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# Characteristics of Complete and Incomplete Physicians' Unlearning with Electronic Medical Record

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## Abstract

This study examines the concept of unlearning, the process of disuse or replacement of an action, procedure or belief in favor of a new one, in the context of healthcare. Little is known about the true nature of unlearning and related learning change processes within the context of healthcare. The study of unlearning continues to be important not only due to the nature of the discipline itself, but physicians are required to support knowledge change for improved care quality. The study argues the introduction of new Health Information Technologies (HITs), such as EMRs, affect the unlearning process in physician providers. We address the following research question: "What are the characteristics of the unlearning process by physicians who are using EMRs?" using a qualitative case study methodology. Interviews, the primary data collection method and coding is mainly used for data analysis. Results show physician unlearning is characterized as either complete unlearning or incomplete unlearning.

**Keywords:** Complete Unlearning, Electronic Medical Records, Healthcare, Health Information Technology

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## 1. Introduction

Healthcare organizations are increasingly relying on the use of teams to complete healthcare pathways (De Vreede, Boughzala, De Vreede, & Reiter-Palmon, 2017) and on technologies to fulfill their goals and objectives. Many hospitals in the United States are investing in information technologies to reduce the associated cost and improve the quality of care for patients as well as heathy people. Well-planned investments in IT systems that meet requirements, and are designed to have a positive impact on organizational members are desired by healthcare organizations. The unintended consequences of IT investments create difficulties in adoption for end-users that impact the quality of care.

With the implementation of electronic medical record (EMR) systems becoming a priority of healthcare organizations, providers are expected to perform correctly in light of new procedures, processes, and regulations. System utilization that can substantially contribute to improving patient safety and cost containment will allow organizations to remain competitive while delivering quality services.

EMRs are important components of health information technology at many points of service delivery (Harb, Sarnikar, & Noteboom, 2016). The impact of EMRs on practitioners, healthcare quality, and healthcare delivery systems has been the focus of recent studies. EMR is one abbreviation for many related terms including, electronic health records (EHR), electronic patient record (EPR), and computerized patient record (CPR) (Car, Black, Anandan, Cresswell, & Pagliari, 2009). The use of EMR in this study will refer to these types of current technological systems involving service delivery and patient records in healthcare.

Among existing health information technology (HIT), EMR has been important for many healthcare facilities to create coordination of care and appropriate documentation for reimbursement. Due to its potential for continuous quality improvements, EMRs are now considered an efficient medium for sharing patients' related information and improving care (Miller & Sim, 2004). The implementation of any new technologies, such as EMRs, can generate internal problems, especially when it conflicts with current structure and procedural routines (Cegarra-Navarro & Cepeda-Carrión, 2013). Achieving healthcare quality improvements through EMRs is highly dependent on the physicians' use of the EMRs for daily tasks (Miller & Sim, 2004). Physicians need to accept changes in service delivery to adopt EMRs.

However, despite the fact that HITs have completely transformed the healthcare industry and provided opportunities for reducing cost, increasing improvements in care delivery, and reducing risks, the adoption of these HITs within hospitals is still slow and limited (Cegarra-Navarro & Cepeda-Carrión, 2013; FitzGerald, Rorie, & Salem, 2015; Menachemi, Chukmaitov, Saunders, & Brooks, 2008). This slowness in the adoption of HITs is due to the fact that many healthcare organizations are not yet ready to face the challenges associated with HITs development and adoption (Brakensiek, 2002; Martinez-Caro, Cegarra-Navarro, & Briones-Penalver, 2014; Solano-Lorente, Martínez-Caro, & Cegarra-Navarro, 2013).

The literature identifies a number of barriers faced by physicians when it comes to EMRs with respect to updating service delivery procedures. Internal changes of physicians' processes include, but are not limited to, physicians' traditional working style (DesRoches et al., 2008), slowing physicians' work process and flow (Menachemi, Langley, & Brooks, 2007), and requiring more time to learn how to use devices and applications (Paré et al., 2014) thus, reducing professional autonomy (Li, Talaei-Khoei, Seale, Ray, & MacIntyre, 2013). Barriers also become important to those healthcare knowledge workers, for example, physicians, who need to update patient safety procedures.

To overcome existing barriers, especially those related to traditional working style, learning, and professional autonomy, physicians need to start unlearning (Boonstra & Broekhuis, 2010; Rushmer & Davies, 2004). In order to unlearn, physicians and other healthcare providers replace their procedural knowledge with more current knowledge, thus removing barriers, making change occurrence more effective.

