happens, there is only not so much IMITS can so but so definitely training is a shared responsibility” (Participant 7 lines 48 to 57).*

To summarize (figure 6), participants regarded training as an opportunity to create an environment ready for technology through communication with users. The trainers utilised different modules to let users understand and align the project goals with the organizational initiatives and users’ needs. Through this loop of communication and

engagement, the project team would be able to use feedback from the users and convey it to project managers and developers to bring the project to success.

Furthermore, through this loop of communication, the change management team can identify pockets of resistance and react accordingly and in a timely fashion.

The interviews also observed an enhanced level of computer literacy among users. This observation opens the way to progress with training into advanced and more complex system functionalities. When users use the system effectively, they develop a sense of professionalism and ownership of the new system.



**Figure 6: Training opportunities,**

Other factors that contribute to the sense of professionalism among users include recognizing that users are professional learners and that the trainer has to build on their prior experience. These factors are drawn from the principles of adult learning or Andragogy and should be incorporated within the training design and practice.

### 4.3 Incorporating learning styles and adult learning principles

All participants identified that awareness and understanding of adult learning principles is crucial for effective training. One participant noted that since he is not a formal trainer he did not have this education, however, he was interested to develop the knowledge necessary for training adults.

Application of adult learning principles varied among participants; one participant noted that a focus on the learners' experience is critical for adult learners; the trainer should be able to focus on what the learners know rather than what they don't know:

*"I like to survey at the start of the class to see where they are coming from if they are bed-siders or registration clerks, if it is all registration people then I don't need to talk about the impact on the bedside that much, and focus is on a slightly different direction, more to pointing to the results rather than organizing the workflow I guess"* (Participant 3, lines 114 to 118).

The participant further added that the previous experience of the learner may be negative towards the application. In this case the trainer needs to acknowledge and show empathy with the learners rather than ignoring their negative experience.

The participant interviews provided detailed commentary on this point:

*"Say they worked in Calgary with the product and they were totally frustrated, know the facts really helps but you want to lead, so the person to deal with this, you know the facts but you still acknowledge the learner, so let them have the reaction don't be threatened by it, like someone having an emotional reaction to the product, don't ignore, just try to listen and have that valid communication, really helps. So say, I know that was really difficult for you and I understand that. Because sometimes you know the product like sometimes, yes I had that, I heard about that actually, that was a tough time with that implementation, so and then try to make them focus on the objective of today or the class, so with this what we have tried to do to address that there is something that you can offer like you can address it or change it, but most importantly the person comes first and then the facts, the data and the training come second"* (Participant 7 lines 217 to 228).

Other participants highlighted the classroom opportunity of training to enhance the critical thinking among users by engaging learners in discussions related to system application in real life scenarios. Participants offered the users the chance to ask

questions; this method of engagement was particularly useful for the trainer to identify participant learning styles and pace the training according to their needs.

As stated in the participant interviews:

*“Because we understand that not every one learns well by just looking into the online training, some people learn better in the classroom setting, some people learn better by asking questions, some learn better by hands on doing it, so in the classroom we have instructions, we guide them through having them use the application, we follow them through and we have them try the application out. So we try to touch all of that to make sure we meet all different styles for people.”* (Participant 1, lines 112 to 117).

Awareness of the project objectives and how to align that with the organization’s strategic plans has been raised by one participant and was linked to identifying the benefits for the end-users during training:

*“You need to tell them what benefit they will get out of it and show it to them and what situation they can use it for example, you have to direct that to each group you know if there is a group of emergency staff then their needs are different from maternity for example”* (Participant 4, lines 181 to 184).

*“I think you have to be able to plug into that stuff and be aware of it an know what’s relevant to the learner, like if the project is within the concept of patient safety initiatives, then use that language, bring it up make sure you are aware of what the objective of the system is, so every system has an outcome like goals or this what we are trying to achieve from IT prospective which hopefully aligns with the organizational one so you know when we are talking about why, ideally you know the project is already aligned with those objective”* (Participant 7 lines 159 to 164).

*“I think that staff are over loaded with new information and change and coming out from all directions, now they need to know what do I need to do my job, I don’t need any extras, very focused education because the change is happening all the time”* (Participant 7, lines 24 to 27).

All participants have noted the ability of the trainer to organize the training sessions and tailor different learning style. One participant noted that, depending on the application and the content to be taught, the instructional content may vary but the hands-on training

also has to be varied to the same extent in order to fulfill the needs of users who want to learn by practicing the application.

The following is quoted from participant interviews:

*“I think if it is a simple section, I give them a bit of introduction before the hands on, I think if it is complicated that where we use the trainer to tell them what we are talking about, what is important to me is you have to spend the time equally between the 2, overview is that much time and hands on is 50%, in complicated cases overview will be a bit longer but hands on will extend the same time”* (Participant 5, lines 236 to 240).

Another participant, on the other hand, noted that throughout the session he could identify those who may be falling behind the class. He would then focus more on them, slow the pace of the session, and engage them through class activities by encouraging them to ask questions and engaging them with other groups that provide peer-to-peer support.

The following is quoted from participant interviews:

*“Is really a mix bag of things, a 2 hours sessions is too long, too long for one to absorb information, we have designed that 2 hours so that they can play with the system and realize that they may learn better by just doing that themselves, we have to build the time that they can use the system and play with it not just sitting there and listening to us”* (Participant 1, lines 124 to 127).

One participant went beyond the adult learning principles and ascribed the trainer role as more of a coach or facilitator, able to deal with the users’ emotions, frustrations and previous negative experience with technology:

*“I think good trainers are also good coaches, like good facilitators, because that is really this doesn’t have to do with training, you know training you have to be able to deal to people’s different reactions, their frustrations, or their previous experience with the product”* (Participant 7 lines 213 to 216).

#### Awareness of user needs

All participants identified having a trainer with a clinical background as an opportunity to familiarize users with the application. One participant noted that being a clinician has a

psychological value to the users making them feel that the trainer has experienced the same suffering and shared the same responsibility to provide patient with optimum care:

The following quotations from participant interviews convey the value of clinician trainers:

*“I think it is, I am nurse and I start with courses to tell them that I am a clinical person and this is my background so we are both looking at the application from the same point of view, like how it is meant to me as a clinical user, and it breaks the ice and I think it helps them asking questions, more than for an IT guy, rather than just sitting there, they would feel more comfortable asking clinical questions, like if I had this patient”* (Participant 3, lines 104 to 109).

*“Ok, so clinically, yes, my background has been in clinical education, and yes, that is a big part getting to know the staff I am responsible for and then using that knowledge to have a better learning plan for them, I guess that just knowing the staff has been important to me and building on their past experiences”* (Participant 6, lines 34 to 37).

Another participant noted that being a clinician he was able to draw scenarios from the existing workflow and was able to probe users for questions related to the clinical practice and provide them with efficient answers. One participant who did not have a clinical background identified that he was able to overcome this challenge by developing scenarios from the users and recycling these scenarios in different classes

The following is quoted from participant interviews:

*“Yes, for me not having the clinical background, I usually go to the classroom with scenarios in my pocket, I ask users to develop scenarios and recycle them with other classes,”* (Participant 7 lines 181 to 183).

One participant noted that learning styles are identified once the users begin hands-on training with the computers. He added that they emerge as excitement and stress in reaction to technology, and from there he tailors his training and support for different styles:

*“Usually not until they get on to the machine, they usually don’t identify themselves not for a while till someone comes and says I don’t know much of the*

*computers, but it is not usually till the hands on part, then you probably will circulate and you kinda notice some people are in pace and some people are behind it, so you spend more time with them and slow down” (Participant 3, lines 79 to 83).*

To summarize, trainers recognized the value of incorporating principles of adult learning into training both implicitly and explicitly. The trainers explained the value of the system to facilitate their practice, timely availability of patient information, and documentation of care activities. Trainers also highlighted the importance of training for optimum use of the system functionalities. The optimum use of the system will be reflected in performance and service quality. In this way, the learners develop a clear understanding of the benefits of training and develop a desire to learn and integrate the system into their work.

Engaging users during training was vital to achieve the training goals. Trainers engaged the learners through offering them the opportunity to ask questions and initiate discussions in order to develop critical thinking among the learners. Through these discussions, the trainers were able to identify different learning styles and tailor their training to match those styles. They were also able to provide hands-on experience for those who learn by practice and offer information and instructions to those who prefer to learn before practice.

Trainers also incorporated scenarios drawn from the learner’s own experience; this method developed self-motivation among the learners.

In addition to the principles of Andragogy, trainers identified that the methods of training could contribute to the principles of adult learning and subsequently optimize their learning experience. In what follows, these training methods are discussed

#### 4.4 Training methods

The trainers identified that training is a valuable tool, but that there are also barriers to be faced within organizations that affect the kind of training needed.

Among the organizational barriers to delivering effective training are the limited budget allocated to training, the small project size in terms of functionalities, and the large number of users. Given the barriers within the organization, trainers found that although there was value in both online and classroom training, blended training was ideal. To reach this decision, trainers also drew from their past experience on similar projects.

### Barriers to Teaching

All participants identified that the limited funding was a major factor in moving most of the training material into the online module.

The following is quoted from participant interviews:

*“Ideally it would great to have multiple sessions, but because of the time constraints, we only have 2 weeks to do excelling users, and we have to fit them into the 2 hours sessions because we don’t have the resources”* (Participant 1, line 129 to 131).

*“Funding is important for the hands-on approach, and I believe that’s why we have got much to web based training, because, what is built people can do it 24/7”* (Participant 4, lines 20 and 21).

Participants further added that with the limited funding it was not possible to backfill the total number of 3200 users when scheduling for class training. Similarly, with the limited number of trainers, it would be impossible to schedule trainers for the large number of classes needed to accommodate the users.

Another challenge was the limited number of functionalities being implemented and the availability of the legacy system running in parallel. As a result, the project team considered the project as low risk (being only a viewing application), and this allowed the training team to move most of the training material for users to the online module.

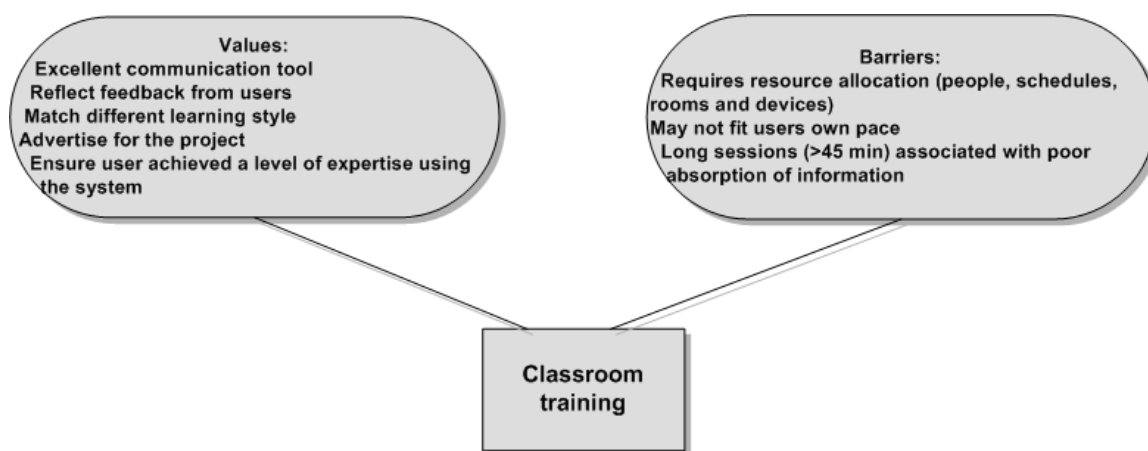
The following is quoted from participant interviews:

*“I think if it was bigger and more components are installed they would be encouraged to revisit the application training”* (Participant 5, lines 68 to 70).

