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New Perspectives on Implementing Health Information Technology

Sumantra Sarkar

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NEW PERSPECTIVES ON IMPLEMENTING HEALTH INFORMATION TECHNOLOGY

By

Sumantra Sarkar

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

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2014

ACCEPTANCE

This dissertation was prepared under the direction of the Sumantra Sarkar's Dissertation Committee. It has been approved and accepted by all the members of the committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

NEW PERSPECTIVES ON IMPLEMENTING HEALTH INFORMATION TECHNOLOGY

BY

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3rd August, 2014

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The importance of studying challenges in implementing information technology solutions in health care organizations is highlighted by the huge investments in health care information technology (HIT) which has been spurred by recent government mandates. Information technology can help improve health care delivery cost by facilitating the standardization of work processes or routines and reducing variations among them.

Set in a premier 950+ bed hospital in the south eastern part of US, this dissertation consists of two studies examining the challenges involved in implementing HIT solutions. In the first study, we seek to gain deep insights into how the process of creating a patient's chart evolves over time in a health care institution. The second study focuses on the users of Electronic Health Records (EHR) system, investigating the compliance behavior of various providers with respect to patient records in the system.

In the first study, through the lens of Activity theory our results show that the charting routine is implicated by the following environmental factors: (1) Tools, (2) Rules, (3) Community, and (4) Roles, and by individual factors: (5) Computer Self-Efficacy and (6) Risk Propensity. In the second study, our results indicate that there is a substantial effect of subculture of the different occupational groups on IT security compliance intent and behavior in a health care institution.

Keywords: routines, process, activity theory, information security, information security policy, compliance behavior, policy violation, pseudo-compliance

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And lastly my Dad who had told me when I was very young that I do well in academics and that I should choose academia as my career. I never accepted it. But as fate would have it, I am now submitting this dissertation, fulfilling his dream when he is not here. I know I have his blessings.

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NEW PERSPECTIVES ON IMPLEMENTING HEALTH INFORMATION TECHNOLOGY

Introduction and Overview

The importance of studying challenges in implementing information technology solutions in health care organizations is highlighted by the huge investment of nearly $36.5 Billion in health care information technology (HIT) which has been spurred by recent government mandates (Washington Post 2009, Romanow, Cho et al. 2012). As a part of the American Recovery and Reinvestment Act of 2009, health care institutions have been given strict timelines by the Centers for Medicare and Medicaid Services to implement EHRs to achieve "meaningful use" of information systems, failing which penalties are imposed (CMS 2014a). While a RAND report of 2005 (Hillestad, Bigelow et al. 2005) projected that implementation of HIT solutions can save $81 billion annually tax payers, these savings have not materialized. Despite concentrated effort, implementation of EHRs has been challenging resulting in annual health care costs going up by $800 billion (Kellermann and Jones 2013). With the implementation of EHRs storage of data on a central server, patient data now are more vulnerable to theft and misuse because of easier access (Angst and Agarwal 2009) compared to paper records (Choi, Capitan et al. 2006). Loss of patient records is costing the US health care industry $7 billion annually (Ponemon 2012).

To understand the challenges and how HIT implementations can be done better, Payton et al. (2011) identified three perspectives that HIT implementations should be studied from (1) process, (2) people and (3) the patient. This thesis focuses on the first two: a process perspective (Study 1) and a people perspective (Study 2). In the first study, we seek to gain deep insights into how the process of creating a patient's chart evolves over time in a health care institution with changing goals of a physician. The second study focuses on the users of EHR, investigating their compliance behavior with respect to patient records in the EHR. The studies were conducted in a premier 950+ bed hospital located in the south eastern part of the US. This hospital had implemented one of the largest EHR systems in the world, at a cost of about $40 million. Specifically, the study was conducted in the Emergency Department (ED) which is an urban Level I trauma center. The ED receives nearly 120,000 patient visits per year and has approximately 120 emergency attending physicians, 50 resident physicians and 150 nurses working in this department and 200 support staff.

In the next two sections, an overview of the two studies is provided.

Study 1: **Evolution and Adaptation of Routines in Health Care: An Exploratory Study**

Organizational routines, also called processes in technological literature (Pentland, Feldman et al. 2012), are the fundamental building blocks for delivering services in organizations. The importance of the role of routines in complex organizational settings such as health care delivery has been recognized by recent research (Payton, Paré et al. 2011). Information technology can help improve health care delivery cost by facilitating the standardization of work processes or routines (Gawande 2012) and reducing variations among them (Spear 2005). The development

of a comprehensive understanding of how routines are evolved, adapted and practiced in an organization is the necessary first step in achieving standardization. With this background, this study attempts to answer the following research question:

How are routines evolved, adapted and practiced in a health care organization?

A case study approach which allows the investigation of the "how" and "why" questions of interest in natural settings was used. This approach is appropriate especially for the study of "sticky, practice-based problems where the experiences of the actors are important and the context of the action is critical" (Benbasat, Goldstein et al. 1987). This qualitative exploratory study investigates a "charting" routine in a hospital and explores how different factors influence the evolution of this routine. Activity Theory is the theoretical lens used to understand the evolution of routines. Our study establishes that goals of an individual performing a routine are a critical element in the evolution of routine in the following ways:

- The physician sets different goals for the use of EHR at different phases of residency. A resident physician's charting routine also evolves as his or her goals evolve during the course of residency.
- Another factor that implicates the charting routine is the "effective use" (Burton-Jones and Grange 2012) of the EHR which also advances to a higher level as the resident physician progresses in residency.
- Through the three years of residency, the resident gets indoctrinated into the profession and learns the norms and rules of the profession. There is a gradual progression in this learning which is facilitated by the norms and rules embedded in the EHR.
- The charting routine also gets influenced substantially by the community (peers and senior residents). Collaboration with members of their cohort and senior residents is extremely important in shaping the charting activity because most resident physicians had never used an EHR before and the training on the EHR that is provided by the hospital is also very limited in scope.
- There are clear distinctions between roles held by resident physicians in different stages of residency. While their role is as an intern in the first year of residency, they graduate to become a leader in the third year guiding interns on the charting routine. The charting activity is appropriated by the role the resident plays at various stages of residency.
- Two personal factors that appropriate a charting routine are computer self-efficacy and risk propensity. Both factors played a critical role in shaping the charting routine of the individual.

Summarizing, our results show that the charting routine is implicated by the following environmental factors: (1) Tools, (2) Rules, (3) Community, and (4) Roles, and by individual factors: (5) Computer self-efficacy and (6) risk propensity.

By examining the role of evolving goals in the evolution of a routine, our research responds to the call by Loch et al. (2013) for further studies on how routines are influenced by contextual factors. With a deeper understanding of how goals influence routines, this investigation may contribute to the literature on organizational economics which is focused on understanding the

purpose or motivation of routines (Parmigiani and Howard-Grenville 2011). Our findings reinforce the views of Dionysiou and Tsoukas (2013) that routines are capable of adjusting and adapting to the environment (Feldman and Pentland 2003). Our research represents an initial attempt at using Activity Theory to examine the evolution of routines. Additionally, this study is one of the few studies where the temporal dimension has been added to Activity Theory. Our study also contributes to our knowledge on the influence of an IT artifact, the EHR application, on a routine (Feldman and Orlikowski 2011) which is of significance to organization theory scholars interested in understanding how people enact routines (Parmigiani and Howard-Grenville 2011). Our findings confirms the work of Feldman and Pentland (2003) that the ostensive aspect of a routine might be the same for the organization or department, while different individuals might enact the same routine differently (performative aspect). Our findings add a new dimension by explicating that some part of this variation may be attributed to personal factors. This study contributes to the literature on organizational routines by developing an understanding of how routines evolve, and how users adapt and practice routines in complex processes (Abell, Felin et al. 2008) such as the delivery of health care. Additionally, by developing new theoretical perspectives to explain the phenomenon of evolution of routines, this research will add to the body of knowledge in category 3 of health information systems research (HISR) literature focusing on the relationship between IS theory and context (Chiasson and Davidson 2004). From a practitioner's point of view, this project will help identify factors that influence the adaptation of an IT-enabled routine application in health care organizations. The knowledge gained would also be beneficial to practitioners in developing training requirements, redesigning processes, identification of feature enhancements and developing guidelines for standardizing processes.

Study 2: **Understanding IT Security Compliance Behavior in Health Care: An Empirical Study**

It has been long accepted fact that insider threats are one of the biggest concerns for information security managers (Posey, Bennett et al. 2011, Willison and Warkentin 2012). A 2014 PricewaterhouseCoopers report (PwC 2014) suggests that the source of a vast majority of security breaches (at 58 %), can be attributed to insiders. In health care organizations, nearly two thirds of the organizations face this problem (PwC 2014).

Research on analyzing information security issues in health care (Appari and Johnson 2010), particularly focusing on the human side of IS security breaches (Parker 1998) is scant. The culture of the group that an individual belongs to has a strong influence on his or her behavior (Srite and Karahanna 2006). This research attempts to analyze the differences in IT security policy violation behavior between different occupational groups (or subcultures) inside a health care institution. Specifically, the research attempts to answer the following research question:

> ***How do differences in subculture among different occupational groups in a health care organization, influence behavior with regards to IT security policy violation?***