With HITs, especially EMRs that continually provide access to huge amounts of information, physicians may begin to suffer from "knowledge-overload." Cepeda-Carrión, Cegarra-Navarro, Martínez-Caro, and Eldridge (2011) suggest that physicians need to start unlearning in order to overcome this knowledge-overloading problem. Through successful unlearning, physicians can retain the most relevant and critical knowledge reduces this upset and complete tasks required to maintain quality care.

Continual learning in healthcare is required by physicians to overcome quality of care challenges (Rushmer & Davies, 2004). However, some areas of healthcare quality require ''getting people to stop doing things as well as getting new practices started'' (Macdonald, 2002, p. 173; N. Nutley, Davies, & Tilley, 2000; Rushmer & Davies, 2004, p. 11). This means, that in addition to learning, unlearning is also required by providers, to be able to tackle new challenges related to quality of care (Cegarra-Navarro & Cepeda-Carrión, 2013).

There may be a connection between learned techniques within the knowledge base and unlearning for the change of knowledge base during periods of knowledge transformation. When end-users process incoming new knowledge, comparison and awareness of the inconsistencies occur. From this point in time, the individual recognizes the gap between previous and current knowledge. Change occurs to maintain functional actions. As a result, when physicians need to continually update their knowledge as old knowledge becomes obsolete with time, or new technologies are developed, upset may appear (Hafner & Noteboom, 2015b).

We still know little about the true nature of the unlearning and related learning processes. This work aims at developing additional understanding about the concept of unlearning within the context of healthcare providers. The process of unlearning of routinized actions and its relation to successful knowledge management requires further study. We seek to further characterize the process of physician unlearning during EMR use. The goal of this investigation is collecting characteristics of the unlearning process by physicians who currently use EMRs.

The remainder of this paper outlines the literature, defining the current understanding of the unlearning process, presentation of the study methodology, and results. We conclude with a discussion of the implications for future research and recommendations for healthcare organizational leadership to facilitate unlearning.

## 2. Unlearning in Healthcare

Unlearning has been defined as the replacement of actions, procedures, or beliefs (Hedberg, 1979), elimination of old logic (Assink, 2006), or the release of prior learning in favor of new knowledge (Becker, 2008). According to the literature, three levels of unlearning, individual, group, and organizational unlearning may be impacted by change (Hedberg, 1979; Klein, 1989; Sessa & London, 2015; Vera & Crossan, 2004). This study focuses on individuals, more specifically, the physicians who are responsible for maintaining current competencies when providing services. In healthcare, physicians are the key players (Nambisan, Kreps, & Polit, 2013), and should be the target for understanding unlearning and its impact on healthcare organizational change.

During the past decades, the volume of healthcare related knowledge has witnessed rapid growth due to increases in the number and type of specialties and subspecialties (do Rosário Cabrita, Cabrita, & Cruz-Machado, 2014). This also includes a better understanding of human health, treatments, interventions, and most importantly, HITs, including EMRs. The need to change classical ways of dealing with knowledge with the introduction of EMRs has become a central problem. A physicians' ability to adapt and respond to numerous changes within the healthcare environment is crucial. There is a need to bring this knowledge forth to aid in efficient care delivery.

The nature of continual changes within healthcare organizations has stressed physicians and created knowledge overload. These practitioners require the ability to process endless amounts of information, adapt to ongoing changes and improvements in technologies, and maintain current competencies. Change is difficult due to challenging knowledge and the fact that releasing well-established routines of behavior, processes and practices to complete healthcare provision is involved (Coombs, Hislop, Holland, Bosley, & Manful, 2013). As a result, unlearning is now a necessity for successful updating and competency maintenance of healthcare providers. Successful unlearning continues to be difficult because physician's investment in maintaining current competencies are supported (S. Nutley, & M. Davies, 2001). Unlearning can be the solution to this knowledge and technological innovation challenge in a healthcare setting (Cegarra-Navarro, Cepeda-Carrion, & Eldridge, 2011; Senge, Scharmer, Jaworski, & Flowers, 2005).

HITs, including EMRs, is the main source for such knowledge overload which create a variety of unintended consequences. It is therefore worthwhile to investigate unlearning and the successful usage of EMRs by physicians. In light of the need to understand requirements that contribute to physician "burnout and rejection" of EMRs, healthcare organizations are interested in employing those personnel that are successful with this documentation technology (Rutkowski, Saunders, Wiener, & Smeulders, 2013).

Limited research addresses unlearning in the context of healthcare. Cepeda-Carrión et al. (2011) found that technology and physician–patient knowledge are related to unlearning, where the unlearning process context itself can positively or negatively impact the quality of care. The healthcare environment, which is mainly focused on "custom and practice rather than evidence," calls for the need for new strategies that focus on unlearning old ways of doing things (S. Nutley, & M.