*“Again you have to look at what we are trying to do, we have the luxury of not diving with the training, simply, because the release of the project is just a viewer” (Participant 1, lines 141 and 142).*

*“So if I don’t use it every day it will not be in the background, we get forced to use it, when we have different functions that keeps application always in the computer back ground” (Participant 5, lines 82 to 84).*

*“We know that 2 hours sessions is too long, we know we give them a lot of information, we are not too scared of they forget 80% of that they are given, because it is a view only product, the lab results we are giving” (Participant 1, lines 149 to 151).*



**Figure 7: Classroom training,**

Classroom training:

Trainers viewed classroom training as the gold standard to effective training. This was of particular importance when the application involved documentation entry, where the risk of inadequate use of the application is high. The training team decided to provide in class training for this particular group of users to ensure all their questions were answered, and to ensure a higher level of performance when using the system.

The following is quoted from participant interviews:

*“So we focus on the PowerNotes users, bringing them to the classroom sessions, we that we just don’t want to leave them with the online sessions and then questions afterwards” (Participant 1, line 142 to 144).*

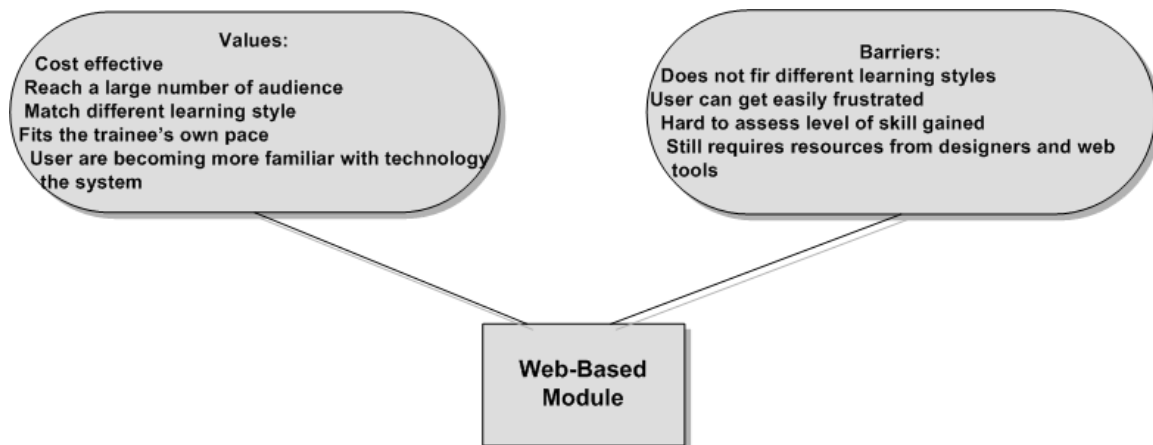
*“But in order to build that base of competent users we made the classroom sessions in order to build that level of competency and once they are out there any new user will go into the online training and rely on their peers” (Participant 1, lines 178 to 181).*

*“Being a nurse I think we will never move away from the class training, because of workflows and things like that, for me if you want an electronic application to be in success you need to link the training to the workflow and you can’t do that electronically” (Participant 5, lines 178 to 180).*

*“The project will allocate money and time to get the people up to speed and the only way to ensure that somebody has completed the training or somebody understands is to have somebody placed in front of them” (Participant 1, lines 201 to 203).*

*“Only the classroom sessions on areas that we want to focus, have the users do the online training, they come back with questions, that we can answer them, we also go over the major highlights of the online training” (Participant 1, lines 112 to 114).*

*“Yes, they benefit a lot from coming to class, because the online training is not proactive, basically it tells them do this and click that but it doesn’t give them the real chance to play with the application” (Participant 3, lines 84 to 86).*



**Figure 8: Web-based training,**

### Online Training

Regarding the online training, three trainers identified the online module as effective since most of the users are computer literate. Other participants added the advantage of

the online module is that it fits the user's own pace, and this is particularly valuable for busy clinicians.

The following is quoted from participant interviews:

*"I find we are moving more and more to the online training module the reason for that you can actually get to a larger target audience easier, they can pace themselves, they can use the information over and over again, they can take the information as many time as they want, they can work at their own pace"* (Participant 1, lines 187 to 190).

*"But I think the online training is the future and it has that much of advantage of having a wider audience than just the classroom or the reference material alone"* (Participant 1, lines 196 and 197).

*"I also think web based training is much better than it was several years ago, based on that people starting to know how to use a web page, I remember when people did not know how to use the mouse. So you could not expect them to do training, but it is much better now"* (Participant 4, lines 26 to 29).

However, three participants identified a potential risk of relying solely on the online module being increased frustration of the user when they have questions or did not understand a particular element:

*"That being said, online training doesn't work 100% if you don't have reference material to back it up, so when somebody completes the online training they do need some way to practice that information so it is a mixture of things"* (Participant 1, lines 193 to 195).

*"By following the online module it just tells to click here and do that, it doesn't tell them feedback, like if you click while you are supposed to click there nothing happens"* (Participant 3, lines 99 to 101).

*"I agree with P1, I think that scope that availability of the online material and asking the staff to go online and train themselves without feedback, it is not very positive"* (Participant 5, lines 10 and 11).

They further offered a solution in the form of drop-in centers where users could come with questions and practice the application in the presence of a knowledgeable trainer who can answer their questions effectively and walk them through the application.

The following is quoted from participant interviews:

*“I did help in the drop in centers, so people would come in when not in schedule, but we did not have many people drop by, we made it clear that someone should be available when someone wants to come, and to the online modules”*  
(Participant 3, lines 41 to 43).

*“Because the physicians wanted a supported environment to go to complete the learning and ask the questions and get support, so we expecting the drop-in centers to be busy the post Go-live”* (Participant 6, lines 62 to 64).

*“I would think it would be very nice to have information kiosks in the different areas of the hospital leading up to Go-live, I think this would have partnered very well with training because a lot of hearing is people want to know why, they have more questions, so I have had a budget, I would definitely put in for information kiosks”* (Participant 6, lines 70 to 73).

However, with the online module, one participant also noted the impact of the continued modification of the application while training materials had already been released to the users. Because of the application modifications the content of the training needed to be modified several times, which was inconvenient to both the trainers and the users. The participant also identified the related issue of tight schedules and suggested there would have been a better outcome if the training content were designed after the final modification and update to the application. This would ensure consistency of the training with the application.

The following is quoted from participant interviews:

*“The guy who developed the e-Learning with me found it frustrating because they were changing and building past the time after the module was posted”*  
(Participant 6, lines 5 to 7).

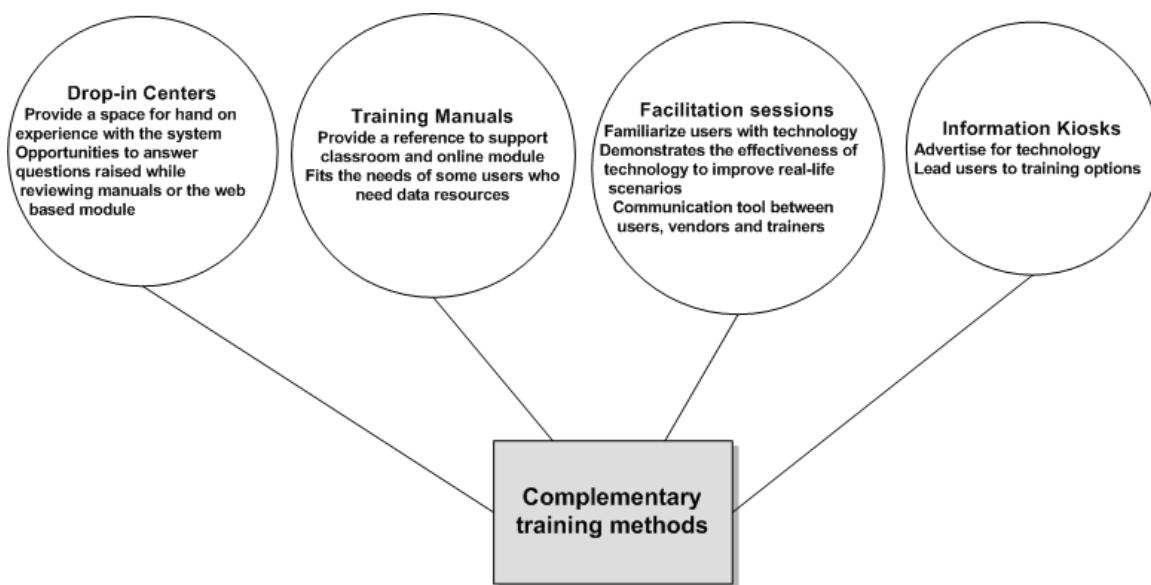
All users agreed that the online module is expanding with users’ familiarity with technology and noted the improvement of the online module design by including different interactive materials.

One participant focused on the value of dividing the online module to 3 sessions. This would reduce the information load on the users and enable them to participate according to their own schedules.

The following is quoted from participant interviews:

*“The online module is divided into 3 modules so that learners can pace themselves in the way [they] learn”* (Participant 1, lines 127 to 129).

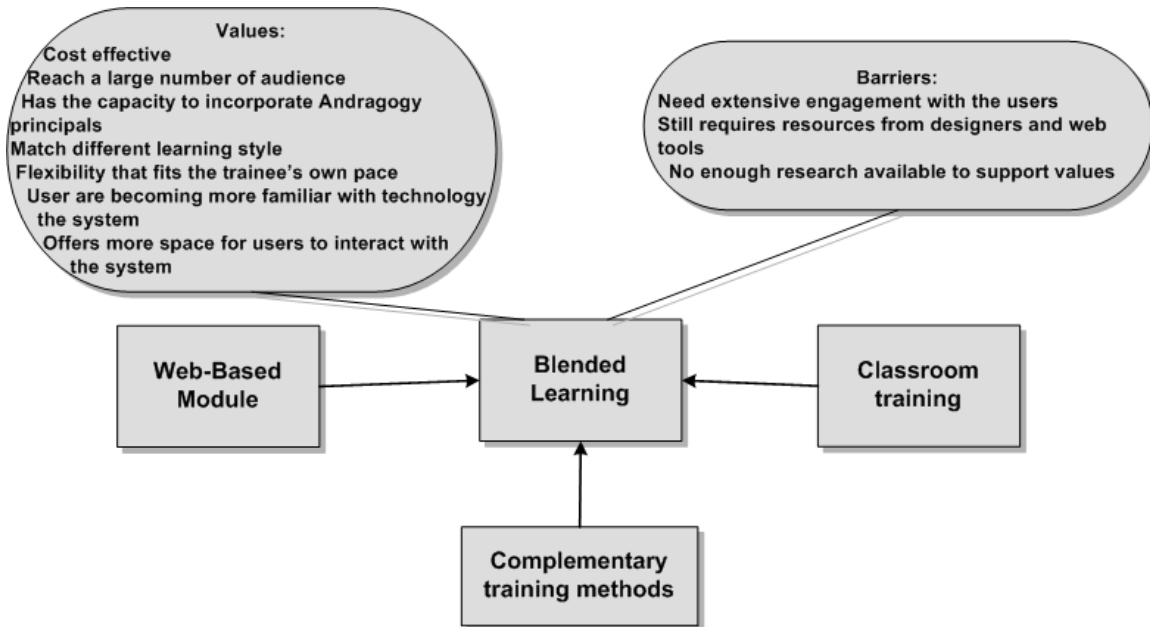
One participant further added facilitation sessions as an effective training method that demonstrates the application of the system on real-life clinical scenarios. This would allow them to see the difference when using the system to execute a task in real life.