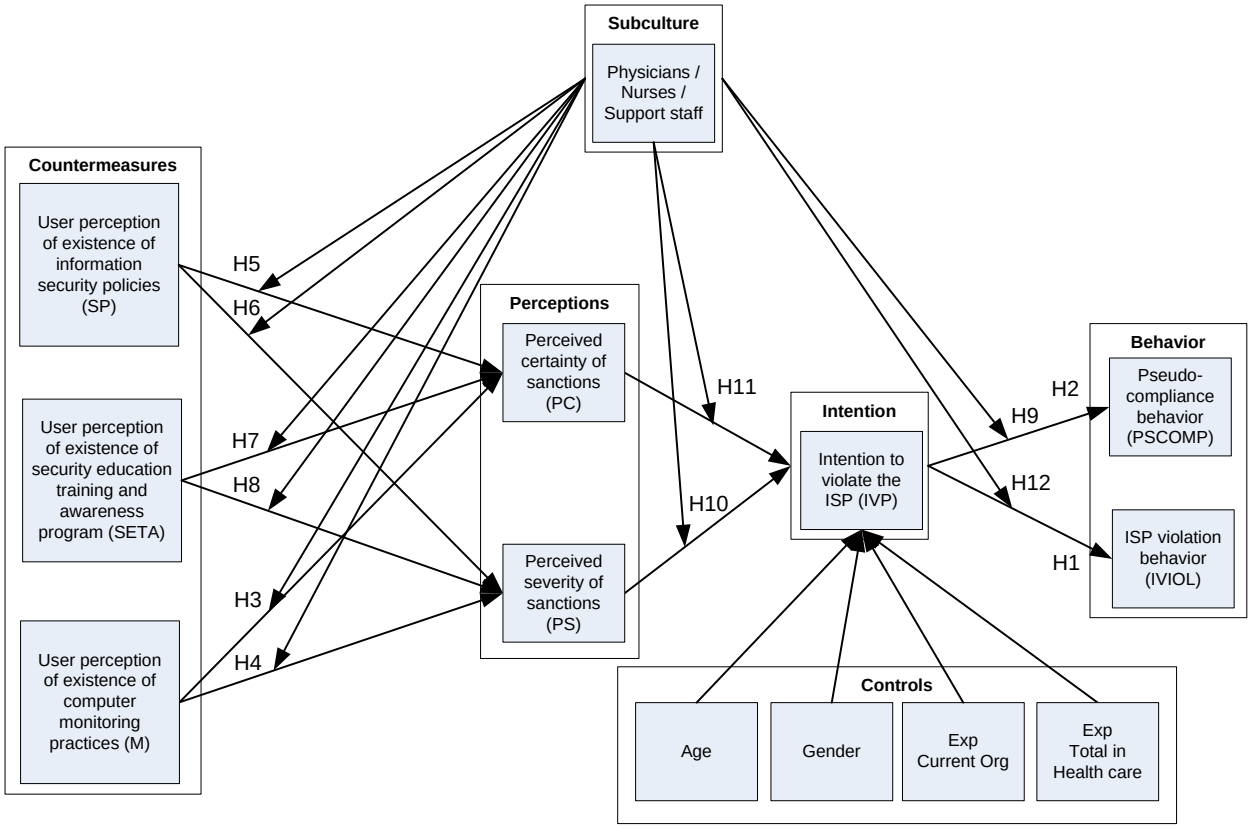

Figure 1: Research Model (extends D'Arcy et al. (2009) model)

A field study using a hypothetical scenario method (Weber 1992) was used to test an extended version of D'Arcy et al. (2009) model. Subculture was used as a moderator between three groups of occupation in the health care institution namely: physicians, nurses and support staff. Support staff in this context are personnel who help the clinical staff in patient registration, movement of patients, checking vitals etc. Our results indicate that there is a substantial effect of subculture of the different groups on IT security compliance intent and behavior in a health care institution. Subculture moderates most of the relationships of the extended D'Arcy et al. (2009) model. Analysis of the data shows that there is a hierarchy between physicians, nurses and support staff though these groups do not have a formal reporting structure to each other.

This is one of the first studies which recognize that within an organization, different groups with varied subcultures exist; and they can behave very differently in response to a common IT security policy. This research contributes to the literature on IT security compliance by developing insights on subcultures influencing compliance behavior. Secondly, this study adds two constructs to the IT security policy compliance literature: (1) "Pseudo-compliance behavior" to examine behaviors which are advertised as compliant behavior but are not actually compliant and (2) "ISP Violation behavior" which measures the extent that an individual violates a security policy. Both constructs open new avenues in IT security compliance research. Lastly, it contributes to the Health IT literature by improving our understanding of a critical challenge faced by organizations while implementing HIT solutions. From a practitioner's perspective,

these findings help IT security team design awareness programs for focused groups since not all groups behave in the same fashion to a common organization wide IT security policy. The research findings also highlight that not all policies are implemented as designed, suggesting a careful review of actual implementation of security policies. Based on such a review, managers can develop incentives for promoting IT security compliance.

Study 1
Evolution and Adaptation of Routines in Health Care: An Exploratory Study

Introduction

Organizational routines are the fundamental building blocks for delivering services in organizations. IS literature defines organizational routines as "repetitive, recognizable patterns of interdependent actions carried out by multiple actors" (Feldman and Pentland 2003). Routines are spread across the organization in time and space and therefore the observation and analysis of a routine can be difficult and complex (Cohen and Bacdayan 1994). Our understanding of how routines are evolved, adapted and practiced is limited and ambiguous even though this topic has been studied for over three decades (Becker 2004, Parmigiani and Howard-Grenville 2011).

The importance of the role of routines in complex organizational settings such as health care delivery has been recognized by recent research (Payton, Paré et al. 2011). Information technology can help improve health care delivery by enabling the automation and innovation of routines used in the process. The importance of studying IT enabled organizational routines in health care organizations is highlighted by the huge investment of nearly $36.5 Billion in health care information technology (HIT) that has been spurred by recent government mandates (Washington Post 2009). Since health care costs account for nearly 17% of the GDP in the USA, controlling costs is a major goal for health care organizations. A promising avenue for achieving this goal is the standardization of work processes or routines (Gawande 2012) and reducing variations among them (Spear 2005). A first step in the standardization of a work process or a routine, is the development of a comprehensive understanding of its how it is performed, especially how it is enacted by different actors and the reasons for variations among these enactments. This research attempts to open the black-box of an IT-enabled routine in a health care institution to develop such a comprehensive understanding of a critical routine

The next section describes the objectives of this research leading to the research question. The theoretical basis and prior work done on this topic are explained in the ensuing section followed by a discussion of research design and methods. The subsequent sections give details on the site selection, data collection and analysis framework. The last two sections describes the findings and discussions followed by conclusions.

Research Objective and Question

The development of a comprehensive understanding of how routines are evolved, adapted and practiced in an organization is the necessary first step in achieving standardization. Routines may be adapted differently by different users or groups of users. Also, the same user may enact a routine differently in different contexts and at different points in time due to influences from the environment. This study seeks to develop an understanding of how and why there are variations

in the adaptations of routines. While on the one hand, the standardization of routines may improve efficiencies and provide cost benefits, complex service organizations like hospitals (McDaniel, Lanham et al. 2009) may not seek to avoid variations in the execution of routines (Tucker, Nembhard et al. 2007) because health care professionals are expected to treat every patient differently depending on their unique needs (Butler, Leong et al. 1996); and therefore, there may be wide variations in routines followed by them. This inherent conflict offers an interesting setting to study how routines are adapted by health care professionals. Specifically, this research is guided by the following research question:

> ***How are routines evolved, adapted and practiced in a health care organization?***

Theoretical Background

A review of the literature on routines, specifically in complex settings like health care organizations was performed to identify knowledge gaps, guide research design and facilitate theory development (Webster and Watson 2002). There have been primarily two distinct approaches through which organizational routines have been studied in the past. Stemming from organizational economics is the "lens of capabilities" approach where the interest is to understand the purpose and motivation of routines, focusing on "what" or "why" of routines (Parmigiani and Howard-Grenville 2011). On the other hand, the "lens of practice" approach is grounded in sociology and organization theory which attempts to investigate the "how" of a routine, focusing on how routines are enacted (Parmigiani and Howard-Grenville 2011). In this study we use practice theory (Feldman and Pentland 2003) which has been used in the past for studying routines (Feldman and Orlikowski 2011) as the theoretical lens.

Nelson and Winter's (1982) seminal work studied organizational routines as a central construct in explaining organizational and economic change. According to Becker and Zirpoli (2008) three different perspectives on organizational routines have been used in the literature: (1) as a repeated behavior pattern to accomplish a task, e.g., technical assistance over a phone at a software support call center (Pentland and Rueter 1994), (2) as rules in an organization, e.g., standardized work processes at McDonald's for providing fast food (Leidner 1993) and (3) as capacities or dispositions to invoke acquired or adapted behavior by responding to appropriate cues, e.g., an employee is able to reenergize a regular routine the next start of day at 9 AM, after he ended work the previous day at 5 PM (Hodgson 2008). In this research, routines are considered as recurrent patterns, such as actions (Cohen, Burkhart et al. 1996), activities (Jones and Craven 2001), behaviors (Edmondson, Bohmer et al. 2001) or interactions (Zollo, Reuer et al. 2002).

Specifically, a routine will consist of many activities and not all activities will be enacted in every instance of the routine. For example, a hiring routine may consist of activities such as determining the need, writing position description, advertising the position, receiving and reviewing applications, interviewing applicants, ranking applicants, offering position and negotiating terms (Feldman and Pentland 2003). The hiring routine might be practiced differently in a fast food restaurant when compared to a university. For example, while a

research presentation followed by negotiations is deemed necessary for university hiring, they will not be appropriate in the hiring routine of a fast food restaurant. Closely connected to this view, Feldman and Pentland (2003) analyze routines from two different mutually constitutive perspectives. The "ostensive" aspect describes the abstract idea, while the "performative" aspect describes the specific performance of a routine. These concepts are similar to a musical score and the actual performance of the score respectively. This implies that while the ostensive aspect might be the same for a routine in an organization, different enactments of this routine might not be the same. Feldman and Orlikowski (2011) further add that the ostensive aspect of a routine guides the performative aspect of a routine in its creation and maintenance. They conceptualize routines as generative systems created by recursive interactions between the ostensive and performative aspects of the routine.

It is difficult to study routines since they are complex patterns (Pentland and Rueter 1994). In service organizations like health care institutions, data collection on routines is exceedingly hard (Tucker, Nembhard et al. 2007) because observation, analysis and description of routines in this complex setting is difficult (Cohen and Bacdayan 1994). Moreover, evolution of routines is difficult to predict due to their tacitness (Cohen, Burkhart et al. 1996). Szulanski and Jensen (2004) add that knowledge about routines is difficult to transfer since they are "sticky." In view of these challenges, further research is needed to understand how routines evolve in complex settings like health care organizations (Loch, Sengupta et al. 2013). In a similar spirit, Cohen (2007) also calls for studies that provide a nuanced understanding of how routines evolve.

Routines have been conceptualized as rigid entities because they are represent the "memory of the organization" (Cyert and March 1963). They have known to be a source of inertia (Hannan and Freeman 1983) and inflexibility (Gersick and Hackman 1990). However, organizational routines have also been observed to be capable of adjusting (Dionysiou and Tsoukas 2013) and adapting to the environment (Feldman and Pentland 2003) if conditions change (Winter 1964). Standardization of routines promotes reduced variability (Spear 2005). Adherence to rules or standard operating procedures leads to standardization (Lazaric and Denis 2005). The tension between standardizing routines to achieve efficiencies and providing flexibility in practicing routines has been investigated by recent research (Turner and Rindova 2012). By analyzing the evolution of routines, our research seeks to understand how routines evolve, get adapted and practiced leading to identifying opportunities for standardization.