Davies, 2001). The unlearning process is considered a "challenging mental model" due to physicians' tendency to preserve professional autonomy (Esa & Abdulsamad, 2011).

Within the context of healthcare, it is usually difficult and challenging to unlearn old behaviors and values acquired through one's primary socialization. There are frequent conflicts between "head" and "heart" among healthcare providers (Xu, 2010; Xu, Gutierrez, & Kim, 2008). Among nurses, the process of unlearning is time and energy consuming (Xu et al., 2008). Healthcare providers are faced with additional problems and challenges when helping others to unlearn old practices using the EMRs effectively (Harrington, 2012). "… Many healthcare professionals, and health services, do not have the 'looking glass spaces' to examine and locate" (Brand, 2015, p. 522) behaviors and previous ways of completing tasks and preserving their professional identity within a broader socio-cultural context in which they live. Consequently, opportunities for healthcare providers to be successful in unlearning completion are limited.

Unlearning at the individual level is difficult due to six specific reasons (Rushmer & Davies, 2004). Individuals resist altering the way they do things or the way they think. Habit and security are two reasons reinforcing why "habitualized routines demand less conscious attention" (p. ii12). Behaviors become easy when they are repeated, which lead to known, trusted, and secure routines (Rushmer & Davies, 2004). Fear of the unknown makes unlearning change difficult. The willingness to step into what is unfamiliar continue to be another strong reason that prevents individuals from unlearning (Cegarra-Navarro, Eldridge, & Wensley, 2014; Diefenbach, 2007; Rushmer & Davies, 2004).

Other related factors are stereotypes (Ryder, Yarnold, & Prideaux, 2011), mental models (Becker, 2008), and mindsets (Greener, 2016). Each of these factors may prevent ease of adoption of new procedures or knowledge. Physicians' willingness to unlearn different mental shortcuts (e.g., stereotypes, mental model, and mindsets) involves the loss of current familiarity and habitualized routine. This can be disorienting and upsetting (Rushmer & Davies, 2004). Finally, the lack of awareness for the need to change hinders unlearning (Cepeda-Carrion, Cegarra-Navarro, & Jimenez-Jimenez, 2012; Rushmer & Davies, 2004). Professionals assume current competency is stable when working on a daily basis, and without proper feedback, professionals fail to recognize the need to start unlearning.

## 3. Statement of the Problem

The transformation of healthcare using information technologies has become inevitable. Such transformation requires healthcare providers to give up outmoded knowledge, old ways of doing things, and alter their current professional autonomy. Unlearning is proposed as a process of knowledge change for individuals, groups, and organizations (Hafner & Noteboom, 2015b).

However, unlearning has not been extensively studied in the context of healthcare providers. The study of unlearning continues to be important due to the nature of the discipline itself, which requires physicians support knowledge change for improved care quality. There is a gap in the healthcare literature on how unlearning occurs in light of the introduction of HITs, especially EMRs. The purpose of this study is to investigate the nature and characteristics of the unlearning process by physicians who use and interact with EMRs.

## 4. Methodology and Data Analysis Results

The hospital selected for this study has successfully integrated all its internal units with various modules of a single EHR vendor. The EMRs have been fully integrated with all the internal units within the selected hospital. Various modules of the EMRs were adopted from a single EMR vendor. The data were collected over a three-month period in 2013 at an acute care county hospital in the Midwest. The hospital was chosen because of its central location and importance in providing healthcare for the county. The hospital was selected based upon convenience; a facility with ease of access to researchers. One of the researchers conducted the interviews with the selected population. Twenty-eight resident physicians representing the entire resident physician population were selected and interviewed. These twenty-eight (28) interviews (representing 76% of the entire hospital physician population) were completed yielding 21 pages of electronic transcripts for study.

Interviews are the primary data collection method and open coding is used mainly for data analysis. Qualitative methods are used to provide relationships that are not prominent to the investigator (Eisenhardt, 1989). This study uses a qualitative inductive research method to investigate unlearning by physicians perform current tasks using EMRs. A case study approach (Eisenhardt, 1989; Yin, 2013) "which focuses on understanding the dynamics present within single settings" (Eisenhardt, 1989, p. 534) was used to assess the collected data. This data interpreted and analyzed using a theoretical background that informs participant selection as well as developing the interview questions, and the analysis of data.