**Figure 9: Complementary training methods,**

The following is quoted from participant interviews:

*“Well I think on unit training, because I have done training on Exeleries implementation in ED with just one product one department, I just sat there with the vendor in a physician lounge with donuts and a computer and we trained all the docs within 3 days so they just came in and out 20 minutes, I would say I just love doing training like that, that is the best, one on one, on the job, clinically relevant, like you can use just an example they just saw like minutes before and you show them what is the difference, how they use the system, today right now in their job”* (Participant 7 lines 234 to 240).



**Figure 10: Blended learning,**

To summarize, several competing factors were involved in the design of the training methods. These factors include the large number of users, the limited number of trainers, limited resources to backfill the users while training, limited numbers of classrooms, and the organization's visualization of the project as low risk.

Online training has been expanding due to being cost effective and being adaptable to a user's own pace. However, relying solely on the online module may produce frustration in some users when they face a problem or have a question during practice with no trainer support.

Classroom training on the other hand is an excellent opportunity for engagement between users and the training team, which is crucial for effective training, optimum use of technology and successful implementation. However, it may be costly and unfeasible when the budget allocated to the project is limited and the number of users is large, compared to the risks and values of the project.

Blended learning has been recognized as the most successful model, by incorporating classroom training, online module, facilitation sessions and drop-in centers that will match different needs of the learners and offers diverse methods to support and communicate the learning experience to the learners.

In the following chapter, the above findings from the participant interviews will be discussed together with the survey questionnaires in order to make the case for the contribution of blended learning and adult learning methods in training design for EHR systems.

## Chapter 5: Discussion

The current chapter will discuss the themes that emerged from the interviews together with the survey questionnaire results. These study findings will be examined in relation to the relevant literature. The discussion will address the limitations of the current study, as well as its generalizability and contribution to the field of health information science. Finally recommendations for organizations planning EHR implementation projects to achieve effective training will be put forward in accordance with the study findings.

The study was designed to understand end-users' expectations of training that would enhance satisfaction and the adoption of new technology. The survey questionnaires facilitated exploration of this perspective. Interviews focused on exploring another dimension of training: the means by which effective training is delivered in order to meet end-users' expectations. This extended to address the challenges in delivering effective training. Delivering effective training that meets end-users' expectations, increases satisfaction with and promotes adoption of technology.

Survey questionnaires revealed that end-users had limited expectations of new technology. End-users also perceived the challenges that impede the delivery of effective training, such as limited resources. Such challenges have been explored in-depth through the interviews.

The interviews uncovered 3 main findings: 1) Several challenges face delivery of effective training, including lack of organizational support, environment not ready for change, and lack of clinical ownership. In contrast, training can enhance users' satisfaction with technology by providing an excellent communication tool with end-users, enhanced computer skills among users, and opportunities to convey organizational initiatives through training. 2) Adult learning theories have the potential to improve users' satisfaction with technology. 4) Training methods offer an opportunity to overcome training challenges, as well as enhance users' satisfaction with technology.

It is essential to mention that although different themes have been discussed distinctly, they are amalgamated, and their isolation in this study is for the purpose of clarification. For example, when discussing the e-Learning module under training methods, it has been recognized both in the interviews and in the literature that e-Learning contributes to the adult learning principles in several ways.

### **Aligning the study with the literature review:**

The academic literature addressing the impact of EHR training was consulted to support the investigator knowledge and further formulate the research questions. The literature comparison phase was the last stage in the data inquiry. The objective at this stage was to compare the "emergent theory" to the existent literature. At this stage the researcher compared and contrasted the study findings with various findings from the literature. This method ensures clarity and completeness of the theories that explain the phenomenon under the study (Jackson, 1999).

There are two distinct advantages of aligning the emergent theory to the extant literature, namely (1) it improves construct definitions and therefore "internal" validity, and (2) it also improves "external" validity by establishing the domain for which the study's findings can be generalized (Pandit, 1996).

The study identified the following factors that impede delivering and effective training:

### **5.1 Challenges to effective EHR training:**

The extensive training required to teach staff and healthcare providers to use the EHR is one of the larger costs of HIT implementation projects and an opportunity to realize the benefits of transformations in the care delivery the HIT can bring. The study revealed critical challenges to achieving a successful EHR training, which are grouped into 3 main categories; resource availability, implementation climate, and management support.

### 5.1.1 Resource Availability

Resource availability was the most evident theme that emerged from trainers' interviews, although it was not perceived as a challenge by the end-users. Most of the trainers perceived that funding was a major challenge to achieve training goals.

For the end-users, the survey questionnaire results were contradicting and showed that super-users had a positive perspective of the support from the organization (42.1% in the pre-training survey and 43.8% in the post-training surveys). Also the surveys showed no significant difference in the expectation of sufficient resource availability before and after training (24.6% in the pre-training survey compared to 25% in the post-training surveys). The reason might be the different perspective of the end-users from that of the trainers. The trainers had the motivation to train users on a wide range of system functionalities, including advance computer training, which required dedicated resources in the form of funding, devices, classrooms, and schedules. The end-users, on the other hand, viewed training as an opportunity for exposure to technology and to achieve proficiency using the new system.

Limited funding accounted for the limited availability of sufficient numbers of trainers, the number of devices, and classrooms required for training.

Funding also impacted the schedules of both trainers and end-users; the trainers could not dedicate all their time to training and were assigned to other projects. Consequently this limited their capacity to fully focus on training. The end-users had to attend the training sessions outside their working hours, which impacted their capacity to absorb the class content. Funding also involved rewarding and engaging super-users in the training design early in the project implementation.

Furthermore, survey results showed end-users did not fully support the organizational initiatives behind the project. They also perceived that their co-workers and managers were not fully encouraging the change. Only when they became familiar with the technology did their expectations of the system increase. Subsequently, they supported the organizational initiatives and were motivated to change to the new system. From

these findings, it is concluded that training provides an opportunity to convey organizational initiatives and act as an effective communication tool, provided that users are familiar with technology. As well, those users also had a higher self-adaptability to learn the new system and integrate the new functionalities into their workflow.

Training offered the end-users a realistic view of the system functionalities. Limited system functionalities impacted the users' expectations of the project functionalities, as shown from their negative feedback on the documentation functionalities. So, when they had hands-on experience during training, they identified a lack of documentation functionalities in the system. This was reflected in the negative feedback of the post-training survey.

The end-users recognized the value of the new system functionalities, which facilitate communication of the care activities particularly when transferring the patient within and outside hospital facilities. Training played a major role in improving end-users' expectations and enhancing their satisfaction with the system, as shown in the post-training survey results.

The crucial role of the organization and the impact of limited resources on delivering effective training are evident in other studies. A study by Dansky et al (1999) found that organizational support was a strong, positive predictor of perceived usefulness of an EHR system. Similarly, Swanson et al (1997) reported that firm institutional commitment and commitment from program leadership and a core group of faculty helped overcome barriers to EHR system adoption. In their description of one health centers' experience with EHR implementation, Townes et al (2000) reported that communication of leadership commitment was a key factor in the successful implementation of an EHR system. In addition, Chiang and Starren (2002) found that a clear statement of EHR system objectives and commitment from upper management was a significant predictor of EHR implementation success for a large organization, as in the acute care environment of PHSA, but was not significant for small organizations.

Geisinger Health System in Danville, Pennsylvania (Nebeker, et al 2005) has conducted six funded studies of the quality and efficiency effects of EHR-enhanced care processes in real-world practices, with five more under development. Through their studies they found that the implementation that provides adequate resources for these activities will cost far more than one that is just adequate to meet evolving EHR accreditation requirements. Since most organizations will have difficulty funding even a minimum implementation, few EHRs are likely to be robust enough to support meaningful work-process transformation. Even for organizations that have made sizable resource commitments at one point in time, it remains a challenge to continue funding workflow analysis, configuration, testing, and training. Recent reports of the errors caused by EHRs probably reflect this reality (Kobel et al., 2005).

Remarkably, end-users who had more experience with technology and felt more comfortable using the system provided steadily more positive feedback from training and were more adept at understanding the organizational initiatives, support through co-workers and managers, and found themselves easily adapted to the new system. With the progressive growth of technology awareness, training will have higher chances of achieving the training goals and users expectations as well as appreciations to technology projects. Unfortunately, no sufficient literature has addressed this momentum, which calls for further research.

Another contradictory finding is the reduced awareness of the organizational security policies and confidentiality in online module completion after training (Kendall's tau-c value -0.191 and -0.021 successively) although these results were not statistically significant ( $P=0.08$  and  $0.81$  successively). The reason for that is the focus of training content on system functionalities and interactive training disregarding the security and confidentiality material. This topic requires further attention from the trainers in future training projects.

### **5.1.2 Implementation climate**

Trainers recognized that it is not just a matter of money. Few organizations will be able to find, attract, train, and retain an information technology team with the critical skills (technical, clinical, process redesign, project management, and informatics) needed to implement an effective EHR. Participants emphasized that the organizational support for technology is tremendous, but they also raised the factors that retain such skilled trainers, such as dedication to training and allocating more resources to enhance and develop training skills.

Survey questionnaires identified the weaknesses of the implementation climate with questions focusing on topics like organizational, managerial, and co-worker support. Analysis of these indicators revealed that end-users were not sufficiently supported to adopt technology due to several factors: namely lack of resources and limited project functionalities. Similar findings were concluded from the interviews.

Similarly, the American Medical Informatics Association announced an initiative to train 10,000 healthcare workers over 5 years. Dedicating two trainers to each hospital encouraged implementation climate. In addition, the project offered clinicians with sufficient resources and clinical functionalities, in addition to freeing schedules for both clinicians and trainers to achieve training goals. Results were outstanding; training successfully achieved the training goals and the end-users showed high adoption rates (AIMA, 2005). Another study recommended that organizations implementing EHR allocate about 40% of an implementation budget to training, but is the area most often left short (Cresswell, K. M., et al., 2013).

### **5.1.3 Management support**

Finally, and most importantly, the implementation of an effective EHR system requires an organization to be passionately committed to transforming the ways it cares for patients and to be capable of effecting that transformation. The role begins with the managers and then can be promoted by the power champions. Low rates of EHR

adoption and the high rate of EHR project failures suggest that both passion and capability need to be nurtured within organizations.

Lack of managerial support was reflected in both survey questionnaire and interview results; both trainers and end-users recognized that lack of managerial support impacted system uptake, training, and consequently, technology adoption.

Overall, the current study is consistent with findings in the above mentioned literature that organizational support for funding, creating urgency among users, and allocating sufficient resources for training are critical for effective training to ensure successful and optimum use of EHR.

Interestingly, the literature did not distinguish between managerial and clinical leaders, in the current study however, a gap in the clinical leadership support and technology ownership was analyzed. Although the organization management and key stakeholders had full support for EHR, the clinical leadership did not have sufficient ownership. Interviewees highlighted the impact of leadership support to help them deliver effective training and related this to the limited clinical functionalities of the phased implementation. Trainers had greater expectations that with further incorporation of clinical functionalities in future projects, clinical leaders would develop a greater sense of urgency and ownership. Thus, with this gap in the published literature, more research surrounding the lack of a relationship between managerial or administrative leadership and clinical leadership in the successful implementation of EHR is warranted.