Though our research question is motivated by the concern to standardize routines to reduce costs and increase efficiency, the scope of this project is limited to understanding how routines evolve and are adapted and practiced. This is an essential first step in an investigation on the feasibility and desirability of standardization of routines in complex settings like health care organizations.

This research responds to the call for research to investigate the internal workings of a routine made by Parmigiani and Howard-Grenville (2011). It attempts to understand the evolution and life cycle of a routine by exploring "how routines are born; how do they die; are they ever resurrected?"(Parmigiani and Howard-Grenville 2011).

Routines can exhibit duality: stability and change as well as repetition and variety. In Feldman and Orlikowski's (2011) study they narrate the dualities in the characteristics of routines. While routines had "mind-numbling" stability, they also exhibited change which was significant in some instances. Pentland ch (Pentland 1992, Pentland 1995) describes how he looked for repetition, but found variety. Routines can be subject to endogenous change (Feldman 2000). Individual routines get shaped to accommodate changes in environmental conditions (Kim 1998, Feldman 2003). Subjects may 'repair' the routine to make it stable again (Feldman 2000).

While going through this process of transformation, the outcomes produced by routines also vary considerably. Activity Theory has been used as an analytic framework to study such human information behavior in organizations (Widén-Wulff and Davenport 2007, Allen, Karanasios et al. 2011). Information behavior is defined as "the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use." (Wilson 2000, p. 49). Using constructs from Activity Theory, we explicate human behavior across time to explain the variations that are observed in the outputs produced by routines. In this research we characterize an organizational routine to be comprised of single or numerous individual activities.

Social context, technological artifact and people are the key pillars of Activity Theory. Activity Theory suggests that even when an individual performs a mundane activity (such as purchasing an item over the Internet), this activity is shaped by the social context (Beaudry and Carillo 2006). This research uses a "person-centered approach" (Wilson 2000) and attempts to "get inside the head" of the individual informant, their social context and influence, and gather greater insight (Case 2007) to understand how the individual's information behavior gets shaped by feedback, events and triggers from the environment.

Described below (Figure 1) are the major components of Activity Theory system as described by Engeström (1987), who extended the work of Russian psychologists Vygotsky (1978) and Leont'ev (1978). The following major components are described first with examples from the 'charting' activity in a hospital in which all health care providers participate. The focal routine for this project is "charting" – a routine practiced by health care providers to document all interactions with a patient. Charting is done mainly using an Electronic Health Records (EHR) system (for brevity we will use the term EHR to refer to the EHR system in the rest of this paper). Charting involves a repetitive pattern of interdependent activities by various health care providers who contribute to the patient's chart. It is the glue that ties together the complaint, investigations, analysis, findings, medication orders, diagnosis, medical decision making, and procedures that are related to a patient.

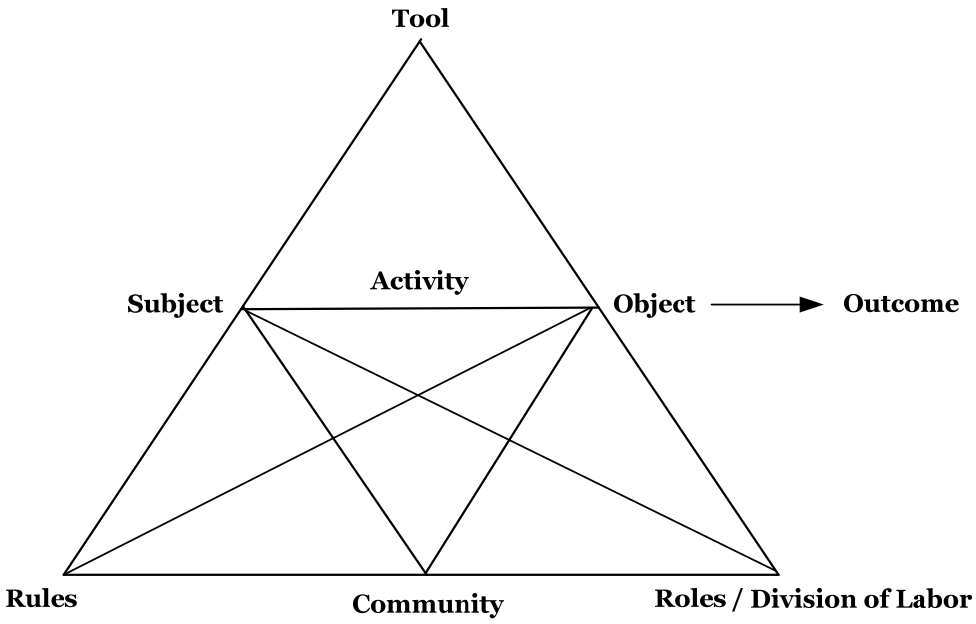

Figure 1 – Activity Theory - adapted from (Kuutti 1995)

1. The ***subject*** "refers to the individual or subgroup whose agency is chosen as the point of view on the analysis" (Engeström 1993, p. 67) as depicted in Figure 1. In this research, this term refers to the resident physician in a hospital.
2. An ***activity*** here "is a form of doing" (Kuutti 1995). The Russian/ German term used in the original work was "Tätigkeit" or "deyatel'nost" denoting "a structural moment of society that produces something for a generalized, common need" (Roth 2012, p. 90). The process of "charting" is the activity studied.
3. The ***object*** "refers to the 'raw material' or 'problem space' at which the activity is directed" (Engeström 1993, p. 67). According to Kuutti (1995), it can be a plan, an idea or a material thing. Creation of charts for specific needs (e.g., for billing, legal and communication needs) is the object in our study.
4. *The* ***outcome*** is the direct or indirect transformation of the object (Kuutti 1995). In our project, it refers to the chart.
5. ***Tool*** are artifacts which mediate the relationship between the subject and the object of doing (Engeström 1991). In our research project, tools refer to the Electronic Health Records (EHR) system. Features of the tool can facilitate or sometimes hinder achievement of the object (Kuutti 1995).
6. ***Rules*** "refer to the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system" (Engeström 1993, p. 67). In our study examples of rules include the conventions for charting that are dictated by departments like billing and legal.
7. ***Community*** refers to the group who participate directly or indirectly in the activity system (Beaudry and Carillo 2006), "who share the same general object" (Engeström 1993, p. 67). In our research, all the health care providers like the physicians, nurses and support staff in the health care institution form the community. Support staff in this

context are personnel who help the clinical staff in patient registration, movement of patients, checking vitals etc.

8. ***Roles*** refer to the characteristics of differentiation between groups in the community (Beaudry and Carillo 2006). Cole and Engeström (1993) initially conceptualized this as division of labor referring to distribution of "tasks, power and responsibilities." In a health care institution, the role of the resident is quite different from that of the billing coders, attending physicians or nurses in the context of the charting activity. Additionally, the role of the resident also gets transformed in the three years of his or her residency.

Summarizing, a subject (resident physician) undertakes an activity (charting of one section) to achieve an object (creating artifacts for billing) which results in an outcome (chart). The activity is mediated by tools (enterprise systems, EHR), rules (e.g., billing guidelines) and roles (e.g., student role or leadership role of a resident or supervisory role of an attending physician).

Activities are constantly evolving due to the tension and contradictions between the components (Engestrom 1987, Cole and Engeström 1993). The examination of these tensions and contradictions is needed to understand how they shape the activity, object and the outcome over time. This study extends the static model of Activity Theory to explain how environmental influencers like tools, rules, community and roles shape the object and subsequently the outcome, over time.

This research is also informed by the work of Polites and Karahanna (2013) in which the researchers investigate how organizational routines comprise of individual activities or routines. Individual routines performed repeatedly are called habits (Cohen and Bacdayan 1994). Ortiz de Guinea and Markus (2009) hypothesize that individuals traits influence the use of information systems in the enactment of organizational routines and individual routines or habits will get adapted. Old habits will get disrupted and evolve through the course of an information systems implementation. This research attempts to extend Polites and Karahanna's work by studying how individual traits influence the evolution of organizational routines in the process of an information systems implementation in a health care organization. Additionally, Orlikowski and Gash (1994) posit that an individual's IS use in an organization is influenced by the group to which the user belongs. Many professional groups like physicians, nurses and support staff exist in a health care organization and their IS use is influenced by their "clan"(Ouchi 1980). Hence, evolution of the routine will be different across clans.

However, within the same clan there can be differences in IS adoption among individuals. This research acknowledges that "that humans are free to enact technologies in different ways" (Boudreau and Robey 2005). Specifically, different health care providers use technology such as an Electronic Health Records (EHR) application differently resulting in variations of routines. This research also recognizes the technology-in-practice views of Feldman and Orlikowski (2011) in that, though there are functionalities built into an IT artifact, like an EHR application, a user's enactment of a routine is dependent on whether the user is in a state of inertia, application or change (Orlikowski 2000). This perspective allows a better understanding of the

"internal workings of the "black box" of a routine," an area that deserves further study (Parmigiani and Howard-Grenville 2011).

At the operational level, people interact with physical and non-physical artifacts to accomplish tasks via routines (Ray, Barney et al. 2004). Organization routines in complex environments have information systems as in integral part (Gasser 1986). The focus of this research is on the information system used to enact routines. Specifically, this research investigates how the IS artifact contributes to the evolution of a routine. Information systems are being used to support or automate organizational routines. How effective are they in contributing to the success of the routine? According to Representation Theory (Wand and Weber 1990, Wand and Weber 1995), an information system comprises of three structures. This study investigates how these structures, (deep, surface and physical of the information system), contribute to the adaptation and evolution of routines.

The concept of "effective use" of an information systems application is quite complex and different from just use, but little research has been done on this important issue (Marcolin, Compeau et al. 2000, Burton-Jones and Grange 2012). Burton-Jones and Grange (2012) define effective use as "using a system in a way that increases performance" (p. 2). This research seeks to use the three dimensions of effective use as conceptualized by Burton-Jones and Grange (2012) to understand how the adaptation of routines has been affected by the effective use of an information system. Seated deep in this conceptualization is the idea that effective use improves performance. Therefore, as the level of effective use increases, performance improves. According to Sonnentag (2002), two aspects of performance are worth studying: effectiveness and efficiency. Effectiveness is generally measured in terms of overall goal attainment (Burton-Jones and Grange 2012, p. 11), e.g., overall sales made in a month without considerations of the input. In contrast, efficiency is measured by the level of goal attainment for a specific input, e.g., monthly sales per employee (George and Bettenhausen 1990).