Qualitative data analysis, "seeks to organize and reduce the data gathered into themes or essences, which, in turn, can be fed into descriptions, models, or theories" (Walker & Myrick, 2006). It enables discovery of the relationships in the real-world situation. Theoretical sensitivity allows the researcher to have insight into and give meaning to the events and

happenings in data. "Insights do not just occur haphazardly; rather, they happen to prepare minds during interplay with the data" (Strauss & Corbin, 1998, p. 47). Eisenhardt's enfolding the literature step complements the development of sensitivity. "An essential feature of theory building is the comparison of the emergent concepts, theory, or hypotheses with the extant literature" (Eisenhardt, 1989, p. 544). This research utilizes both theoretical sensitivity and enfolding the literature to develop the lens for focus and to strengthen the results.

Before coding starts, a coding structure needs to be established. Bradley, Curry, and Devers (2007) have described a set of steps that considered as a systematic approach to which integrates both inductive and deductive processes to find "emergent concepts with a focus on generating taxonomy, themes, or theory" (p. 1761).

The first step in the approach consists of having a thorough understanding of the available data. This understanding consists of going over the data without coding, which helps in the discovery of some of the hidden themes "without losing the connections between concepts and their context" (Bradley et al., 2007). Developing such structure is an "iterative and lengthy process"; the coding structure can be either inductive or more deductive (p. 1762) or can be both, inductive and deductive (Bradley et al., 2007; Stacey, Felton, & Joynson, 2010).

The inductive approach for building the coding scheme "limits researchers from erroneously forcing a preconceived result" (Bradley et al., 2007, p. 1762). In the inductive approach, data are read line by line and codes are assigned to concepts as they become apparent. The researcher continues assigning codes to the concepts as they emerge by highlighting the related data (a lines, paragraphs, or segments) that illustrate these concepts. Codes specifications are refined until they fit the data (Cruzes & Dyba, 2011). In order to check the validity of the coding scheme, segments of data that are assigned the same code are compared with each other to make sure that they represent the same concept or not (Bradley et al., 2007; Cruzes & Dyba, 2011; Curry, Nembhard, & Bradley, 2009). The analysts are able to refine the existing codes dimensions and identify new one by using the "constant comparison" method described before, by doing so, the structure of the code evolves inductively, "reflecting ''the ground,'' (i.e., the experiences of participants") (Bradley et al., 2007, p. 1762).

Table 1 represents the results of the initial open coding process with **62** codes determined. Reviewing, comparing, and contrasting the obtained codes, we found that few codes need to be merged into the same code tag since they represent the same piece of information. This process results in a total of **55** codes. Twenty-one (21) of these coded data presented as perceptually positive, supportive statements of physician participants, whereas thirty-four (34) codes represented negative type physician statements.

| Open Coding | Count | Open Coding | Count |
|---|---|---|---|
| Difficulty/Not Easy to Use | 51 | Takes Time to Use | 2 |
| Functionality | 47 | Takes Time to Learn | 2 |
| Ease of Use | 36 | Useless | 2 |
| Time Wasting | 33 | Alignment with Current Practice | 1 |
| Missing Features/Functionality | 29 | Collaboration/Interaction | 1 |
| Frustration | 21 | Complicated | 1 |
| Time Saving | 21 | Fast | 1 |
| Usefulness/Helpful | 15 | Inability to Work Together | 1 |
| Redundancy | 13 | Inconsistency | 1 |
| Time Consuming | 11 | Incorrect Location for Information | 1 |
| Reduce Productivity | 10 | Interactions | 1 |
| Not User Friendly (Poor UI Design) | 10 | Not Compatible | 1 |
| Ease of Access | 8 | Not easy to access | 1 |
| Comfort | 6 | Not easy to Learn | 1 |
| Not Supporting Business Processes | 6 | Not easy to Understand | 1 |
| Improve Business Process | 5 | Not Reliable | 1 |
| Negative Collaboration | 4 | Positive Collaboration | 1 |
| User Interface Design | 4 | Positive Feeling | 1 |
| System problems | 4 | Problem | 1 |

| | | | |
|---|---|---|---|
| Communication | 3 | Productivity | 1 |
| Compatibility | 3 | Requires Time | 1 |
| Support Business Processes | 3 | Requires Training | 1 |
| Tedious | 3 | Satisfaction | 1 |
| Communication Problem | 2 | Slow Business Processes | 2 |
| Increase Efficiency | 2 | Speed Up Processes | 1 |
| Inefficient | 2 | Support Objectives | 1 |
| Inflexible | 2 | Usability | 1 |
| Not Useful | 2 | | |

Table 1. Open Coding Results

The next step is axial coding, which consists of intense analysis of obtained codes in order to reach cumulative knowledge about them and their relationships were used in this study (Eriksson & Kovalaine, 2008). In axial coding, "the researcher gets deeper understating of the relationships in the phenomena by relating the categories with relevant subcategories" (Baskerville & Pries-Heje, 1999; Corbin & Strauss, 1990). Following Urquhart (2001), we draw some kind of preliminary distinction between these codes based on the meanings of the codes themselves. Based on these initial distinctions, the main conceptual categories are selected. Reviewing, comparing, and contrasting the obtained codes, we found that some codes would be merged into the same code tag since they represent a similar piece of information.