Given the above challenges to training, this study identified opportunities in training to enhance satisfaction of the end-users with technology and overcome training challenges and adoption barriers. These opportunities include:

#### 5.2.1 Opportunities in training:

*Training as an excellent communication tool:*

Analysis of the interview scripts with the trainers revealed that training offered an opportunity to communicate organizational initiatives. Face-to-face communication through classroom training offered a space for trainers to clarify the reasons for implementing the new system. Trainers also explained the phased implementation projects and the benefits that users will gain down the road. In other words, training acted as an enabler to communicate the users' feedback to the training team and recycle the system design and ensure the fit to the organizational workflow.

Survey questionnaire results, on the other hand, came out with opposing results; training was associated with negative feedback and support to the organizational initiative. It is only when users had expertise using technology and computer system that they provided significant positive feedback. The explanation has psychological roots. Because users who lacked facility with the computer system had stress associated with the project, they might have felt that they would not have enough experience to operate the new system.

*Enhanced user literacy with technology:*

Both the end-users and the trainers recognized that the growing expertise with the computer system facilitated ease of use and satisfaction with technology. Trainers were able to provide end-users with advanced training that improved their proficiency with the system and ultimately job satisfaction and EHR adoption.

End-users who had expertise with computer systems readily understood and supported the project, as revealed in the questionnaire results. Unfortunately, research on the enhanced literacy of users with technology and its relation to satisfaction and adoption of the EHR is limited.

## **5.2 Training methodologies**

Several training methods have been discussed during trainers' interviews, including current training methods and potential methods that will evolve with technology advancement. Since most of the users had a long and solid experience of EHR training,

they were able to aspire to the best practices of training methods to achieve training goals.

### **5.2.1 Classroom training**

All participants appreciated classroom training at variable degrees and from different prospective. Trainers viewed face-to-face communication through classroom sessions as a valuable tool to communicate the learning objective, establish a communication pathway with users and inspire motivation and urgency among end-users to adopt the new information system.

These findings align with the literature findings. For example, a South Carolina law that mandated experts to witness a physician practice encouraged the incorporation of electronic prescribing to avoid penalties. Subject matter experts focused on face-to-face communication with clinicians to gain expertise with e-prescribing and incorporate the related billing codes. The results were more than satisfactory, and the attitude of practicing physicians changed dramatically from resistant to technology adopters (Avitzur O, 2011).

In another case, Brigham and Women's Hospital, Boston, MA adopted an EHR training program similar to PHSA. The project entailed moving from hybrid to fully electronic health record in the operating room. The steering committee used "train the trainer" model by training super-users on optimal usage of the new EHR functionalities. They conducted 4 hours of face-to-face training sessions with super-users, combined with the opportunity to participate in staff's training classes. This allowed the super-users to develop and master their own skills in using the new system. Excellent communication among team members and staff ensured a successful rollout of the new system. The success of the project was aided by the efforts of the perioperative super-users. This approach emphasized the value of face-to-face communication within the class as a powerful communication tool to ensure users successfully attained the necessary knowledge to use the system and provide support to their peers within their work environment (Sharon, Theresa, Jasset, & Denise, 2012).

### 5.2.2 E-Learning

Numerous competing factors emerged during interviews that contribute to the appreciation of e-Learning or web-based modules as an efficient training method by all the trainers. The large number of users was the most prominent factor, and the training team felt that training 3200 users with the budget and time constraints would only be possible using either solely the online module or using it in combination with other methods of training. Other trainers thought the value of the online module lay in its ability to match the pace of the users' own schedule, since users could access the training module anywhere and at any time. Another group of trainers viewed web-based training as an efficient reference resource that users can revisit when they need to get information on particular system functionalities they may have missed in class.

These findings align with the literature findings; The Maimonides Medical Center, a 2002 Davies Award Winner for EHR Implementation, concluded that when training healthcare providers on technology, trainers should focus on the human aspect of training, their schedules and pace of absorbing information, and the values that exist to a large extent in e-Learning (Beltran, et al., 2002).

Similarly, Queens Health Network initiated a computer-based training program that was considered highly successful. The Queens Health Network was at the beginning of a trend when it incorporated computer-based training back in 2001 and is used by 64% of corporate training programs because of its cost-effectiveness, flexibility, and accessibility (Huang, Leelien Ken 2007). For many EHR training programs, e-Learning may provide the flexibility and cost-effectiveness needed to make EHR training a success. In fact, it seems physicians generally prefer to receive one-on-one training and online training as opposed to traditional classroom instruction (Amatayakul et al., 2002).

While various studies have shown that e-Learning can be just as effective as traditional classroom instruction (Leung, 2003), e-Learning boasts many benefits over traditional classroom instruction. The most prominent feature of e-Learning is its flexibility and the ability to learn when you want, where you want, and at your own pace (Rowh, 2007).

This alleviates many problems with scheduling classes for busy clinicians who are mostly available at odd hours and also gives everyone the opportunity to learn the material at their own pace and to their own satisfaction. These qualities make e-Learning a valuable tool for providing “just in time training”, a strategy used to minimize the amount of information that is forgotten between the time it is learned and the time it is used by providing instruction immediately before the end-user needs to use that information (Badger, et al., 2005).

Ideally the content could be easily updated and revised which would ensure that information is always current and that everyone receives the same information in the same way at the same time (Goettner, 2000). The trainers regarded this value mentioned in the literature as a shortcoming, since trainers faced a challenge in providing a consistent module with the ongoing changes in the application design.

An interesting finding mentioned in the literature as a value in e-Learning, that was not raised in the interviews, is the capability to tailor training to each individual learner by offering the information they need and leaving out the information they do not need (Carr & Tang, 2005). The current e-Learning module was generic and did not tailor to user specialties or needs. The reason, inferred from the interviews and researcher experience, is that the in-depth view of the Children and Women’s Hospital is intermingled, since clinical and unit clerk need to have access to clinical and laboratory data to communicate them either to nurses, clinicians, or patients themselves. Different administrative and clinical staff are also involved in the process of patient referral, whether internal or external. Furthermore, on many occasions, clinical staff such as registered nurses performs administrative work such as patient discharge and transfer in the absence of the unit clerk.

This particular point was not raised in the traditional classroom training where everyone receives the same information. For example, a group of physicians with different specialties and roles in a hospital may not all need the same information, but in many

EHR training programs, they would all have to sit through the same class. Some may not admit patients, others may not do consultations, and others may not do discharges. Most trainers also focused on the advanced computer literacy among users, which facilitated their access to the online module. This fact has not been addressed in the literature and needs further study and research. Interestingly, the survey questionnaire results showed a statistically significant increase in user appreciation of the system functionality (related to recording diagnosis, patient transfer) after training when correlated with computer literacy ( $P=0.01$ ) and comfort with technology among super-users ( $P=0.008$ ).

Among the drawbacks of e-Learning, trainers raised the lack of face-to-face communication and ability to ask questions and get on-time support. Trainers also noted that users get frustrated when they face a challenge in the online training and many of them just get discouraged.

Studies recognized aspects of traditional classroom training that e-Learning could not replace. While some may learn well in an e-Learning atmosphere, research suggests that learners with “affiliative” and “variety seeking” personalities may not receive effective learning. The ability to ask questions as well as get feedback from instructors and peers in a live, face-to-face environment is also an important aspect of learning that cannot be replaced by e-Learning. Additionally, the ability to provide flexibility in lessons to explain things in a variety of ways to foster learner understanding is something that e-Learning typically cannot do and is best suited to a live classroom environment (Aronauer, 2006).

Literature also mentions additional challenges of e-Learning such as the logistics of developing the content, which requires a significant amount of effort and planning (Welsh, et al., 2003). This issue has not been raised by the trainers and needs to be taken into account in future training.

### 5.2.3 Blended learning

Blended learning combines several learning modalities. The model adopted by PHSA during the eChart training combined the online module, super-user classroom training, peer-to-peer support, and drop-in centers. Trainers appreciated blended training in different ways; most of the trainers focused on the drop-in centers and classroom training as complementary to the online modules, as when users face a problem and they come up with questions for the trainers.

Other trainers viewed this blended training an opportunity to tailor the needs of different users. Resources offered as back up for face-to-face training, allow learners to refer back to coursework when they are on the job. In this view, the online part is subservient to the offline.

Participants further added that classroom training motivated other users to access the online module, tracking for online module registration showed a sharp rise in the number of subscribers from 229 before classroom sessions to over a thousand subscribers one week after the classroom began. An explanation raised by participants is the role of classroom training in advertising for the project and spreading the word of technology among users.

Another view inferred from the trainers' interviews is to start with an online course and add on face-to-face training events (group work or one-to-one) as milestones, which help to pace the training program. This can help keep a group working to a set timetable, while retaining an element of individual flexibility as to what to study and at what time.

Across the literature, blended learning is not a new concept and has been adopted in a variety of settings. During the blended learning method, it is common for the instructor to transition to a coach or mentor role. This interaction with learning participants may be especially important for new employees and in healthcare settings. In the blended learning method, participants spent less time in instructor-led activities and more time practicing their skills (Bersin J., 2004).

In 2012, Edwards K. & Breckenridge S. used a mixed-methods approach with a retrospective, comparative, descriptive, secondary data analysis comparing training participant satisfaction with two different types of EHR training methods in a 70-bed, level I trauma center. Equal satisfaction with different training methods has found that trainees are open to new methods of delivering training. The study also concluded that blended learning generally took less time to complete, which affects cost in terms of time for both the student and the instructor.

In a study of medication administration training for new nurses, Sung (2008) also found that the addition of electronic learning methods reduced lecture time, easing the burden on instructors. Furthermore, this study's instructors reported greater satisfaction with the blended learning method not only because of the decrease in lecture time but also because the new method provided greater flexibility. Instructors were able to assist individual trainees one-on-one when it was most helpful for the trainees.

Findings in the literature consistently align with the interviews' results and, as mentioned, both encourage innovative training methods. Clearly, interaction with the system was a top priority among all participants. This finding suggests that adult learners want increased amounts of time to engage in hands-on activities. This finding is congruent with concerns from healthcare managers that learners should be capable of using HIT in their work setting (Georgio A., 2009). Furthermore, studies of other healthcare providers indicated that hands-on experience resulted in increased knowledge and skill (Quinzio L. et al., 2003). Thus, it is recommended that future research investigate the role of hands-on activities in improving mastery of HIT.

Since training methods can overcome challenges to delivering effective training to end-users, a strategic approach can change resistance factors into positive points when the design and approach to training satisfies the needs of the end-users as adult learners and incorporates adult learning principles.

### **5.3 Incorporating adult learning concepts and learning style in training**

The most effective training is that which is tailored to the individual roles of users, without being too restrictive as this can undermine understanding of how the whole system functions. Some individuals may need more training than others. For instance, older users may never have used a computer and may therefore require more basic training than younger individuals, who tend to be more accustomed to computers. For infrequent users, and in relation to systems that are subject to regular upgrades, continuous training may be necessary.

All participants identified adult learning concepts as crucial for successful training within classroom sessions or e-Learning modules. Outlining the benefits to the learner was crucial in delivering effective training. In particular, introducing the benefits of the EHR in streamlining care activities, improving ability to access patient information such as lab results, imaging reports, medication profiles and visit lists, reducing medical errors, improving patient safety, and improving the quality of care overall were major benefits that trainers had to inform all trainees of before training began. Helping the learner understand how these benefits of EHR would improve his or her work efficiency was the first necessary step to deliver effective training.

Participants added that the organization and clinical leaders play a crucial role in promoting the technology. Participants recognized that users who attended classes paid more attention and were more interactive when their clinical leaders were motivated to support the project.

These findings were consistent with the survey questionnaire results, which showed a positive understanding of the organizational plan for change and the value behind moving to the new system. The result of correlation between pre and post-training surveys were statistically significant ( $P=0.001$ ); this observation was highly significant when correlated with computer literacy and comfort ( $P=0.000$ ).