The dimensions of effective use are hierarchically related (Barki, Titah et al. 2007, Burton-Jones and Grange 2012). The first level is "transparent interaction" which "mainly improves performance by saving users time when working on the system, increasing efficiency." (Burton-Jones and Grange 2012, p. 13). The effectiveness with which a user is able to seamlessly access (navigate, find and use features in) the application may be used as a measure of transparent interaction. The second level of effective use is "representational fidelity" which improves performance primarily by improving effectiveness. The ability of the user to obtain sufficiently complete, clear, correct and meaningful information by using the application is a measure of representational fidelity (p. 24). The last level in the hierarchy is "informed action" which improves performance jointly in both dimensions: increasing efficiency and improving effectiveness. The ability of a user to effectively use the application to act and improve his or her state is a measure of informed action. For example, critically reviewing an email calendar schedule allows an individual to allocate time for more important activities (effectively) and quickly (efficiently) (p. 14). As discussed above, since an IS artifact may have a substantial influence in the evolution of routines, we investigate how the evolution of routines is affected by the "effective use" of an information system?

In one of the first studies examining the effects of a technology implementation in health care, Barley (1986) investigated how the implementation of identical new technology in two hospitals led to different routines. While Feldman (2000) observed how routines like hiring, training, budgeting, moving-in/out of residence halls evolved over time, this research is focused on identifying the differences in the execution of the same routine by different people and in different contexts, as well as understanding how these adaptations evolve over time. In another study, Edmondson et al. (2001) examined how new routines get developed when changes in technology are introduced in health care organizations. In one of the recent studies on HIT implementations, Goh et al. (2011) conclude that co-evolution of routines and technology is necessary for successful HIT implementation. In contrast, the focus of this research is on how societal influences and the HIT tool contribute to the evolution, adaptation and practice of routines in a health care organization

Lastly, as regards to the context of this research, Chiasson and Davidson (2004) suggest that a very promising avenue for research in health care is to examine a phenomenon in its context and use theory to explain the phenomenon, thereby extending current knowledge. A recent *Management Information Systems Quarterly* editorial (Romanow, Cho et al. 2012) on future directions of HIT research calls for theory development in analyzing the implementation of HIT solutions. This research which is set in the context of a health care organization will also contribute to this literature by exploring the evolution of a routine that has been implemented using HIT.

In summary, much of the past literature discusses various characteristics of routines such as: ostensive and performative aspects; adaptability and stability; and flexibility and rigidness of routines. Most work on routines has analyzed routines at a single point of time. This study is one of the first studies to investigate evolution of routines over time. While Activity Theory gives us a robust analytical framework (Wilson 2006) to study computer supported activities (Chen, Sharman et al. 2013), this theory has not been used to study the temporal evolution of an activity. Also, our research is one of the first attempts to introduce the concept of effective use of IT in the evolution of routines. Drawing upon the above discussions of prior literature, three critical elements– routines, activities and contribution of effective use of IT artifact in the evolution of routines – were identified as seed concepts in analyzing data collected in our case study. The next section describes the research design and methods.

Research Design and Methodology

As the literature on the evolution, adaptation and practice of routines is very limited, an exploratory research approach (Yin 1994) is used in this study. A qualitative case study approach is befitting here since this research strategy “attempts to examine: (a) a contemporary phenomenon in a real life context, especially when (b) the boundaries between phenomenon are not clearly evident" (Yin 1981). The unit of analysis is the individual and this longitudinal research seeks to understand the evolution of information behavior of an individual.

A case study approach allows the investigation of the "how" and "why" questions of interest in natural settings, especially the study of "sticky, practice-based problems where the experiences of the actors are important and the context of the action is critical" (Benbasat, Goldstein et al. 1987). Case studies have been used in the past to build theory (Eisenhardt 1989a). As is the norm in case study research, multiple methods of data collection including observations, interviews and document review have been used. The researcher's role in the project is that of an observer, which helps the researcher collect data in a natural setting and elicit less self-conscious responses from the informants (Barley 1990). This is in line with the belief that "our knowledge of reality is a social construction by human actors" (Walsham 1995) and our own background, knowledge and prejudices influence how we see things (Walsham 2006). An interpretive approach (Walsham 1993) has been used in the analysis of the data since the "intent is to understand the deeper structure of a phenomenon" which can be used to "inform other settings" (Orlikowski and Baroudi 1991). A single case study is appropriate for interpretive field studies (Davidson and Chismar 2007).

Site Selection

To understand the evolution of routines, a premier 950+ bed hospital located in the south eastern part of the US was selected as the study site. This hospital had implemented one of the largest EHR systems in the world, at a cost of about $40 million. Specifically, the study was conducted in the Emergency department (ED) which is an urban Level I trauma center. In this paper, the terms hospital and health care institution, have been used interchangeably. The ED receives nearly 120,000 patient visits per year. A Level I trauma center is equipped to give the highest level of surgical care to a patient suffering traumatic injury any time of the day or night. As the study site is the only Level I trauma center in this part of the country, it is very busy most of the time. Patients from neighboring states that need extreme specialty care are transferred to this ED by helicopter. The ED is staffed with emergency physicians, surgeons and anesthesiologists and it is supported by radiology, pharmacy, laboratory and internal medicine departments. The ED has been divided into three zones and patients are assigned to a zone depending on their acuity level. The T zone with 16 rooms is used for patients with the highest acuity. All of these rooms have the latest technology installed and could be transformed into an operation theater in just a few minutes. The B zone with 14 rooms is used for patients with medium level acuity, and the R zone with 5 rooms is used for low acuity patients. Besides these, there are two more zones - P for walk-in and very low acuity patients who could have been treated in an ambulatory practice for common illnesses, minor injury etc. and C for patients who need observation for more than 24 hours, but are not to be admitted to the hospital. There are approximately 120 emergency attending physicians, 50 resident physicians and 150 nurses working in this department. All of these health care providers use the EHR application.

Since the hospital implemented the EHR system about four years ago, the study site provides an opportunity to examine the evolution of routines over time. This research seeks to explore new or uncharted areas, aiming to "maximize opportunities to compare events, incidents, or happenings to determine how a category varies in terms of its properties and dimensions" (Strauss and Corbin 1998) in the evolution of routines.

Data Collection

Through semi-structured interviews and observations of health care providers in their work setting, we developed deep insights into the way they enact the charting routine and how the routine evolved over time. Data collection was supplemented by review of documents that are created in the charting activity to overcome dependency on a single source of data from the interviews (Jick 1979). The primary informant was the Chief Medical Information Officer (CMIO) of the hospital. Based on discussions with the CMIO and other senior executives, a target informant list was developed. These informants include physicians, nurses, and other health care providers who are directly involved in the care of the patient and update the chart after their interaction with the patient.

Further, snowball technique (Patton 2002) was used to recruit additional informants who can provide critical information about EHR use in charting. With this technique, the interviewer asks the interviewee for recommendations on probable informants, who can throw more light on the research topic. This process leads from one person to the other and helps the researcher to obtain a critical mass of informants (Myers and Newman 2007). A senior attending physician provided deep insights into process flows and EHR use and helped identify other key informants. A total of 67 informants were interviewed. Each semi-structured interview lasted between 30 and 90 minutes. These interviews provided data on the use and evolution of the charting routine. Follow up interviews were conducted to seek clarifications and additional insights.

Prior to starting data collection, the primary researcher requested some of the physicians participating in the interviews to allow him to follow them during their shifts so that he can gain a deep understanding of their work routines. Such shadowing helped develop rapport with the informants which can be very beneficial in qualitative data collection (Barker 1993). The primary researcher observed attending physicians during both day and night shifts. He observed all interactions of the health care providers with the EHR from the start to the end of each shift. The researcher maintained a distance of at least 5 feet from the health care providers and the patient so that he can observe their actions and take notes, but not interfere in the provider-patient interactions (Chisholm, Collison et al. 2000). To understand how and when the health care providers update the EHR, and to examine differences in the charting activity between health care providers, the researcher traced a few patients with the same chief complaint and same acuity level, through the entire process of care - also termed as patient pathway (Trebble, Hansi et al. 2010), from registration to treatment in the emergency department to discharge or admission to the inpatient department.

The researcher also familiarized himself with frequently used terms, shortcuts and phrases that are used in the EHR (e.g., MVC refers to a “motor vehicle collision”; LOC refers to “loss of consciousness”; SOB is “shortness of breath”). The researcher also observed nurses and support staff’s interaction with the EHR. He interviewed IT support staff and members of the quality support team to understand the details of EHR implementation at this site. He also interviewed IT training staff to understand how EHR training was imparted to health care providers. Additionally, in order to understand the functionalities of the EHR and the training received by

physicians in its use, the primary researcher participated in two training programs provided to physicians. In addition, the primary researcher participated in more than 15 meetings convened by the senior management staff of the hospital that were focused on reviewing how the functionalities of the EHR for charting were being used by various health care providers.

On two occasions the researcher was informed that the EHR system will be down and charting needs to be done manually. This afforded the opportunity for the researcher to observe how the patient interactions would be documented without the EHR. During the outage period, paper records were created for patients that were discharged within the period and critical information such as vitals, orders or doses administered was noted on paper records. This information was later updated in the EHR when the system was back in operation. This gave the researcher the opportunity to observe the different levels of importance assigned to different parts of the patient health record by health care providers. Since the outages lasted only for a few hours and were planned ahead of time, other updates to the charts of patients (such as their history and medical decision making data) who were not discharged within the outage period were made only after the system came back to service. These observations provided additional data for developing a detailed understanding of the patient charting activity.

A semi-structured interview guide which included generic questions about the informants' experiences with EHR use for charting as well as specific questions on the evolution of the charting routine was created. Most of the interviews were conducted while the researcher was in the ED with health care providers. The ability to observe the health care providers *in-situ* environment provided opportunities to develop deep insights. Notes were taken to capture the sequences and differences in the way particular health care providers used the EHR. The differences that were evident in the initial analysis of the data were used to refine the interview guide so that more detailed data on how and why a health care provider uses the system in a particular way could be collected. Initial analysis of data showed that for the same chief complaint and acuity level of a patient, the details that a resident charted differed across the years in residency. Additionally, charts of residents showed the widest variations when compared to those created by other health care providers (attending physicians, nurse practitioners, physician assistants, and nurses). Hence our study focuses on understanding how residents' charts evolved during the course of their residency.