The process of reviewing, comparing, and contrasting these 55 codes result in grouping them into 6 conceptual categories. The 6 conceptual categories will help in finding and developing a "fuller picture of relationships or explanation that exist in relation to the data and research question" (Eriksson & Kovalaine, 2008, p. 199). Table 2 illustrates the resulted conceptual categories from the axial coding process.

| **Axial Coding** |
|---|
| Comfort |
| Frustration |
| Positive Collaboration |
| Technology Upset |
| Technology Ease |
| Negative Collaboration |

Table 2. Axial Coding Results

With selective coding, our analysis starts to evolve around two main concepts, complete unlearning, and incomplete unlearning.

| **Selective Coding** | |
|---|---|
| **Complete Unlearning** | **Incomplete Unlearning** |
| Comfort | Frustration |
| Positive Collaboration | Technology Upset |
| Technology Ease | Negative Collaboration |

Table 3. Selective Coding Results

The data shows that a fresh lens on the unlearning process along these two lines may focus the process of updating knowledge in patient care models of service delivery. When physicians use an EMR, they complete the process through either complete unlearning or incomplete unlearning. Complete unlearning can be defined as, "consistency in repetition, knowledge storage, and retrieval systems in place", for successful knowledge change. On the other hand, incomplete unlearning can be defined as, "inconsistency in repetition, knowledge storage, and retrieval systems in place" reducing effectiveness of knowledge change (Hafner, 2016, p. 4325).

Complete unlearning and incomplete unlearning as concepts may have merits in understanding this updating within new HITs, such as EMRs. This knowledge change may significantly affect unlearning both positively and negatively at the same time.

## 5. Findings

The research question was answered through the development of subcategories of perceptions that are present in physicians in the process of unlearning when they use an EMR. Physician perceptions about how unlearning processes occurred were assessed during specific unlearning of EMR systems. Based on the analysis, there are three main aspects around which the unlearning process is characterized - technology perception, feelings and expectations, and collaboration.

Technology perception defined as the relationship of physicians' perceived usability of EMR and their feelings towards such systems during the unlearning process. Such perceptions might be positive or negative (Hafner & Noteboom, 2015a). For example, positive technology perception can contribute to the ease of use of EMR, ability to access the necessary information by physicians, the perceived usability of EMR to meet care objectives, and intuitive and simple EMR user interface design. On the other hand, negative technology perception contributed to the EMR actions being difficult to use, were not useful in completing care, were missing some functionality features, and were not user friendly. Such differences of technology perception were referred to as "technological ease" (positive technology perception) and "technological upset" (negative technology perception) (Hafner & Noteboom, 2015a)

Feelings and expectations are related to physicians' perception involving the emotional ease or the emotional upset about using the EMR in unlearning. These perceptions might be characterized as positive or negative. Positive feelings and expectations, related to comfort, positive feelings, helpfulness, usefulness, and satisfaction with the operations. Negative feelings and expectations were related to feelings of frustration, information redundancy, slowing of processes or care delivery, tediousness of data input, and inflexibility during use. Such differences in perceptions of feelings and expectations are defined as comfort, positive feelings and expectations or frustration, negative feelings and expectations.

Collaboration, generally defined as a process where healthcare providers, such as physicians and nurses complement each other's roles and work together and perceived positively. They share responsibilities and problem-solve to provide improved patient care. E-collaboration (Zhonggen, 2016), the ability of the EMR to support the collaboration process among physicians and nurses is used extensively in healthcare service delivery.

Collaboration has positive or negative consequences. Positive collaboration allows physicians to interact effectively with patients, and other healthcare providers to achieve shared patients care goals. This creates patient satisfaction, and supports competency in physician perceptions. Negative collaboration, i.e. reduced level of collaboration, often results in inefficiency, where there is a lack of interfaces between various specialties, clinics, or organizations. With this lack of collaboration, errors may occur and care quality can be low.

According to the three previously mentioned themes, we can characterize unlearning and rethink of some of the traditional views about providing patient care. With the introduction of EMRs in a healthcare environment, two main concepts are introduced according to our findings from the selective coding phase, complete unlearning and incomplete unlearning.