The second major concept deduced from participant interviews is the critical value of integrating learners' experiences into training content, whether classroom or web-based. Although the vendor can conduct training, it is not always sufficient. The vendor might know the product, but he may not understand clinical workflow and match the training content to the specific environment. Since the majority of the trainers had a solid clinical background, they were able to provide real life examples, scenarios, and exercises that facilitate engagement of the users with the EHR. Another valuable aspect of having clinicians as trainers was that users could ask questions freely knowing that the trainer would understand their clinical practice and provide them with an efficient answer.

Both users and trainers identified the advantages of having trainers who are clinicians and corporate members in improving users' experiences with training. Similarly, California community clinics and healthcare centers have identified the crucial role of the clinical trainer and dedicated a full time clinical nurse onsite to provide training. The strategy successfully enhanced users' training experiences and allowed training to proceed quickly so that users were able to provide peer-to-peer support and limit the classroom training (Kushinka, S. A., 2010).

A third concept concluded from participant interview and related to adult learning concepts is the empathy and support trainers can offer during engagement with the users. Participants further added that frustration with the product as a result of previous bad experience or lack of computer literacy is alleviated when the trainer shows empathy and acknowledgment of the users' frustration and creates a positive attitude among users by focusing on the positive values of technology.

Those participants further added that a focus on what users already know about technology creates strong self-motivation. Similarities of the product with other common applications, such as Windows and Microsoft Suite, were effectively used to eliminate stress and anxiety associated with technology and gain users' trust.

Considering the literature, Dolores Fidishun (2000) addressed the value of incorporating the principles of Andragogy into the design of technology-based learning environment. This value would deliver an environment that meets the needs of the users to learn technology, as well as their requirements as adults. E-Learning lends itself well to the principles of Andragogy, being a learner-controlled tool that allows the user to take control of their own education by learning what they specifically need to learn and at their own pace. Despite its almost natural fit with adult education, the design of e-Learning lessons is still of critical importance to its effectiveness.

Williams conducted a study (2002) in which several principles of Andragogy or Adult Learning were studied and perfectly aligned with effective adult learning. The study focused on web-based training and came out with recommendations for effective training that align the study results with the fact that the trainer must access the learner's objective for learning before beginning to design a course; thus, training modules should be designed based on the background of the learners. In addition, training modules should be designed to be meaningful and relevant to the learner and should be adapted to the learner's current level of experience and skill.

Both the survey questionnaires and the interviews recognized that effective training will enhance proficiency with the EHR in respect to some advanced features such as faster navigation tips, using short-cuts, and subsequently improve end-users' comfort and skill with technology. This may be a useful way to reduce resistance, improve proficiency with the EHR, and measurably improve a physician's overall job satisfaction and perception of the organizational support for providing good care to their patients.

Dastagir M. T (2012) conducted a study on the relationship between EHR proficiency and job satisfaction. He established a program called "Pathways to Proficiency" in which clinicians were offered intensive training to excel in the use of computer systems and EHR. The study confirmed that improvement in EHR proficiency may be associated with improvement in job satisfaction and subsequently overcome resistance barriers to the EHR system.

## **Conclusion on how the framework aligns with findings from the literature review**

In summary, the researcher reviewed the literature to determine what is already known about the concepts that emerged from the data. This was done to address knowledge gaps and provide clarity in the research findings (Jackson, 1999). Thus, the research findings were analyzed along with information available in the literature. In particular, challenges to provide effective EHR training, different training methodologies, and incorporating adult learning concepts into training courses were considered with respect to the current literature. As well, contributing factors (financial resource availability, implementation climate, management support) and solutions (including reallocating financial resources, utilizing new methods of training, guidelines, education, requisition of information, communication, and engaging users in the training design) to current challenges were analyzed using current literature. Thus, grounded theory was used to align research findings with information available in the literature.

## **Addressing the Research Questions**

This research aimed to investigate several research questions through key informant interviews as well as pre and post-implementation survey questionnaires. First, this research examined how trainers perceive the challenges against achieving the training objectives. All trainers believed that financial resource availability and time constraints were the main challenges. Participants raised solutions to combine different training methods that can reach a larger audience and include more interactive modules in the online module.

Participants also noted the lack of ownership from the clinical leaders due to limited clinical functionalities in the module and raised the solution of explaining the benefits of

EHR in streamlining the delivery of care and the availability of information for future projects using classroom training and super-users to promote and convey the urgency of training to clinical leaders.

The trainers saw the implementation climate as both challenging and encouraging. Encouragement emerged from the situation in which project stakeholders believed in the technology and showed leadership in supporting and allocating resources at a time when financial resources were limited. The major challenge was the lack of clinical ownership and the phased implementation strategy that minimized the value of EHR in the view of clinicians.

Identifying technology adopters, “keeners,” as mentioned by the participants, was a successful strategy to diffuse the technology through the organization. However, participants noted the lack of a rewarding and strong engagement strategy to retain those champions. They recognized from their current and past experience that engaging power champions as early as the procurement phase, and continued communication through meetings, as well as financial rewards and freeing their schedules for the project would have offered a strong facilitator role to achieve the optimum benefits of technology across the organization.

Among different training methods, participants demonstrated universal agreement that the online module is an effective and efficient method to train users for several reasons including the ability to capture a large number of users, cost effectiveness, familiarity of the users with technology as shown in both questionnaires and interviews’ results, and alignment with the principles of the Andragogy, since users have control over their own training.

They further added that classroom training is indispensable and complementary to online training; it functions as an excellent communication tool between the technology team and the users and caters to learning styles that are not satisfied by online modules.

Drop-in centers offered another cost effective training method, particularly for those users who need hands-on experience to develop the necessary technology skills.

Other participants requested further methods to motivate and create the need among users for technology, such as facilitation sessions with the vendor that would allow users to use the system to perform tasks from clinical scenarios they just faced. Other trainers have seen an opportunity to increase awareness of the new system functionalities by using information kiosks across the organization.

This study was also interested in gauging whether trainers believed effective training acts as a catalyst to improve user satisfaction and optimum use of technology, generally. In answering this, the majority of participants believed that communication through training is an excellent tool to convey the organizational initiatives and to get an impression of what users perceive from the organization. Similarly, this research was interested in the participants' perspective of methods that could potentially help the trainers to achieve their training goals. The majority of participants believe blended methods and interactive training are successful tools to effective training. Several participants mentioned two other methods of optimizing EHR training: Information Kiosks and facilitation sessions to motivate users and develop an urgency to diffuse technology across the organization.

Participants also emphasized increasing communication and dedication from super-users, and incorporating adult learning principles within different training methods. Andragogy by itself involves learner understanding and belief in the value of the technology being implemented and creates ownership through the ability of the learner to control his own training.

More generally, this study aimed to expand on the currently available literature regarding delivery, challenges, and opportunities of EHR training, the evolution of training methods, and incorporating Andragogy principles in different training methods, including incorporating the trainers' perspective. Overall, these research questions provided a framework to guide this qualitative research.

## Limitations

While conducting this study, the researcher acknowledged several limitations, including recruitment, time, and interview questions. This section describes these limitations in further detail. Overall, several limitations are identified that could be considered for future studies in this area.

First, recruiting trainees to participate in this study proved difficult. The researcher was involved in discussions with the project manager and the training team to identify the best way to recruit users. After discussion, the decision was made to circulate the pre-training questionnaires during classroom training designed for a total number of 134 super-users, who were the knowledgeable clinical leaders within their departments. Computer expertise was not a selection factor for super-users. Instead, the selection process was based on familiarity and solid understanding of the clinical workflow within the organization and was representative of different departments and different roles within the organization. This strategy proved successful, recruiting 78 out of 134 super-users without overwhelming them with emails in the limited time offered before training.

In coordination with the project team, the post-training survey was emailed to 127 super-users. To enhance the respondent rate, three reminders were sent over a one-month period in addition to site visits to the super-users after permission. However, the respondent rate was low (19 out of 127). Reflections perceived from trainers about some key survey question were deducted to fill the gaps in the respondent questionnaires. Since the researcher was involved daily with the project team in different capacities, he could achieve saturation of data through engaging in group meetings with super-users.

Another limitation was that the concepts of Andragogy are relatively unfamiliar to many trainers who participated in this study. To address this gap in knowledge, the researcher provided participants with a definition of Andragogy prior to interviews. Based on the definition provided and their personal knowledge of Andragogy concepts, trainers were asked to identify the current state and value of incorporating Andragogy concepts into training. Due to time constraints, the researcher could not provide a full explanation of

Andragogy and learning styles to each participant prior to the interview. This variation in understanding and experience could bias participants' responses to relevant questions during the interviews.

In summary, the researcher acknowledges that the above cited limitations to the current study could be remedied in future studies.

### **Generalizability and Credibility**

The study's credibility is established through triangulation of data collection and analysis methods (literature review, questionnaires, and interviews).

Regarding generalizability, this study reflects the views of EHR trainers from Canada regarding their experience with technology training. Thus, generalizing this study to countries that have differing health care models may not be appropriate. That said, other EHR implementation projects for large healthcare organizations with similarity to the Canadian Healthcare system could benefit from this research. Overall, concepts from this study could be generalized to other areas in healthcare.

## Chapter 6: Conclusion

EHR is a tool that helps HCOs succeed in their mission to provide the best care to their patients. Implementation of EHR will initiate discussions about best care practices and expectations about the shared use of collected data. As a result, training will have an impact on aspects of the HCO far beyond the technology itself. As EHR changes the quality of patient care and the way the care is delivered, a strategic approach to training can turn these changes into opportunities for improvement and help users overcome the stress associated with any change.

Training has been identified as a key facilitator for improved user acceptance of technology in healthcare. Despite this fact, there is a lack of information in the current literature on what factors contribute to EHR training as a catalyst to improved user acceptance of technology. The current study employed a multi-method research approach, including qualitative and quantitative approaches to study different dimensions of current training from both trainer and end-user perspectives.

A main focus of the current research is to apply grounded theory to extract theory from data and fill the gaps in the survey questionnaires. From the interviews, the main themes that emerged were the challenges and opportunities of the current training, incorporating adult learning theories into EHR training, and an evaluation of various training methodologies.

This entailed the emergence of subthemes. Organization support emerged from four subthemes that include resource availability, management support, ownership of the clinical leaders, and readiness for change.

Opportunities for training to create effective and optimum use of technology emerged from three subthemes, opportunity of training to convey provincial and organizational

initiatives, training as an excellent communication tool, as well as enhanced user readiness for technology.

The study also evaluated incorporating adult learning principles into the training, particularly the focus on bringing user experience scenarios into the classroom and online modules. Another principle the trainers focused on was the awareness of the project objectives and how to align them with the organization's strategic plans and bring them to the attention of the trainees.

The study also emphasized the value of the role of having clinicians and members of the organization as trainers. This role was further raised by the survey questionnaire results and was attributed to the psychological effect of sharing the same empathy for patient care, having the same language, as well as the ability of the users to raise clinical situations and ask related questions.

Health information technology training methods must truly engage adult learners since learners are concerned about the immediate applicability of their training experience. Therefore, EHR training strategies should go beyond teaching system functionality and include methods that facilitate everyday clinical practice and result in quality healthcare documentation. Among the training methods discussed were the values and limitations of classroom and web-based learning. The study focused on the value of incorporating different learning methods, referred to as blended learning. The study also raised evolving methods such as drop-in centers and information kiosks to facilitate user engagement.