Since the study site was a very busy emergency department, there were many interruptions during the interviews. Therefore, some interviews which were only one hour long in total duration took more than 4 hours to complete. However, these interruptions provided additional opportunities to collect observational data. These data sources provided more than 275 hours of observational and over 60 hours of interview data. Access to anonymized charts created by health care providers was also provided. Charts created by some health care providers were examined to understand the evolution of the outcome of the charting activity over time. For example, charts prepared by resident R1 as an intern and as a senior, for acuity level 2 "chest pain" patients were compared. The transcripts from interviews and the documents constitute the primary source of data. Data collection in the form of observations, shadowing and interviews was done over a period of two years.

Interviews		
Profiles	Number of people interviewed	Interview total time
Clinical		
Senior Management	6	9 hrs
Attending Physicians	15	12 hrs
Resident Physicians	22	18 hrs
Medical Students	3	1.5 hrs
Nurses Practitioners	4	2 hrs
Physician Assistants	2	1.2 hrs
Nurses	2	2.5 hrs
Non-Clinical		
Billing	3	2.2 hrs
IT	3	5 hrs
Training	2	4 hrs.
Quality	5	7.5 hrs
Total	**67**	**64.9 hrs**
Observations		278 hours
Documentation reviewed		504 charts
	Training Material – Physician training	
	Reporting training materials	

Table 1 – Data collection summary

Data Analysis

The data were initially open coded, which was followed by axial and selective coding (Strauss and Corbin 1998). Open coding involves unrestricted coding of data by scrutinizing interview transcripts, field notes and charts to produce concepts and map them to categories that were identified from our literature survey on organizational routines and Activity Theory (Miles and Huberman 1994). Following Straussian version of the Grounded Theory Method (Kelle 2005), the data analysis approach used in the study acknowledges that prior theory, literature and personal and professional experience can serve as a guide in the analysis of the data. The goal of this research was not to test any theory but to use theory as a sensitizing device in the analysis (Klein and Myers 1999). Since this study was exploratory, the researcher was open to broader concepts or phenomena that evolved from data during the course of the analysis. In the process of axial coding, opportunities were explored to discover relationships between categories or concepts identified in the open coding phase. In selective coding, core categories were summarized "that relate to the core codes in sufficiently significant ways as to be used in a parsimonious theory" (Strauss 1987). Data displays as described by Miles and Huberman,(1994) were also done for doing within-case comparisons between different groups and develop an observational matrix (Barley 1990), which aided in drawing substantial and meaningful conclusions from the study. As is typical for qualitative case studies, data collection and coding were intertwined. Data collection continued until theoretical saturation or informational

redundancy was reached (Sandelowski 1995) which is "the point in category development at which no new properties, dimensions, or relationships emerge during analysis"(Strauss and Corbin 1998).

Data were analyzed across three different perspectives: synchronic, diachronic and parallel (Barley 1990). Synchronic analysis highlighted the differences and similarities in how different health care providers like attending physicians, resident physicians, nurse practitioners, and nurses use and adapt routines. Diachronic analysis helped understand the development path of a routine from the time the EHR was implemented. The parallel perspective helped understand the evolution of routine across the three zones (T, B and R) which cater to different acuity levels in the emergency department.

Findings

In this section, we first describe the tool and then provide a description of how the key elements of Activity Theory help in understanding the evolution of the charting routine. Resident physicians (hereafter called residents) go through a period of intense hands-on training during the three years of residency training. Developing expertise on the charting activity is one of the salient features of this training. Though the residents are trained in the use of many tools and systems in these three years, this research will focus only on their use of the EHR for charting. We describe how the charting activity evolves as the resident uses the EHR in different ways during the course of his or her residency. The residents are referred to commonly as interns, junior and senior in their first, second and third years of their residency. While we describe the evolution of routines from a resident's progression through these three stages, we acknowledge that there may be variations in the progression among individuals. For example, the practices followed by a junior resident may be as 'mature' as that of a typical senior resident and vice-versa.

Tool

First, we describe the EHR (which we refer to as the tool, following the terminology used in Activity Theory) since a description of the tool is necessary to understand its complexity, and how it constrains or facilitates the appropriation of the charting activity. An understanding of the functionalities of the tool is also helpful in understanding how effective use of the tool helps in shaping the charting routine.

The EHR is built around a patient-centric database which supports the entire gamut of patient interactions including registration, scheduling, and clinical systems with health care providers in the emergency, outpatient and inpatient departments. It also has built-in integrated functionality for laboratory, pharmacy, radiology, oncology, obstetrics /gynecology and billing and insurance departments. The EHR captures static data from the patient like demographics, smoking status, drug allergies and present medications. Encounter specific data like vital signs,

problem lists, lab and medication orders, test results, diagnosis and procedures performed can also be tracked.

As a part of the American Recovery and Reinvestment Act of 2009, hospitals have been given strict timelines by the Centers for Medicare and Medicaid Services to implement EHRs to achieve "meaningful use" of information systems, failing which penalties are imposed (CMS 2014a). Meaningful use basically implies that by using an EHR the hospital should be able to: (1) improve quality, safety, efficiency and reduce health disparities, (2) engage patients and their families, (3) improve care coordination and (4) maintain privacy and security of patient health information (CMS 2014b). It is expected that use of an EHR will ultimately result in better clinical outcomes, better population health outcomes, increased transparency and efficiency, empowered individuals and availability of more robust research data (CMS 2014b). Compliance to "meaningful use" will be judged on reporting two measures: core mandatory measures consisting of data like patient demographics and menu measures like structured lab results (Blumenthal and Tavenner 2010). Hospitals are required to demonstrate "meaningful use" in three stages (CMS 2014b): Stage 1, which commenced in 2011, primarily focuses on basic data capture and reporting; Stage 2, commenced in 2014 and its primary objective is to measure the meaningful use of EHR in advancing clinical processes; Stage 3, reporting is scheduled to commence in 2017 and is targeted to measure improvement in outcomes with the implementation of EHR. Hospitals can receive incentive payments if they demonstrate that, through the use of EHR, they are able to comply with the "meaningful use" objectives set for each stage. The ability to generate reports from the EHR based on the stored data can be used to demonstrate compliance with "meaningful use" requirements (CMS 2014c) for each stage. For example, a hospital can claim incentives for compliance to Stage 1, if the hospital has met 11 required core measures, and five of ten menu measures totaling 16 measures (CMS 2014c). Stage 2 "meaningful use" requires enhanced reporting of all Stage 1 measures with the additional requirement to generate progress notes of patient records that include tracking of medications from order to administration.

Data needed to meet all the reporting requirements can be extracted from a patient's electronic record. The patient's progress note, also called the "chart", is the central IT artifact that the EHR application is built around. The chart primarily serves three objectives, namely:

- Serve as a communication tool between health care providers,
- Provide information necessary for billing for the services provided, and
- Serve as a record that protects the health care provider if legal challenges to the care provided arise.

Though the patient data are maintained in a centralized database, the application interface to a physician is customized to the department to which he or she belongs. Hence, an emergency physician's view is very different from an internal medicine physician's view of the same patient data. The frequently used interface for the emergency department, where the study was conducted, is described below. There are five sections (tabs) in the patient's chart as described below:

Section 1: The first tab is named **HPI** which captures "history of present illness" of the patient. It is also sometimes referred to as history of presenting complaint (HPC). Details of the chief complaint like location, quality, severity, duration, timing, context, modifying factors and associated symptoms are captured here. An excerpt from a HPI for a patient with chest pain (Acuity Level 2) is provided in Table 2.

Episode onset:	*1 day ago.* *Duration of episode(s) is 15 minutes. Chest pain occurs intermittently. The chest pain is unchanged. The pain is associated with exertion and breathing. At its most intense, the pain is at 10/10. The pain is currently at 7/10. The severity of the pain is severe. The quality of the pain is described as sharp. Radiates to: to L side and L leg. Chest pain is worsened by exertion (Improves with resting). Additional symptoms include fatigue, shortness of breath and vomiting. Additional symptoms include no fever. Lightheaded when standing for "a while" and with chest pain*
Episode onset:	*2 months.* *The shortness of breath developed with exertion (Also occurs when lying down).*
Additional symptoms include claudication, orthopnea, paroxysmal nocturnal dyspnea, lower extremity edema and weakness. Additional symptoms do not include numbness or near-syncope. bilateral leg swelling x 2-3 mos. He tried nothing for the symptoms. *Risk factors for ischemic cardiac disease include smoking/tobacco exposure, a sedentary lifestyle, being male, a family history of coronary artery disease and obesity.* *I reviewed the patient's prior history: No pertinent past medical history. No pertinent past surgical history. No pertinent family history.*	

Table 2 - HPI for a patient with chest pain (Acuity Level 2)

Section 2: The second tab is termed **ROS**, i.e. "review of systems." It is a comprehensive record of all the systems in the body. Symptoms of the patient are noted here based on patient's response to oral inquiries. This part of the chart is subjective in nature since it is solely based on physician's perception. In contrast, objective data gathered from physical exams is noted in the next tab. The systems that are examined are: constitutional, eyes, ENT (ears, nose and throat), cardiovascular, respiratory, gastrointestinal, genitourinary, musculoskeletal, integumentary, neurological, psychiatric, endocrine, hematologic and allergic. Excerpt from ROS for the same patient with chest pain (Acuity Level 2) is shown in Table 3.

Constitutional:	*Positive for chills and fatigue. Negative for fever.*
HENT:	*Negative for congestion.*
Eyes:	*Positive for visual disturbance. Negative for photophobia and pain. Occasional double vision while watching TV*
Respiratory:	*Positive for shortness of breath.*
Cardiovascular:	*Positive for chest pain, orthopnea and claudication.*
Gastrointestinal:	*Positive for vomiting. Negative for diarrhea and blood in stool.*
Genitourinary:	*Positive for frequency. Negative for dysuria.*
Musculoskeletal:	*Positive for arthralgias. C/o right arm "stiffness"*
Skin:	*Positive for wound. Old skin wound on right ankle*
Neurological:	*Positive for weakness and light-headedness. Negative for seizures, syncope and numbness.*

Table 3 - ROS for the same patient with chest pain (Acuity Level 2)

Section 3: Physical Exams is the third tab where findings from visual or "hands-on" observations are noted. Excerpts from a Physical Exam for the same patient with chest pain (Acuity Level 2) is shown in Table 4.