### 5.1. Incomplete Unlearning

Incomplete unlearning, according to physician interview results occur when there is an inability to adapt to the EMR. This creates upset when they interact with the EMR, a reduced or limited collaboration through EMR, and results in frustration caused by the EMR in some cases.

The data analyses showed that physicians who are unable to complete the unlearning process were due to many reasons. Examples include, the non-intuitive EMR user interface, perceptions of technological upset, the physician's inability to use the EMR to support their work, the inability to support collaboration mechanisms between all healthcare participants, and perceptions of technological upset through the process. Previous research supported this coding process with participants defining incomplete unlearning as a negative process where the ability to use the EMR successfully (Hafner & Noteboom, 2015a). The following excerpts from interviews data support the discussion about incomplete unlearning. The following statements represent these physician perceptions:

> *"Not intuitive to navigate through"(P1), " Not very intuitive, takes a while to learn the details and now to navigate the system"(P2), "Difficulty to find certain*

> *information especially in scanned files"(P3), "I spend too much time clicking on multiple copies of the same med to find the one with correct dosage and form"(P4), and "seems every time I learn to do something one way, it makes an update, and I have to relearn (usually by a mistake) how to do the same thing again."(P5).*

It appears that for some physicians, the healthcare practice processes were not supported by the EMR use. Among the listed reasons by the physicians were an unintuitive user interface, lack of support for their work, slowness of data processing and screen change, inflexibility, and redundancy. Physicians' perceptions in these excerpts from the interviews represent the sample excerpts demonstrating an incomplete process. These statements support the discussion related to physicians' frustration:

> *"Not a very user-friendly system"(P8), "trying to put in orders can be extremely time consuming and frustrating and this can slow things down"(P9), "The numerous allergy checks that you have to click through"(P11), and "It makes entering orders much easier but can also take away from thinking critically about what the patient needs in that everything is check boxes."(P13).*

For those physicians that were unable to complete the process effectively, incomplete unlearning negatively impacted the physicians' work practices and workflows. Numerous EMR updates, negatively affected practitioners creating upset. When the EMR documentation process is perceived as frustrating, physicians are prevented from efficiently collaborating with patients and co-workers. Physicians that became upset, due to their inability to establish a working relationship with new technology, limit participation in the healthcare organization.

Data analysis showed that physicians were unable to utilize the EMR for successful collaboration. The physicians were challenged by the requirement of EMR use to collaborate with patients as well as co-workers. Physicians' inability to make required changes to successfully interact with the system was problematic. These perceptions were demonstrated by the following excerpt from the interviews and support the discussion about the impact of negative collaboration:

> *"All orders need to be seen by nursing and providers and nurses should not have to fight over who has control of the chart, this slows things down if one has to wait for the other to get out"(P1), "two people cannot be in the same chart, and this causes time problems" (P6), "not letting provider and nurses work in the same chart at the same time" (P11), and "system does not communicate well with nursing. Orders are sent to nursing that are not easily seen from their side, and orders are missed."(P18).*

Incomplete unlearning may also be related to the EMR non-intuitive structure. When presented with a non-intuitive system, physicians have difficulty in unlearning prior knowledge, actions, and procedures. These perceptions are indicated through the following excerpt from the interviews and support discussion about technological upset:

> *"Searching for labs and medications is cumbersome"(P20), "…there are lots of redundancy with ordering…" (P16), "if system goes down, no work can be accomplished" (P5), "Slows the physician"(P9), and "creating templates does not seem to be an easy process " (P2.)*

Incomplete unlearning, as the excerpts present, results when there is difficulty using the EMR and may create upset, frustration, a change in collaboration and can be considered as a detraction to a successful knowledge change process in healthcare physicians.

## 5.2. Complete Unlearning

Complete unlearning positively impacted the physicians' work practices by facilitating the unlearning processes. Those that could establish technological comfort and ease with EMR were successful in completing the learning change process. The perceptions point to their ability to produce current and new competencies during knowledge change. Physicians were more likely to make subsequent knowledge changes more capably, and update competencies easily. Previous research supported this coding with the majority of participants defined complete unlearning as a positive process where the ability to complete unlearning with positive perceptions about their ability to complete the functions of the EMR (Hafner & Noteboom, 2015a).