The study can be generalized to EHR training in other acute care facilities with similarities to the Canadian acute care environment. This study also offers unique insight into the trainers' challenges and opportunities regarding the current training to provide users with effective and efficient learning and ensure satisfaction and optimum use of technology. These findings contribute to the field of health informatics by emphasizing

the crucial role of effective training as a critical factor for improving users' satisfaction. This study identified research gaps that could also guide future research.

### **Recommendations for future training projects**

When effective training is delivered to users, organizations ensure successful mitigation of EHR adoption issues, including social, technical, and psychological issues. This study identified several recommendations for organizations implementing EHR to ensure effective training and optimal use of technology by the users:

1. **Organizational role:** this is fundamental for successful training; the organization has to fulfill its role for the patients as well as create a creative environment and enhance readiness for change towards technology.
2. **Managerial role:** through support from the organizations, managers need to convey organizational initiatives, visions and missions to employees; they also need to identify power champions or "keeners" for technology.
3. **Power Champions:** they are the early adopters of technology and can visualize how technology will fit into their roles. They are also able to convert negative points into positive emotions such as optimism, enthusiasm and motivation to their peers.
4. **Trainers:** they should be involved in the change management team and work hand-in-hand with different stakeholders to identify pockets of resistance and interpret user perspectives of the project and organizational activities.
5. **On-going support:** since technology implantation has a learning curve, the integration of technology into workflow needs support that is a continuous process throughout the implementation process and after Go-live.
6. **Blended learning:** various training methods should be incorporated into the training design for different user needs. Blended learning is an emerging concept

that incorporates different methodologies, and when well-designed it will fit different users regardless of their number or the available budget.

7. Adult learning concepts: understanding adult learning concepts and incorporating these principles into the training design and classroom sessions is crucial. Most important is showing the users the benefits of the project and the training, drawing from users' experiences, and having a clinician within the training team to facilitate communication among clinical users.

### **Future Directions**

One of the most significant findings in the current research is the role of increased computer literacy among users and its impact on training strategy. Interview results showed that increased user readiness to learn advanced system functionalities also increased users' comfort with the e-Learning modules. Consistent findings were found among the survey questionnaire results with better appreciation of the system functionalities and the organizational momentum behind the move to technology. The lack of literature to support these findings calls for further research in order to modify training plans and provide more effective training.

Another gap in the literature that needs further research is the distinction between clinical and managerial ownership, as discussed previously in this chapter. Although the managerial support for technology was strong, clinical leaders were not on-board. The reason behind this gap was discussed in relation to the current project; however further research is required to explore further factors contributing to ownership and urgency of the clinical users. Identifying factors to resistance and ownership of technology will help organizations to bridge the gap between technology and human and social factors. Once identified, organizations can establish best-practice pathways to smooth the transition to a new technology.

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## **Appendix A - Letter of Invitation to participants**

### **Evaluation of EHR Training as a catalyst to achieve clinician satisfaction with technology in acute care setting**

#### **Research team:**

- Principle Investigator** : Dhalie Patara  
Project Manager Cerner Millennium implementation project.  
IMITs solutions.  
(604) 603-2961
- Academic supervisor** : Omid Shabestari, MD, PhD  
School of Health Information Science  
University of Victoria  
(250) 721-8582
- Co-Investigator** : Walid Youssef, MBBCh, MD  
Graduate Student - Health Information Science  
University of Victoria  
(604) 338-5546

We are writing to consider your participation on a study on evaluation of role of training to improve satisfaction of clinicians with technology, and evaluation of the barriers and opportunities in the current training programs to achieve clinician satisfaction with Electronic Health Record (EHR)

You have been invited to take part in this research study because you are identified as one of the Cerner Millennium users/trainers. We are interested in recruiting participants who are currently practicing as a clinician (physicians, nursing staff, ancillary care providers as laboratory technicians, radiology technicians, social workers, and physiotherapists) and scheduled for Cerner Millennium training.

The purpose of the current study is to explore the clinician expectations from Cerner Millennium training in Children and Women Hospital of British Columbia. The study will identify the evolution of perspective of clinician towards EHR training, the expected skills that will be gained from training and how this affects their attitude towards EHR. The current challenges and barriers that prevent trainers from delivering effective knowledge to clinicians will be explored.

The proposed study will answer the following questions:

- Explore the clinician expectation and prospective on the EHR training in acute care setting within the PHSA
- How effective the EHR training is to achieve clinician satisfaction with the ease of use of EHR?
- How do clinicians perceive the usefulness of each methodology used for training?

You have the right to refuse to participate in this study. If you decide to participate, you may still choose to withdraw from the study at any time without any consequences to the medical care, education, or other services to which you are entitled to or are presently receiving.

The current study is a qualitative research method that involves survey questionnaires, in-depth interviews and focus groups. You have the right to participate in all or parts of the study phases and activities.

The initial survey questionnaire will be emailed to clinicians two weeks before training starts. This survey will take approximately 10 minutes to complete, and will focus on exploring the prior experience with technology and EHR, prior EHR

training experience, the clinicians' perceptions and expectations from training to develop skills and competencies when going live.

During training, semi-structured in-depth and focus-group (5-7 trainers) interviews will take approximately 30 minutes with the trainers will be conducted to ask open-ended and close-ended questions about their experience with previous and current training, how they fit clinician needs into training strategy, and how they bring adult learning theories into classes and other training modules. The interview questions will also explore what training experience can cater into clinician attitude towards technology. Furthermore, the channels of communication between trainers and clinicians as facilitator or barriers to transfer knowledge will be examined.

The interview will be conducted in person (or over the phone if necessary) by the co-investigator (Walid Youssef) at the time and location convenient to you. With your permission the interview will be digitally recorded and transcribed. It will last approximately 30 minutes and will consist of a series of question on the topic discussed above.

The focus group will consist of 5-7 trainers. The participants will agree upon the time and location. The discussion will last approximately 30 minutes and will involve a series of questions on the topic and will be facilitated by the co-investigator (Walid Youssef). The facilitator will ensure that all participants' opinions are discussed. With the group permission the discussion will be digitally recorded and transcribed.

Two weeks after training, a post-training questionnaire will be conducted to explore how the clinician perceived usefulness and expectations of impact of EHR on their workflow has evolved after training. The questionnaire will solicit the challenges they faced while training and how they evaluate training to match their needs in respect to their schedules, duration, content, methods and effectiveness of training. This survey will take approximately 10 minutes to complete.

You can stop or reschedule the interview or the focus group discussion at any time.

Your participation is voluntary. If you decide to participate, you may still choose to withdraw from the study at any time without any consequences to the medical care, education, or other services to which you are entitled to or are presently receiving.

There are no restrictions that have been placed on publishing the study results. Participants will be able to access the study findings and report. The dissemination of the study results will be explained to the study participants in the process of obtaining their consent. Moreover, the research team intends to publish the results in aggregated format. This study will also be a research thesis project for the co-investigator and the results will be discussed in an oral examination for this purpose.

Please contact Walid Youssef by phone (604-338-5546) or <mailto:walid.youssef@phsa.ca> to request further information or arrange to participate in the study. We also attached the base line survey sheet for your convenience.

Your time and interest in this study are much appreciated.

On behalf of the research team,

Dhalie Patara

Project Manager Cerner Millennium implementation project.  
IMITs solutions

## Appendix B - Baseline, Post-training Questionnaire and Interview Questions

### Baseline Questionnaire

#### Instructions to Participants:

This survey will take approximately 5 minutes to complete. The following survey is intended to better understand staff perceptions and attitudes about the Information System training. No identifying data will be collected. Your participation in this survey is voluntary. If you have any questions about the survey, please contact Walid Youssef through Email: Walid.Youssef@phsa.ca or Tel: 604-338-5546. In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of British Columbia Office of Research Services by e-mail at RSIL@ors.ubc.ca or by phone at 604-822-8598 (Toll Free: 1-877-822-8598).

*Please check only one (1) response per item.*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
<b>I. Please indicate the extent to which you think that the following <u>expectation</u> from training will be achieved.</b>						
1. Training will focus on reducing the amount of time I now spend:						
➤ Documenting patient care						
➤ Recording diagnoses and symptoms						
➤ Preparing discharge documents						
2. Training will focus on reducing the amount of time I now spend:						
3. The training will reduce error while using EHR and improve safety of patient care						
4. The ability to implement best care practice guidelines into our patient care practices						
5. Training will improve my typing and navigation skills before focusing on the electronic health record system functionalities.						
6. Training will focus on improving Communications						
➤ At end of shift handoffs						

➤ When patients are transferred to different units within the hospital when patients are readmitted or receiving follow-up outpatient care							
➤ When patients are transferred to other facilities							
7. Training will help me understand the decision to change to the new clinical information system							
8. Sufficient technical IT support will be available to operate the new system							
9. Training will be general and not tailored to my specialty.							
10. The trainer is expected to be a clinician							
11. The trainer is expected to be a C&W staff.							
<b>II. Please indicate the extent to which you agree with the following statements;</b>							
1. I support the planned change in current clinical information systems							
2. My coworkers support the planned change in clinical information systems							
3. My supervisor supports the planned change in clinical information systems							
4. It will have no difficulty in adapting to information systems changes							
5. I understand the decision to change to the new clinical information system							
6. I know who the Super-users are in my work unit.							
7. Sufficient resources have been provided for me to learn to use the new systems							
8. Overall, the feedback I hear about EHR in clinical practice is positive							
9. I am aware of PHSA information security policy.							
10. I have done the e-Learning “PHSA Patient Confidentiality” on the learning hub.							
11. I expect that learning to use the EHR would be easy for me.							

**III. Did you help select this EHR for your practice?**  Yes  No

**In general, not just in terms of this Clinical Information system, how would you rate yourself as a computer user?**

Novice  Average user  Expert

**IV. I would describe my comfort with using computers as:**

1. Very comfortable
2. Comfortable
3. Somewhat comfortable
4. Not very comfortable.

**V. Do you have prior experience with EHR (other than EVE)?**  Yes  No

**VI. How many hours do you expect class training should be to help gaining enough skills?**

1. I don't need training, I can develop skills on my own
2. 1-3 hours
3. 3-6 hours
4. More than 6 hours

**VII. What is the best time to have the training?**

1. Early (8-11 AM)
2. Mid-day
3. Afternoon

**VIII. Background information:**

**1. Age:**

- Under 30,
- 30-40
- 40-50
- 50-60,
- 60+

**2. Sex:**

- Male
- Female
- Prefer not to identify

**3. Professional discipline:**

- Clinician (Family practice/Specialist)
- Resident
- Nursing
- Physician Assistant
- Pharmacist
- Laboratory/Radiology technician
- Physiotherapist

- Social Worker
- Other: \_\_\_\_\_

**Thank you for completing this survey**

### Post-training Survey for the Electronic Health Record training

#### **Instructions to Participants:**

This survey will take approximately 10 minutes to complete. All responses will be kept strictly confidential. No individual data or responses will be reported, as only aggregated data will be reported. Your participation in this survey is voluntary. The Survey will be available one week before the training ends. However, if you are participating only in the survey part of the study, you are not required to sign the consent form. If you complete the survey, consent for completing the survey is assumed to be given. If you have any questions about the survey, please contact Walid Youssef through Email: [Walid.Youssef@phsa.ca](mailto:Walid.Youssef@phsa.ca) or Tel: 604-338-5546. In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or [ethics@uvic.ca](mailto:ethics@uvic.ca)).

The following survey is intended to better understand explore how the clinician perceived ease of use has evolved after training. Specifically we are interested in learning about the impact of the *Clinical Information System training* on your expectations and satisfaction with technology within PHSA's unique environment. All responses will be kept strictly confidential.