Initial Vitals:	*Temp: 36.3 °C (97.3 °F); Heart Rate: 84; Resp: 16; BP: 163/101 mmHg; SpO2: 94 %*
Constitutional:	*He appears well-developed and well-nourished. No distress.*
Head:	*Normocephalic and atraumatic.*
Right Ear:	*External ear normal.*
Left Ear:	*External ear normal.*
Mouth/Throat:	*Oropharynx is clear and moist. No oropharyngeal exudate.*
Eyes:	*Conjunctivae are normal. Pupils are equal, round, and reactive to light. Right eye exhibits no discharge. Left eye exhibits no discharge.*
Neck:	*Normal range of motion.*
Cardiovascular:	*Normal rate, regular rhythm, normal heart sounds and intact distal pulses. Exam reveals no gallop and no friction rub. No murmur heard.*
Pulmonary/Chest:	*Effort normal and breath sounds normal. No stridor. No respiratory distress. He has no wheezes. He has no rales. He exhibits no tenderness.*
Abdominal:	*Soft. Bowel sounds are normal. No tenderness. He has no rebound and no guarding.*
Genitourinary:	*Guaiac negative stool. No gross blood*
Neurological:	*He is alert.*
Skin:	*Skin is warm and dry. He is not diaphoretic.*
Right medial ankle:	*3 cm lesion with eschar, crusting, no active drainage, no fluctuance, no erythema; hyperpigmentation and scarring present.* *Bilateral soles of feet with thickened skin, yellowish, hyperkeratotic lesion on left sole. No skin breakdown.*

Table 4 - Physical Exam for the same patient with chest pain (Acuity Level 2)

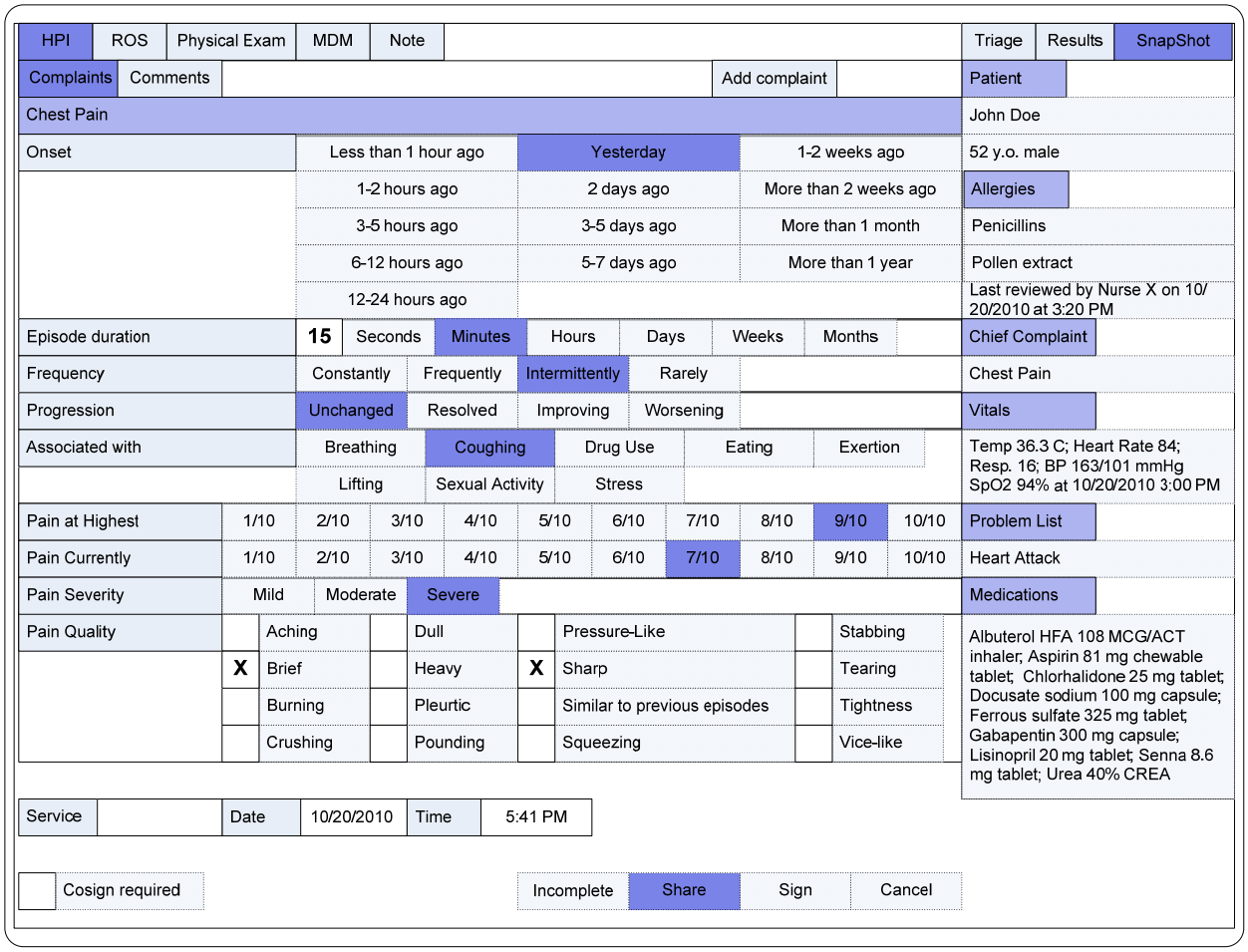

Figure 2 - Hypothetical example of a patient chart (EHR)

Figure 2 shows a hypothetical example of a patient chart. In the top most row, there are five tabs that the physician navigates. The tab in which the physician is working at the present time is highlighted in blue.

The EHR application has built-in features to reduce manual data entry. Most screens provide an array of options to select from or checkboxes to click. The options are based on the most frequently used attributes to describe a patient's condition. The selection of, or clicking the options, denotes the presence or absence of an item. For example, while taking HPI, a physician may select the box "yesterday" and click on "sharp" as the pain quality, if the patient reports that the episode of "chest pain" started the day before and the pain is sharp in nature. There are other features like drop downs for capturing the duration of an episode (e.g. the patient reported that chest pain lasted for 15 min.) Only the first three tabs, HPI, ROS and Physical exams, have these features enabled.

Section 4: The fourth tab is **MDM** or "medical decision making" which is where the physician enters interpretations of tests performed, interventions/treatments, present condition and the final patient disposition. An excerpt from MDM section for the same patient with chest pain (Acuity Level 2) is shown in Table 5

Interpretations:
Lab Interpretation: *Negative cardiac enzymes*
EKG: *no ST elevations, no LVH, no T wave inversions, normal QRS, normal PR, normal rate and rhythm x 2*
CXR: *no acute pathology*
CMs negative x 1, will repeat enzymes and EKG.

Interventions/Treatments:
IV narcotics given: *Pain controlled*
Vasoactive drugs given (nitrates for chest pain)

Consultations: None

Most recent Vitals (1:37 PM):
Temp: 36.3 °C (97.3 °F); Heart Rate: 63; Resp: 14; BP: 155/76 mmHg; SpO2: 99 %

Course in ED:
1:37 PM : Pt's course is gradually improving. Pain relieved with morphine and SL nitrates. EKG negative x 2.
3:30 PM: Negative cardiac enzymes x 2. Patient is a low risk candidate, and will go to CDU for rule out MI and stress test tomorrow.

Disposition:
To CDU for further risk stratification.

Table 5 - MDM section for the same patient with chest pain (Acuity Level 2)

Section 5: The final tab is "**Note**" which allows the physician to view and edit the progress note that has been created by the selection of specific options or check boxes in the previous tabs. Another option available to the physician is to create a chart by directly opening the "Note" tab and typing his or her notes, thus bypassing the tabs described above (HPI, ROS and Physical exams). This type of use of the EHR requires that every piece of data needs to be manually entered rather than using data that could have been populated by using the built-in features that are available in the three tabs.

Once a physician logs into the EHR, she (or he) takes over responsibility (also called "taking charge") of a patient from the physician who attended to the patient in the previous shift by assigning herself to the patient record. She now is able to view and update the patient record with her credentials. During the shift handoff, physicians take charge of patients at different points in the entire process of care. Typically, a chart will be updated at each point in the process of care. For a new patient, the charting activity follows the sequence: (1) HPI (2) ROS (3) Physical Exams (4) MDM. However, the EHR application does not force the physician to update

the patient's chart only in this sequence. Therefore, users may access or update the same chart in multiple ways.

The primary researcher also participated in a four-hour long training session provided to attending physicians as a part of their induction program. This training covered only basic data entry functionalities. Though the physicians understood how the charting activity helps in communicating with other health care providers, the training session provided no information on how the charting activity affects billing or medico-legal needs. The researcher also noted that the training manual included sections that provided details on the advanced features of the EHR. This includes descriptions of mechanisms for improving efficiency (such as creating documentation templates or macros for frequently used activities), but none of these mechanisms was covered in the training. The trainer repeatedly reiterated that the training covered only to the basic functionalities of the EHR application. Also, the trainers are not familiar with the details on how the EHR has been tailored to suit the needs of different departments. For example, emergency and internal medicine departments have different templates for capturing HPI (History of Present Illness) for a patient. Additionally, because of flexibility provided by the EHR, and the inability to enforce the use of specific formats for data entry, there are wide variations in how data are captured even within the same department. Therefore, the training sessions covered only high level features of the system rather than specific details on how the system may be used by various health care providers in their respective departments.

In contrast to typical desktop applications, the navigation within the EHR application menu structure is not user friendly. No online help documentation is available and the available documentation is extremely difficult to use. The researcher observed a senior attending physician spending considerable amount of time to find a new order set (a pre-packaged group of clinical orders for a specific diagnosis) code that he does not use regularly. Majority of the people that the researcher interacted with reported that they were provided only a one-day crash course. This course was offered when a physician joined the hospital or when the EHR was implemented in 2010. No refresher training was provided since the implementation of the EHR.

According to some attending physicians, when physicians were provided with a workstation on wheels (WOW), the use of the EHR for charting shifted their focus from the patient to the system and therefore, significantly reduced the effectiveness of the care provided to the patient. Physician-to-patient eye-contact and physical observations were diminished with the introduction of the WOW and this resulted in in the loss of crucial clues that negatively affected the care provided to the patients. Further, patients were also very dissatisfied with their diminished interactions with their care providers.

Effective-Use of the tool

In this section, we describe how the charting routine evolved with the use of a complex tool (EHR) in a highly complex environment. Learning to complete a chart independently in the EHR that is appropriate for the treatment and the clinical outcome is a goal during residency.

The charting practices of the residents mature gradually over this time. To explain the evolution of the charting activity, we draw upon the concept of 'effective use' which is defined as "using a system in a way that helps attain the goals for using the system." (Burton-Jones and Grange 2012). Our findings suggest that the manner in which a physician was using the system for charting had a direct relationship to the physician's primary objective or goal at the time of their use of the system. As their objectives changed during different phases in their residency, the effective use of the EHR tool also changed as shown in Table 6.