When physicians are able to perform computer operations within the EMR interface and understand the change

in processes and procedures, tasks appear to be processed smoothly and contribute to perceptions of a successful process where complete unlearning occurs. The following excerpt from the interviews support perceptions of complete unlearning:

> *"I can look up past notes and patient data easily" (P9), "Easy to input orders; anywhere/anytime provided you know what you're looking for"(P14), "you can import vitals/labs into notes which is nice and puts everything in one place"(P25), "this provides better comprehensive, continuity of care"(P23), "it does speed up history taking on a patient by being able to look at all records available"(P12), and "I have become more comfortable typing notes"(P27).*

Physicians noted comfort when using the EMR. They reported their abilities to intuitively interact with the EMR where there was the necessary support to fulfill their daily objectives which provided knowledge about current patients' health status. According to the data analysis, when physicians reported comfort, or positive feelings, satisfaction during use and interaction with the EMR occurred. The unlearning process through knowledge updating was demonstrated. The following excerpt from the interviews supported this concept related to physician EMR comfort:

> *"I have become more comfortable typing notes" (P27), "able to cut and paste recurrent information from previous notes, helps to make these documents quick and accurate" (P28), and "don't have to go hunting for records"(P4)*

Physicians were able to utilize the EMR for successful collaboration. This related to all functions of collaboration with patients to fellow co-workers. Interview excerpts describe collaboration that occurs through EMR use:

> *"Better communication with nursing" (P3), "I like that we can receive messages from the FHC nurses/schedulers via Meditech, and then we can easily respond to those messages as well"(P22), "Medications can now be accessed and adjusted by all providers involved" (P15), and "The fact that when I order medications in the clinic, Meditech automatically faxes them to pharmacy because it saves me time and gets patients out of the office sooner"(P7).*

Physicians were able to complete the unlearning process because of the perceptions of technological ease with the EMR. When the EMR is intuitive, and easy to use it without any additional cognitive effort, it supports processes and objectives. Physicians established EMR technological ease and discuss their perceptions:

> *"It does make it easy to see lab and vital trends" (P19), "I am able to access records from home. I can look up past notes and patient data easily" (P11), "I think the interface is clear"(P8), "order sets are very helpful and time saving"(P20), and "past records easy to find and sort through"(P17).*

Complete unlearning, as excerpts above represent, show the use of the EMR creating, comfort, ease, and increased collaboration. These perceptions are considered supportive measures to successful knowledge change process in healthcare physicians.

The data shows that rethinking the unlearning process along these different lines may result in a more effective picture of updating knowledge in patient care models of service delivery. Complete unlearning and incomplete unlearning may have merits in understanding how to best introduce HITs within the healthcare environment.

## 6. Discussion

The main idea emanating from the data analysis and results is that successful unlearning is dependent on physicians' perceptions of the healthcare environment. Physicians need to eliminate existing knowledge to complete the unlearning process successfully (Hafner, 2016). There is a need to increase physicians' awareness that knowledge may need to be replaced. Such awareness can take place when physicians are taught their current knowledge is obsolete or no longer valid in their current practice. When physicians' current procedures are not supported by these actions and do not meet the organizations' quality care objectives, problems in knowledge change exist. In this situation, physicians are required to adapt to new practices. Awareness and identification of obsolete knowledge is vital. The development of flexible and adaptive strategies to overcome unlearning objections will be essential to completing this change process.

Unlearning will require two essentials. One, the ability to facilitate some form of awareness in the individual that something has changed in their care procedures or that a specific care situation needs to lead to new and different

actions (Cegarra-Navarro, Wensley, & Polo, 2014). And, this specific awareness results in the need to release outdated ideas (Becker, 2010; Cegarra-Navarro, Wensley, et al., 2014). The study results and subsequent analysis demonstrated that EMRs facilitate the process of knowledge and information sharing, collaboration, and joint sense making processes.

If EMRs related knowledge systems are not updated frequently and appropriately, physicians are more likely to suffer and have difficulty unlearning old knowledge and habits, which in turn affects quality of patient care. According to Cegarra-Navarro et al. (2011), technology knowledge has a positive effect on the unlearning context. For a successful adoption of EMRs, management needs to "foster an unlearning context which opens the way for new habits, patterns and ways of doing and interpreting things to take place" (Cegarra-Navarrol, Cepeda-Carrion, & Jimenez-Jimenez, 2011, p. 3) . When knowledge is changed correctly and effectively, upset and inconsistencies in EMRs use are reduced. (Hafner & Noteboom, 2015b).

Another way to overcome incomplete unlearning is to adopt an 'adjusted' unlearning approach. Adjusted unlearning is a small incremental change in the existing knowledge structure within an organization. This type of unlearning is used in evolutionary innovation and technological change. Unlearning specifics to this type of change include examples, such as, engineering intervention and work process redesign to improve speed and production quality (Akgün, Byrne, Lynn, & Keskin, 2007). Such an unlearning strategy can fit the environment where a physician interacts with EMRs. Undergoing complete change in mindsets and the way they carry out existing processes when changed frequently allows for increased flexibility and a new habituated skill to develop. This results in more adaptable practitioners that are skillful in keeping pace with ever-changing technologies within the healthcare environment.