#### **I have agreed to participate in the Training Evaluation study at C&W: YES / NO**

*Please check only one (1) response per item.*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
<b>I. Please indicate the extent to which you think that the following <u>expectation</u> from training are achieved.</b>						
12. Training focused on reducing the amount of time I spend in:						
➤ Documenting patient care						
➤ Recording diagnoses and symptoms						
➤ Preparing discharge documents						
13. The training reduced errors while using EHR and improved patient safety						
14. Developed the ability to implement best care practice guidelines into our patient care practices						

15. Training will improve my typing and navigation skills before focusing on the electronic health record system functionalities.							
16. Training will focus on improving Communications							
➤ At end of shift handoffs							
➤ When patients are transferred to different units within the hospital when patients are readmitted or receiving follow-up outpatient care							
➤ When patients are transferred to other facilities							
17. Training will help me understand the decision to change to the new clinical information system							
18. Sufficient technical IT support will be available to operate the new system							
19. Training will be general and not tailored to my specialty.							
20. The trainer is expected to be a clinician							
21. The trainer is expected to be a C&W staff.							
<b>II. Please indicate the extent to which you agree with the following statements;</b>							
10. I support the planned change in current clinical information systems							
11. My coworkers support the planned change in clinical information systems							
12. My supervisor supports the planned change in clinical information systems							
13. Developed the ability to implement best care practice guidelines into our patient care practices							
14. Training improved my typing and navigation skills.							
15. Training focused on improving Communications							
a. When patients are transferred to other							

	facilities						
b.	At end of shift handoffs						
c.	When patients are transferred to different units within the hospital when patients are readmitted or receiving follow-up outpatient care						
16.	Training helped me understand the decision to change to the new clinical information system						
8.	Sufficient technical IT support was available to operate the new system						
9.	Training was general and not tailored to my specialty.						
10.	The trainer was a clinician						
22.	The trainer is was a C&W staff.						
<b>II. Please indicate the extent to which you agree that training has developed;</b>							
1.	My support to the planned change in current clinical information systems						
2.	My coworkers support to the planned change in clinical information systems						
3.	My supervisor to support the planned change in clinical information systems						
4.	Easiness to adapt to information systems changes						
5.	Better understand the decision to change to the new clinical information system						
6.	Identify who the Super-users are in my work unit.						
7.	Sufficient resources have been provided for me to learn to use the new systems						
8.	Overall, the feedback I hear about EHR in clinical practice is positive						
9.	Awareness of PHSA information security policy.						
10.	Completed the e-Learning "PHSA						

Patient Confidentiality” on the learning hub.							
11. I feel use the EHR would be easy for me.							

**III. Did you help select this EHR for your practice?**  Yes  No

**IV. I would describe my comfort with using computers as:**

5. Very comfortable
6. Comfortable
7. Somewhat comfortable
8. Not very comfortable.

**VI. Training Experience:**

**a. How many hours do you feel training should have been to gain enough skills?**

5. I did not need training, I developed skills on my own
6. 1-3 hours
7. 3-6 hours
8. More than 6 hours.

**b. What was the best time to have the training?**

4. Early (8-11 AM)
5. Mid-day
6. Afternoon.

**c. Which module that you find most beneficial?**

1. Class (instructor lead)
2. Web-based
3. Manuals
4. Mobile (web-based with mobile browser)
5. CDs.

**d. Within the class, how many trainees were attending?**

1. 1 -5
2. 5-10
3. 10-15
4. More than 15.

**e. How many trainers were conducting the training sessions?**

1. One
2. Two
3. Three
4. More than three

**f. In your opinion, how many trainees per trainer would be ideal to deliver efficient training?**

1. One on one
2. 2 on 1
3. 3 on one
4. 3-6 on one trainer
5. Indifferent.

**g. Based on your experience, what is the ratio between classes teaching to in-class interactive training should be?**

1. I did not need interactive training, class materials were sufficient.
2. Class teaching should be double the time spent for interactive training
3. Class teaching should be equal to the time spent for interactive training
4. Interactive training should be double the time spent for class teaching.

**VII. Background information:**

**4. Age:**

- Under 30,
- 30-40
- 40-50
- 50-60,
- 60+

**5. Sex:**

- Male
- Female
- Prefer not to identify.

**6. Professional discipline:**

- Clinician (Family practice/Specialist)
- Resident
- Nursing
- Physician Assistant
- Pharmacist
- Laboratory/Radiology technician
- Physiotherapist
- Social Worker
- Other: \_\_\_\_\_

**Thank you for completing this survey**

### **EHR training evaluation-Interview questions**

I would like to thank you for your participation in the study. Your contribution is very valuable.

The purpose of today's interview is to understand your perspective of the challenges and opportunities conducted for EHR training. The interview will be audio recorded and transcribed.

Before we begin, I'd like to remind you that your participation is voluntary, if you feel any discomfort, you can withdraw at any time without any consequences. You can also stop and reschedule the interview to a later date/time that is convenient to you. Also all information obtained in the session today should not be disclosed outside the session to protect anonymity and confidentiality as much as possible. Are there any questions?

Let's begin by reflecting on the training.

1. Did you get enough support to prepare for the training?
2. What are the challenges that you face when developing a training plan?
3. Do you find the training enough to meet clinician needs?
4. What module do you perceive best to suit clinicians?
5. How do you handle a system functionality that does not fit specific clinical situations?
6. How do you encourage clinicians to use the system?
7. Do you see any opportunities for training improvement?
8. Do you have any other comments or feedback you'd like to share?

## **Appendix C - Consent Form for Participants**

### **Evaluation of EHR Training as a catalyst to achieve clinician satisfaction with technology in acute care setting**

#### **Participant Information and Consent Form**

- Principle Investigator : Dhalie Patara  
Project Manager Cerner Millennium implementation project.  
IMITs solutions.  
(604) 603-2961
- Academic supervisor : Omid Shabestari, MD, PhD  
School of Health Information Science  
University of Victoria  
(250) 721-8582
- Co-Investigator : Walid Youssef, MBBCh, MD  
Graduate Student - Health Information Science  
University of Victoria  
(604) 338-5546

Contact numbers: Contact the research team or University of British Columbia Office of Research Services by e-mail at [RSIL@ors.ubc.ca](mailto:RSIL@ors.ubc.ca) or by phone at 604-822-8598 (Toll Free: 1-877-822-8598).

Alternatively, you can contact the Human Research Ethics Office at the University of Victoria (250-472-4545 or [ethics@uvic.ca](mailto:ethics@uvic.ca)).

## INVITATION

You have been invited to take part in this research study because you are identified as one of the Cerner Millennium users/trainers. We are interested in recruiting participants who are currently practicing as a clinician (physicians, nursing staff, ancillary care providers as laboratory technicians, radiology technicians, social workers, and physiotherapists) and scheduled for Cerner Millennium training.

This research is an evaluation of role of training to improve satisfaction of clinicians with technology, and evaluation of the barriers and opportunities in the current training programs to achieve clinician satisfaction with Electronic Health Record (EHR)

## YOUR PARTICIPATION IS VOLUNTARY

You have the right to refuse to participate in this study. If you decide to participate, you may still choose to withdraw from the study at any time without any consequences to the medical care, education, or other services to which you are entitled to or are presently receiving.

Before you decide, it is important for you to understand what the research will involve. This consent form provides details about the study including why the research is being done, what your part would entail, and the possible benefits, risks and discomforts. Nevertheless, the researchers have a duty of care for all participants and will inform you of any information that may affect your willingness to remain in the study. If you wish to participate in the interview and/or focus groups parts of the study, you will be asked to sign this form. However, if you wish to participate only in the survey part of the study, you are not required to sign this form. If you complete the survey, consent for completing the survey will be assumed to be given. Please take the time to read the following information carefully before making your decision.

## WHO IS CONDUCTING THE STUDY

This study is conducted by Dhalie Patara as a Principle investigator and Walid Youssef co-investigator toward the partial fulfilment of the Master's of Health Information Science Degree at the University of Victoria (UVic) (for the co-investigator) under the academic supervision of Dr. Omid Shabestari of UVic. This study is not funded by any external agencies or sponsors.

## BACKGROUND

In alignment with the Ministry of Health Services plan, PHSA recognized that implementation of an interoperable and effective Clinical Information System (CIS) will enhance patient safety and quality of care through better and timely access to patient

information and decision support tools to support clinicians at the time of decision-making.

In 2010 PHSA decided to replace the EVE (Electronic Viewer for Everyone) electronic results viewer at BC Children and Women's Hospital (C&W) with the Cerner Millennium EHR. On April 2012, PHSA launched a phased rollout implementation of the Cerner Millennium project that covers the following functionalities by the Go-live date on November 29th:

**Power Chart:** Lab viewer to enable clinicians review patient laboratory, histo-pathology, and genetic results. Micro viewer for the microbiology result review.

**Power Note:** Admission discharge summary document transcription that enables clinicians to document care plan at admission and a summary of the care activities, patient progress during hospital stay, discharge instructions and medication reconciliation in the discharge summary report. Structured clinical documentation and document distribution to external providers and agencies

By the Mid November 2012 (2 weeks prior to Go-live), training classes will start, the training team is conduction nurses, allied healthcare providers (including laboratory technicians, genetic lab staff, etc.), and administrative staff at BC Children and Women Hospital in addition to web-based learning modules that will be available by November 1st, training will continue for 2 weeks after Go-live.

The current training will allow clinicians at BC Children and Women Hospital to develop skills and competencies necessary to adopt Cerner Millennium functionalities into the hospital workflow and perform their tasks to deliver a high quality patient care.

#### WHAT IS THE PURPOSE OF THIS STUDY

The aim of the current study is explore the clinician expectations from Cerner Millennium training in Children and Women Hospital of British Columbia. The study will identify the evolution of perspective of clinician towards EHR training, the expected skills that will be gained from training and how this affects their attitude towards EHR. The current challenges and barriers that prevent trainers from delivering effective knowledge to clinicians will be explored.

The proposed study will answer the following questions:

- Explore the clinician expectation and prospective on the EHR training in acute care setting within the PHSA
- How effective the EHR training is to achieve clinician satisfaction with the ease of use of EHR?
- Identify how training changed the clinician perceived usefulness and attitude towards EHR.

#### WHO CAN PARTICIPATE IN THIS STUDY

You may be able to participate in this study if you:

- Computer knowledge or Internet experience will not be requirement for the study, as well as prior experience with EHR. In addition to trainers, the inclusion criteria for clinicians include:
- Current practicing clinician (Physician, Nurse, Ancillary care provider) at PHSA
- Scheduled for Cerner Millennium training
- Read, write and speak English
- Give written and informed consent

## WHAT DOES THE STUDY INVOLVE?

### Overview of the Study

The current study is a qualitative research method that involves survey questionnaires, in-depth interviews and focus groups. You have the right to participate in all or parts of the study phases and activities.

The initial survey questionnaire will be emailed to clinicians two weeks before training starts, and will focus on exploring the prior experience with technology and EHR, prior EHR training experience, the clinicians' perceptions about the impact of the EHR on their workflow, and their expectations from training to develop skills and competencies when going live.

During training, semi-structured in-depth and focus-group interviews with the trainers will be conducted to ask open-ended and close-ended questions about their experience with previous and current training, how they fit clinician needs into training strategy, and how they bring adult learning theories into classes and other training modules. The interview questions will also explore what training experience can cater into clinician attitude towards technology. Furthermore, the channels of communication between trainers and clinicians as facilitator or barriers to transfer knowledge will be examined

Two weeks after training, a post-training questionnaire will be conducted to explore how the clinician perceived usefulness and expectations of impact of EHR on their workflow has evolved after training. Moreover, participants will be asked open-ended and closed ended questions through semi-structured interviews to solicit the challenges they faced while training and how they evaluate training to match their needs in respect to their schedules, duration, content, methods and effectiveness of training.