Physician	**Object / "Goal-directed Activity"**	**Effective-Use** *(as defined by Burton-Jones and Grager (2012)*	**Achieved through**
Intern	Communication with preceptor, attending physician or senior resident or peers	**Transparent interaction:** "access the representations"	Learning to use basic features of the tool (e.g., navigation) and hence improve efficiency.
Junior	Improving personal effectiveness	**Representational fidelity:** "obtain representations" & "create representations" (suggested)	Basic features + Learning to use advanced features (e.g., macros)
Senior	Compliance with billing / medico-legal requirements	**Informed Action:** "act upon representations"	Basic features + Advanced features + Optimize use of advanced feature (e.g., LOS tool)
Attending physician	All of the above (depending on his/her knowledge level for effective use of the tool)	Informed Action	All of the above

Table 6 – Change of objectives changed during different phases in their residency and the effective use of the EHR tool

As an intern, learning to use the tool effectively is of great importance to residents because their primary goal is to use EHR for communication with the attending physician and the care team. Accordingly, as an intern, the objective for the resident is to learn how to navigate the EHR application and use the basic features of the tool. Rather than using paper charts as she had done in medical school and orally updating the attending physician, she learns to use the EHR tool. This enables her to enter HPI/ROS/Physical exams data in the EHR for the attending physician to view and make decisions. Thus, during this phase, she is able to improve performance by learning to "transparently interact" with the EHR. A senior attending physician SM52 explains "And that person (resident) comes…and encounters the EHR…for a lot of people….it might be the first time where they are taking notes online." Hence, they tend to learn use the tool by working hands-on with senior residents and attending physicians. So, for example, getting to learn the basics of navigation of EHR is their goal as an intern.

As a junior, the resident is focused on improving personal effectiveness. Her objective is to reduce the time taken on the charting activity. She learns from peers and senior residents about the shortcuts to access advanced features of the system that help her complete the chart efficiently. As a junior resident R5, explains, as she attempts to employ advanced features of the system, such as macros "The macros are really helpful because you can populate a lot of information very quickly. Sometimes there is too much information in the macros…..but it can be very helpful and it can speed things up very quickly. You can make small and big macros." In the senior year, the resident's objective is to learn to use the EHR for billing or legal purposes since upon graduation she is expected to be familiar with these aspects of the charting process as well. She is able to effectively use the EHR tool to make better decisions and take "informed action."

An attending physician is expected to use the tool effectively to achieve all the aforesaid objectives. However, our data show that effective use of the tool varies across attending physicians as well. Primary reasons behind these variations are explained in the "personal factors" section.

In summary, the effective use of the EHR tool plays an important role in shaping the charting activity of the physician. She appropriates her charting according to the objective for the particular period in her residency.

Rules

In this section, we describe how the charting routine of a resident evolved with the adaptation to norms and rules built into the EHR. Through the three years of residency, the resident gets indoctrinated into the profession and learns the norms and rules of the profession. For example, one of the primary skills that a physician is supposed to master is the art of successfully obtaining the HPI, because an improper HPI can lead to an improper diagnoses and hence poor outcomes. An attending physician, A21, suggested that it takes years to acquire skills necessary for interviewing a patient. She explained "one of the things that we teach our interns is to allow free flow of information…but not to get overwhelmed." For an intern, a templated EHR chart (for a chief complaint like "chest pain") is always helpful since embedded in the template are the norms and guidelines that needs to be followed for a good HPI. It guides them to check for necessary conditions that they need to cover for strengthening the logic for diagnosis. As an intern R44 explained, "I do use the check boxes. It helps me remember all the necessary elements I need to check and document. Actually, I do also write some free text. I am about to write some now…I free text whatever is pertinent to the patient….I do both (check boxes and free text) because I want to write in my own language of what I examined. Sometimes it is a repetition of what I already clicked on …."

The EHR tool guides a new resident into a suggested interrogation sequence based on medical norms. As one of the junior resident, R19, explained: "This XXX (EHR) templates has helped me be quicker and manage data better for faster diagnosis. I use the templates that are already in there (in the EHR). So whatever symptoms I found positive in the patient I can click on them. In

paper, when I was in school…though we had a list…we had to write it…which was time consuming and then there were chances of me missing something crucial. Here I do not have to write much. Here I use click boxes much more…which makes me faster. Additionally, I would capture additional data if I need to. Then I would go to ROS and I would use a macro out here which I made. I had put it in here which is easy."

However, some physicians believe that a templated chart makes the physician's interaction with the patient very mechanical. The physician misses important cues from the patient, since the physician may only be asking questions from the template. According to an attending physician, A24, such an approach does not "tell the story" of the patient. Effectively narrating the story of a patient is one of the underpinnings of a chart. Confirming this view, senior resident, R35, asserts "I do not use any templates for charting." He explained how by using a template he is unable to "paint the true picture" of the condition of the patient. He mentioned that he usually includes a narrative because the data collected with the templates do not provide enough detail to create such a narrative. He emphasized that a major purpose of charting is to help the next provider understand the status of the patient and the treatment provided. However, the templates built into the EHR influence the charting routine of the resident if they are used by the resident; some do follow this norm while others prefer to use narratives.

The charting activity is also guided by rules and norms of the billing and the legal departments. Some senior attending physicians stated that the resident is familiarized with the basic norms of billing in the later part of junior year. It includes knowledge of how to document individual items in the relevant sections (tabs) in a chart to help billers use the supporting data. As a senior resident, R35, described, "So…we have to document certain aspects to get an appropriate level of billing for the service here…it is monitored by billing to extract certain things such that they can bill at a certain level." He further added "….and to see that you have done the right things for medico-legal requirements…the patient that you had…thought about certain things has to be written down…whatever problems that you thought about. For instance, a patient with a chest pain and you thought about the top 5 dangerous causes of chest pain…you need to write it down…there are all sorts of issues…like so many bad things happen…like when the patient was first evaluated, when the person signed up for when they arrived, and has it all been timed, and the time between when they arrived in the T zone…and when you saw that patient, were orders placed etc…was there is a lag in between…"

For example, a bill for services provided to a patient in the emergency department should contain the following data:

- An Evaluation and Management (E/M) service code for determining the type and severity of patient condition. E.g., CPT code 99285 is for providing evaluation and management services to a patient in the emergency department which includes comprehensive history and examination, and medical decision making of high complexity.
- The bill should also have a diagnosis code. E.g., ICD-9 code 786.59 – Chest Pain - Non-cardiac.

Each CPT code has guidelines on the minimum number of items that need to be included under HPI, ROS, and Physical Exams. For example, to bill for a CPT code of 99285 (also referred as "level 5" service bill), 10+ ROS is mandated, whereas for a level 4 (CPT code 99284) service bill, ROS for 9 systems is sufficient.

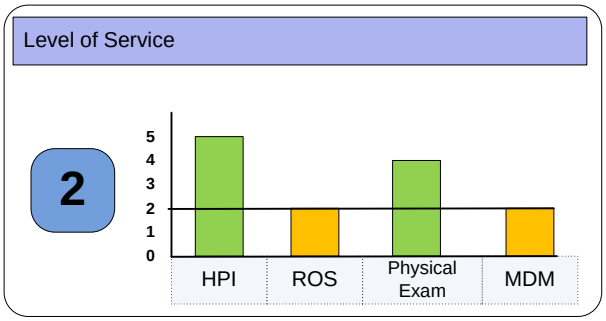

Figure 3 - Hypothetical example of a LOS tool (EHR)

This rule is implemented in the EHR tool with a graphical display termed Level of Service (LOS) as shown in Figure 3. As the physician updates the chart, the system displays the level of service in real-time by calculating the number of items that have been filled under each tab. Depending on the lowest level met on the sections (tabs), the system recommends a level of billing. For example, in the figure above, the system recommends level 2 billing since data in the ROS and MDM sections only satisfy level 2, even though the HPI section is sufficiently populated with data to bill at a level 5.

The implementation of the rule through the LOS feature in the EHR tool shapes the residents' charting activity as it gives them an instant feedback on data that are missing. A senior resident R15, explained "I do use the LOS marker…it gives me instant feedback…and I use that for review of systems that are specific to a complain that they might have…so for example if they have…a CKD…and for their review of systems I will click the positive…negative…and check this screen to see how am I doing (3:12)." Interviews with a senior attending physician, SM 53, revealed that the interns do not have a deep understanding of the requirements or rules that guide billing. He suggested that as they progress in the residency, around the mid-point of their residency, they tend to grasp the rules better since by this time they would have attended conferences in which billing norms were discussed. He described, "The interns don't know that (billing intricacies) very well. Second years know a little bit. We actually spend time with the third years to teach them…that you have to put in so many elements. And in XXX (EHR) there is a counter in there too…so there you are supposed to count…how many times did you pick each of these findings…so that you know…you can display and see in the LOS (level of service) how you are doing. So the reason is…the interns don't know about it…experience, knowledgebase about billing…documentation. And as you go through…they sort of get better at it."

Whereas the residents are not responsible for billing, attending physicians are responsible for billing for the services provided. Hence, though the rules for billing do not have a direct impact on the resident, they learn these rules through their interactions with the EHR. However, for an attending physician, the rules for billing have a direct impact on her charting activity. Also, the charting activity is also shaped by the way the rules are implemented in the tool. The rules

implemented via the LOS tool do not prevent an attending to bill at a higher or lower level than what the documentation in the chart supports. LOS is treated as a guide to appropriate level of billing, but this suggestion can be bypassed. For example, to designate a chart as completed, the attending physician has to "drop-in" a relevant billing code for the services provided. She reviews the services provided by her and/or the resident, updates the chart if some service has not been documented, reviews the documentation that has already been updated in the chart and then decides on the level of billing. Attending physician A21 explained the billing process "We do our own billing. We have BCo (billing company) which I think they technically do the billing. What we do is…drop the level of service charges. So…on the health care side…they extract it based on the level. Here…we have to basically click on a level which we want it to be billed at…and then BCo…which is the clearing house…do some checks and releases the bill. They cannot change a bill…but they can tell us that documentation is not sufficient for billing at that level. So basically, BCo audits us…and we periodically get emails from them (BCo)…"Hey we have gone through a bunch of your charts…we want to sit down with you and talk about them."