## 7. Limitations and Future Research

Healthcare practitioners are required to frequently change existing knowledge in favor of new processes for patient safety and efficiency. With results from ongoing study, healthcare providers, physicians, can use the characteristics established to complete a successful knowledge change process. This study contributes to current understanding of the unlearning process. As yet, the entirety of the process remains undiscovered. Limitations were the sample size and the amount of collected data. Additional interview questions added might better reflect the emerging characteristic of adjusted unlearning to add rich data of the additional factors that facilitated or detracted from the unlearning process.

Healthcare organizations that continue train EMR use with an understanding of the unlearning process may be able to change EMR more effectively including ease in adoption and better focus on collaboration between all providers. Physicians need to remain competent in healthcare practice; all information requires frequent updating to the most current information and knowledge within healthcare practice using EMRs. The incremental nature of the process may serve to add to physician adoption and collaboration of EMRs. How physicians and other healthcare providers make these modifications in their knowledge base will assist organizations to reduce the impact of technological upset. When this process can be facilitated, change and maintenance of current service provision competency is achieved. The complexities of unlearning facilitation remain a good focus for continued research.

Future research should complete additional studies to add additional characteristics and quantify the best situations for updating knowledge using EMRs. Studies involving a variety of methodological constructs can serve to better understand individual experiences, perceptions, and influencers occurring during the unlearning process.

## 8. Summary and Recommendations

We answered the research study question: "What are the characteristics of the unlearning process by physicians who are using EMRs?" We characterized physicians' unlearning differently through rethinking traditional views concerning providing quality care to patients by utilizing EMRs. The study has presented the challenges of Health Information Technologies (HITs), such as EMRs, and how these new technological changes can affect physician unlearning.

The rising cost and decreasing quality of healthcare continues to focus on successful adoption of the use of EHRsto solve these challenges. Improving service delivery and increasing efficiency while maintaining updated technology is an ongoing problem for organizations. However, the challenges to adoption of EHRs by physicians have tempered efforts to improve efficiency of service delivery. As organizations continue to utilize technology to gain efficiency, effectiveness, and consistency in use of best practices, it becomes a requirement to facilitate technology use with ease.

As this research indicates, individual reactions to updating the technology can make unlearning a process, one of technological ease or technological upset. The goal of healthcare organizations is to determine methods to avoid technological upset, or at least offer support to break out of a negative cycle. "Adjusted unlearning", a small incremental change process, may help to modify the existing knowledge structure within an organization and enhance the opportunities for a complete process.

With greater understanding of complete and incomplete unlearning, implementation of new methods of knowledge acquisition, and change can be realized to maintain effective employee competency. This research study adds information to the current understanding of the unlearning process that remains not fully understood. The research has investigated how physicians can successfully use EHRs and the influencers of EHR documentation to enable better healthcare provision.

Changing knowledge requires organizations to alter knowledge base in favor of new competencies for organizational efficiency. Competitive advantage and competency maintenance involves rapid knowledge acquisition and revision from current knowledge, and skill competency through unlearning. Physicians make the difference in healthcare organizations. Physicians were noted to present related factors that positively assisted them and facilitated a complete unlearning process. These included, "a positive prior outlook, understanding the need for change, positive feelings and informal support, individual inertia, feelings and expectations, and assessment of the new way" can enhance unlearning (Becker & Hyland, 2008, p. 193).

We need to develop change management practices to support transitional unlearning to technological ease and reduce the potential for technological upset. Because there are many practitioners providing good quality care in healthcare, physicians should not be the only focus of understanding knowledge change. Organizational leadership plays a major role in supporting complete unlearning. The history of "organizational change and the formal training and support mechanisms" can play an important role in improving or hindering unlearning (Becker & Hyland, 2008, p. 193).

Practitioners that are able to update knowledge may be more effective than those that have perceptions of upset and frustration of EMR use. Change processes become critical in light of increasing information overload required to complete patient care. Our ability to influence the transition process with technological ease provides increased technology benefits, increased technology use and increased perceptions of professional staff competency.

Healthcare practitioners able to fully understand knowledge change processes, using better defined characteristics of complete and incomplete unlearning, will benefit patients and their families. Physicians who unlearn completely also perceive that their care is improved and skills are competent during EMRs use. By addressing the physician end-user requirements during complete unlearning, support for improved service delivery, documentation and continual updating is obtainable.

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