Participants who contact the principle investigator (Walid Youssef) will be contacted via email to explain the consent form and to schedule the date/time of the study. Also, Participants who agree to participate in the study will be asked to refer other potential participants for the study. The researcher will not obtain the potential participants contact information. Instead, the principle investigators' contact information will be provided to the potential participants who can contact the research team if they are interested in the study.

The data to be collected during the baseline observation include the following:  
Reported Issues/challenges related to the use and availability of the current resources.  
Workarounds practices established by the participants to access the available resources.

#### WHAT ARE MY RESPONSIBILITIES?

Surveys:

Complete online survey within the timeframe provided

Interview:

Will be conducted with the trainers only. The researcher/co-investigator will contact you to schedule a 30-minute to one-hour appointment for the interview. You will be allowed to stop or re-schedule the interview at any time.

Focus Groups:

Will be conducted with the trainers only. The researcher/co-investigator will contact 5-7 trainers to schedule a group discussion, the investigator will be facilitating discussion and ensures that opinions of all participants are discussed and shared during the discussion. Participants will be allowed to stop or re-schedule the interview at any time. The duration of the focus group will be 30 minutes to one hour.

#### WHAT ARE THE POSSIBLE HARMS AND DISCOMFORTS?

There are no known harms or discomforts related to participating in this study, however there is a low probability that a participant might experience emotional or psychological harm. Participants do have the right to withdraw from the study or reschedule at any time if he/she feels embarrassed, uncomfortable, anxious, or upset during the interview/focus group period. Furthermore, there is a minimum level of confidentiality risk related to the study.

The research team will use alphanumerical codes to identify the participants. Only the research team will have access to the alphanumerical codes that will be kept in a locked filing cabinet, separate from the study data. The study results will be reported in an aggregated format without any identifying information.

#### WHAT ARE THE POTENTIAL BENEFITS FOR PARTICIPATING?

An anticipated benefit of the study to the participants is to evaluate the computer training offered to clinicians and examine their feedback on the training offered to them, which will voice their concerns, as well as the feedback and recommendations can be used to improve future training.

In addition to clinicians, the study will highlight the role of the trainers who present the frontline of the technology departments and usually disregarded, Healthcare organizations that spend in trainers by dedicating sufficient budget, allocating necessary time to training, are in fact investing to market their systems among HCP.

Furthermore, the study contribute to the body of knowledge by examining new dimensions involved in training and knowledge transfer including social, cultural, as well the value of taking concepts from adult learning methods into training.

#### WHAT IF NEW INFORMATION BECOMES AVAILABLE THAT MAY AFFECT MY DECISION TO PARTICIPATE?

Participants will be advised of any new information that becomes available that may affect their willingness to remain in this study.

#### WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

Participants may withdraw from this study at any time without providing any explanations. If you decide to withdraw from any part of the study, the data collected before you decide to withdraw will be handled according to the following procedure: Anonymous survey data will be retained, as it is logistically impossible to remove anonymously submitted data.

Interview/focus group data will be destroyed and will not be used in the analysis.

#### CAN I BE ASKED TO LEAVE THE STUDY?

The study may be stopped if knowledge of any unexpected risks that affect participant's safety and/or confidentiality becomes known.

#### WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your confidentiality will be respected. However, representatives of C&W Research Ethic Board for the purpose of monitoring the research may inspect research records and health or other source records identifying you in the presence of the investigator or his or her designate. No information or records that disclose your identity will be published, without your consent, nor will any information or records that disclose your identity be removed or released without your consent unless required by law.

As a participant in this study, you will be assigned a unique study number. Only this number will be used on any research-related information collected about you during the course of this study, so that your identity [i.e. your name or any other information that could identify you] as a participant in this study will be kept confidential. Information

that contains your identity will remain only with the principle investigator and/or co-investigator. The list that matches your name to the unique study number that is used on your research-related information will not be removed or released without your consent unless required by law.

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected; This gives you the right of access to the information about you that has been provided to the sponsor and, if as well as, an opportunity to correct any errors in this information, if necessary. Further details about these laws are available upon request.

The following procedures will be used to ensure your anonymity and for preserving the confidentiality of your data:

All data that identify participants for the interview and focus groups will be coded using alphanumerical codes (as A1, Z8, etc.). The research team will ensure that the data are secured separate from the study, whether on the computer or in a locked cabinet.

Only the research team will have access to the study data and the alphanumerical codes. In addition to the alphanumerical coding, the research team will report the results of the data in aggregated format that cannot be linked to individuals. This is particularly useful to protect the privacy of the focus group participants and reduces the risk of linking data to the group for purposes such as policy-making or program evaluation.

The research team will explain to the participants before starting the interview or focus group discussion that they have the right to withdraw from the study or reschedule the study at anytime if they feel embarrassed, uncomfortable, anxious or upset during the interview/focus group discussion period. The written consent form will state clearly this right. Also, the nature of the questions will be not involving any sensitive matters.

The data will be kept in password protected computer file.

The data will not be communicated via email.

The data will not be stored or downloaded to unsecured computer or laptop.

#### AFTER THE STUDY IS FINISHED?

There are no restrictions that have been placed on publishing the study results. Participants will be able to access the study findings and report. The dissemination of the study results will be explained to the study participants in the process of obtaining their consent. Moreover, the research team intends to publish the results in aggregated format. This study will also be a research thesis project for the co-investigator and the results will be discussed in an oral examination for this purpose.

#### WHAT HAPPENS IF SOMETHING GOES WRONG?

Signing this consent form in no way limits your legal rights against the investigators, or anyone else. Furthermore, you do not release the study team or participating institutions from their legal and professional responsibilities.

#### WHAT WILL THE STUDY COST ME?

There is neither cost associated with the study nor financial compensation paid for participating in this study, only for expenses incurred as a result of participating in the study as travel expense or parking costs if the participant had to pay to attend an interview or focus group.

#### WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

If you have any questions or desire further information about this study before or during participation, or if you experience any adverse effects, you can contact Walid Youssef at 604-338-5546 or email [Walid.Youssef@phsa.ca](mailto:Walid.Youssef@phsa.ca)

#### WHO DO I CONTACT IF I HAVE QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A PARTICIPANT?

If you have any concerns or complaints about your rights as a research subject and/or your experiences while participating in this study, please contact the Research Subject Information Line in the University of British Columbia Office of Research Services by e-mail at [RSIL@ors.ubc.ca](mailto:RSIL@ors.ubc.ca) or by phone at 604-822-8598 (Toll Free: 1-877-822-8598). In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or [ethics@uvic.ca](mailto:ethics@uvic.ca)).

**Evaluation of EHR Training as a catalyst to achieve clinician satisfaction with technology in acute care setting.**

SUBJECT CONSENT TO PARTICIPATE

My signature on this consent form means:

- I have read and understood the subject information and consent form.
- I have had sufficient time to consider the information provided and to ask for advice if necessary.
- I have had the opportunity to ask questions and have had satisfactory responses to my questions.
- I understand that all of the information collected will be kept confidential and that the results will only be used for scientific objectives.
- I understand that my participation in this study is voluntary and that I am completely free to refuse to participate or to withdraw from this study at any time without any negative consequences.
- I understand that I am not waiving any of my legal rights as a result of signing this consent form.
- I understand that there is no guarantee that this study will provide any benefits to me.
- I understand that if I complete the survey, consent for completing the survey will be assumed to be given and I do not need to sign this consent form.

SIGNATURES (Not required if you are participating in the survey only)

I will receive a signed copy of this consent form for my own records.

I consent to participate in the interview/focus group (for trainer group) parts of this study.

\_\_\_\_\_  
Participant's signature

Printed name

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of person  
obtaining consent.

Printed name

Study role

\_\_\_\_\_  
Date

## Appendix D - Ethics approval

Approval from the following committees has been granted before the study:

- Human Research Ethics, University of Victoria approved the research on 23 October 2012 and assigned Protocol Number 12-431.
- UBC C&W Research Ethics Board approved the research on November 13, 2012 and assigned a protocol number H12-0287.



University  
of Victoria



### Human Research Ethics Board

Office of Research Services  
Administrative Services Building  
PO Box 1700 STN CSC  
Victoria, British Columbia V8W 2Y2 Canada  
Tel 250-472-4545, Fax 250-721-8960  
Email ethics@uvic.ca Web www.research.uvic.ca

## Certificate of Approval

PRINCIPAL INVESTIGATOR	<b>Walid Youssef</b>	ETHICS PROTOCOL NUMBER	<b>12-431</b>
UVic STATUS:	<b>Master's Student</b>	ORIGINAL APPROVAL DATE:	<b>23-Oct-12</b>
UVic DEPARTMENT:	<b>HEIS</b>	APPROVED ON:	<b>23-Oct-12</b>
SUPERVISOR:	<b>Dr. Omid Lotfollahi Shabestari</b>	APPROVAL EXPIRY DATE:	<b>22-Oct-13</b>
<b>PROJECT TITLE: Evaluation of EHR Training as a catalyst to achieve clinician satisfaction with technology in acute care setting</b>			
<b>RESEARCH TEAM MEMBERS:</b> Supervisor: Omid Lotfollahi Shabestari Co-investigator: Dhalie Patara (PHSA)			
<b>DECLARED PROJECT FUNDING: None</b>			
<b>CONDITIONS OF APPROVAL</b>			
This Certificate of Approval is valid for the above term provided there is no change in the protocol.			
<b>Modifications</b> To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.			
<b>Renewals</b> Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.			
<b>Project Closures</b> When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.			
<b>Certification</b>			
This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.			

12-431

		<b>CHILDREN'S &amp; WOMEN'S HEALTH CENTRE OF BRITISH COLUMBIA</b>	<b>UBC C &amp; W Research Ethics Board</b> Room A2-136 950 West 28 <sup>th</sup> Avenue Vancouver, B.C. V5Z 4H4 Tel: (604) 875-3103 Fax: (604) 875-2496 Email: <a href="mailto:reb@cw.bc.ca">reb@cw.bc.ca</a> Website: <a href="http://www.cfm.ca/Research Ethics">www.cfm.ca/Research Ethics</a> RiSe: <a href="https://rise.ubc.ca">https://rise.ubc.ca</a>
University of British Columbia – Children's & Women's Health Centre of BC Research Ethics Board (UBC C&W REB)			

Nov 13 2012

## C&W Institutional Certificate of Approval

PRINCIPAL INVESTIGATOR Patara, Dhalie	DEPARTMENT IT Services	NUMBER CW12-0278 / H12-02877
CO-INVESTIGATORS: Shabastari, Omid;		
C&W DEPARTMENTS, PATIENT BASED PROGRAMS AND ADMINISTRATIVE JURISDICTIONS IMPACTED BY THIS STUDY:		
SPONSORING AGENCIES:		
TITLE Evaluation of EHR Training as a catalyst to achieve clinician satisfaction with technology in acute care setting.		
APPROVAL DATE: Nov 13 2012	TERMS OF APPROVAL: Nov 13 2012 -Nov 12 2013	
CERTIFICATION:  <p style="text-align: center;"><b>Ethical approval has been granted for the above-referenced research project. I am pleased to inform you that all necessary hospital program/resource approvals and institutional agreements/contracts are now in place and that you have permission to begin your research.</b></p>		
<hr style="width: 20%; margin: 0 auto;"/> Dr. Stuart MacLeod Vice President, Academic Liaison and Research Coordination, Provincial Health Services Authority		
This Certificate of Approval is valid for the above term provided there is no change in the research protocol		