Since the rules implemented in the tool can be bypassed, an attending physician has three options: either to accept the level of billing as suggested by the LOS feature; open the individual sections in the EHR and update them with details so that the service can be billed at a higher level or "drop" (a term used by the health care providers to click on the appropriate code) service bill code that he deems fit without checking for documentation. Our observations showed that many times the attending does not check the LOS feature and bills at a level which she considers appropriate for the services provided. If the documentation in the chart does not support the level at which the attending physician billed, the billing department returns the chart with request for additional data or "downcoding" the bill. For example, a billing manager showed detailed notes (Figure 4) of her periodic meetings with attending physicians to discuss a case which has to be downcoded:

"19 y/o m - psych eval/depressed; Rx refill. PMH: insomnia, biopolar, PTSD. No labs. Pt is no danger to himself or others. ED to 13B (voluntarily). **History: Comp/ PE: Comp/MDM: Moderate.** HPI: 4 (duration, **mod fac,** assoc signs/sym; context); ROS: 10+; PFSH: 2; PE: 10; Dx Mgt: 4; Data Ord/Rev: 0; Risk: Moderate. ***Dropped it from 99284 to 99283 due to nature of presenting problem: Low to moderate."***

Figure 4 – Notes from billing department on "downcoding" a chart

Because the rule is not being enforced (with the bypass option available) each attending shapes his charting activity differently; while some check the LOS and drop the service bill code with appropriate documentation while others do not use the LOS feature.

Summarizing, as an intern, the residents charting activity is influenced by the norms implemented in the chief complaint template. From the later part of the junior year and the senior year, the charting routine of the resident gets guided by rules from billing and legal which are implemented as a graphical display tool. Thus, the residents charting routine evolves and is implicated by the rules that are built into the EHR.

Community

We describe in this section, how with the induction of the resident into the community gradually, the charting routine of a resident gets influenced by peers and senior residents. In the context of this research, community is defined as subjects who share the same object. E.g., all resident physicians are a part of the resident community and all attending physicians are a part of the attending physician community. In a broader view, both form a part of the physician community. Our analysis suggests that none of the residents interviewed had received hands-on training on any EHR prior to starting their residency. Further, the training on the EHR that is provided by the hospital is also very limited in scope. Collaboration with members of their cohort and senior residents is hence extremely important in shaping the charting activity of a resident.

Since all residents in the same cohort go through the same experiences in their training, the community they belong to plays a prominent role in their charting activity. The residents learn how to use the EHR as an intern. They share notes on how to use the basic features (such as navigation between different screens of the EHR) with other members of the cohort. In their junior year, they start to engage with their seniors to jointly develop macros that use some of the advanced features and help improve their personal effectiveness. They also share their knowledge on creating macros with their peers. As one senior resident physician, R35, explained, "I have a lot (of macros)…probably like 50…I created a few and friends shared some…I share it with other residents too…sort of…I do this and give it to each other and pass it on." Another resident, R44, echoed the same sentiment "My other colleagues trained me as to how to use the macros. When I joined…in the first class room training…they kind of showed it to us…but I think seeing other people…how they use…is a lot easier to learn…and motivates me more to use it…."

We found some advanced use of the EHR tool with senior resident physicians which they share within the community. In the HPI/ROS/Physical Exams sections, the "chief complaint" was selected from an existing list of chief complaint template. However, we observed patient cases which do not fit the standard "chief complaint" (e.g., chest pain) template. "Psych cases" is an example which is not available in the list of chief complaints template. In such situations, physicians' type in the complete patient narrative which is time consuming since each interview in "psych cases" would be different and no standardization is possible. Some of the physicians use an advanced feature of the EHR in the form of macros where a template can be created by the physician and saved for future use. Attending physician, R15, explained "I created this EDMDPSYCH macro …so that people can document for psych patients faster if they are straight psyche cases…I can show you…so here is the physical exam that I populate out…so it should cover all the 9 points…I think other people probably use it…I think XYZ (another resident) has made a HPI template and uses it. Lots of people have their own little templates…like for trauma…for chest pain…and they are not standardized."

For example, a physician would create a HPI maccro template (shown in Figure 5) for "psych cases" which identifies data items that need to be completed. The physician will type the rest of the chart based on the patient interview. This framework ensures that the physician does not miss any items for billing or medico-legal purposes when completing the chart.

```
<!--EHR-->
 H I S T O R Y   O F   P R E S E N T   I L L N E S S

<BR>
 Location  ***
<BR>

<BR>
Duration  ***
<BR>

<BR>
Timing  ***
<BR>

<BR>
Severity  ***
<BR>

<BR>
Quality  ***
<BR>

<BR>
Modifying Factors  ***
<BR>

<BR>
Assoc Signs/Symptoms   ***
<BR>

<BR>
Context   ***
<BR>
```

Figure 5 – HPI macro template

Such templates and macros make charting easier for the resident. Sometimes, templates are shared and modified for creating new macros for specific tasks. For example, a resident created a macro for a specific type of "chest pain" by modifying a macro provided by another resident. Macros shared by senior residents and peers shape the charting routine of the residents.

Macros are also used by attending physicians for attesting resident's charts. For example, the following template is used by an attending physician. "I saw and evaluated the patient. Discussed with resident and agree with resident's findings and plan as documented in the resident's note." This macro can be invoked by the attending physician with a shortcut command when she needs to co-sign a resident's chart. This macro minimizes the effort needed from the attending physician to include this information in every chart created by a resident. In fact, an attending physician, A44, described, that in order to facilitate his charting activity, he

uses macros created by other attending physicians. He narrates, “I use a lot of macros which have been shared by others…and I have made a bunch of my own which really helps. All the ones starting with XXs…are mine…created by me. There should be 30-40 of them and they help a lot. I have them here…these starting with YY…are from another physician…actually she gave me access to her’s…and shared it with me.”

In summary, as an intern, the residents share knowledge on basic navigation and functionalities of the EHR with peers to shape their own as well as the cohort’s charting routine. As a junior and senior, residents share tools that they have created with others. In essence, community support contributes substantially in shaping an individual’s charting activity over the years in residency.

Roles or Division of Labor

Role changes and the evolution of a resident’s role in the community have a substantial influence on the charting routine of an individual. In the course of the residency, the role of the resident evolves from that of a student to a leader. High acuity level patients are generally not seen by interns. Interns are generally asked to cover low acuity patients on their own, under supervision from a senior resident. So typically, an intern would do the HPI, ROS and Physical Exams and come back to report her findings to a senior resident. The senior probes the intern to ensure that he or she has covered all the aspects to make a diagnosis (medical decision making). Since the study site is also a teaching hospital, the attending physicians’ role is that of a faculty or preceptor. For higher acuity patient, the discussion would be broader where the senior resident would lead the discussion with the attending physician and the intern would learn from the discussion. Thus, there is a clear distinction between roles held by residents in different stages of their residency.

Attending physician A51 describes the evolution process “As a intern, you don't really see that many of the critical care patient…meaning patients with higher acuity. As a junior, you see a lot of the high acuity and you see a lot of other patients…but you don't assume responsibility for every critical patient coming in to the zone…specially the T zone.” He further adds “As a senior…you are trying to act more in seeing the zone as a whole. So, the senior's…if they see a resident who is a little slow or struggling…they will try and get them to get the process going faster. The senior will…make sure that every critical patient is taken care of…even if they are not seeing the patient…the senior’s are usually aware of all the critical patients in their zone…so it's more of leadership…as a senior you are trying to take more of a role in managing the zone…a bigger role in the department.” Hence, the charting routine for residents is guided by their objective which in turn depends on their role. As an intern, the resident is responsible for her charting only under direct supervision from seniors residents and the attending physician. Hence, her chart is very focused on the HPI/ROS/Physical Exams which are primarily centered on data collection and not decision making. As the resident works with care teams that treat higher acuity patients, they learn how medical decision making is done. Ultimately, the resident moves from being an intern to junior to senior, to become a leader guiding interns on the charting routine. Thus, the evolution of the residents’ role affects the charting activity.

Summarizing, the charting activity is appropriated by the role the resident plays at various stages of residency.

While most of the above discussion explicates the environmental influences on the evolution of the charting routine which in turn affects the objective and the outcome, our analysis also highlighted some individual level characteristics which influence the activity and hence the outcomes.

Personal Factors

Two of the most prominent themes that emerged from the analysis of interview data were (1) Computer Self-Efficacy and (2) Risk Propensity of the individual. Computer Self-Efficacy is the "judgment of one's capability to use a computer" (Compeau and Higgins 1995). Risk Propensity is defined by Sitkin and Pablo (1992) as "the tendency of a decision maker either to take or avoid risks." (p.12)

Familiarity with the use of computers or computer self efficacy was found to be an important factor affecting the charting activity. While being a junior, when a resident R9 was given charge of a pod (with 7-8 beds) to manage on his own, he had to find ways to improve his charting performance to avoid patients queuing up in the waiting room. He described "there was a point in time where…the pods that we had were quite large…and at night you had no supervision…for a quite bit of the night…and I would get ten nurses coming to me with in the T zone…questions…and I had to find some way to make things quicker." He explained "I invested a lot of time…at home…just to make it (macros)…so that when people asked me questions (in the shift)…it wasn't a massive interruption…(10:01)..it wasn't something that I had to stop doing some complex thought…I was just clicking through my macros. It also let me see more patients…because I got tired of…being…kind of bogged down." He further explains his acumen with computers, "I had a pretty heavy computer background. I did laptop repairs….and some coding when I was a teenager….I was working for Toshiba doing laptop repair for a couple of years…and coded C++ for a year or two as well." In contrast, we observed and interviewed a senior attending physician, A20, who was pecking on the keyboard, single letter at a time with one finger of one hand, to type out his chart. He explained "I type in everything. I am a pecker and not a typer. I am waiting for SIRI to come in…and Apple to come in….cause they will go with SIRI and do some smart text where they will recognize my voice and not yours." Our data also show that the charting routine is also appropriated due to improvements in computer self-efficacy of individuals over time. This improvement may be effected due to extended use of the tool. As attending physician A44 acknowledged that his charting has improved over the years "My documentation has improved because of XXX (name of the EHR)….it takes longer and I am not a real good typist. But it certainly has gone better now than what I used to be. I used to be like this…one letter at a time with one finger…but not like the younger residents who grew up typing…it makes a little more painful for me. I used to take around four to five minutes when I was doing paper charts, but it (writing a paper chart) was more complicated because you want to make sure that there are certain things that you have documented….like I said….. you had two pages and you had to write really little."

Our analysis also identified risk propensity as another factor that influences the charting routine. Our analysis of secondary data revealed that some charts were very meticulously crafted. A senior resident, R59, on being asked why are differences seen in charts with the same chief complaint and acuity, explained why not all charts are not prepared similarly, "Well…I think…part of it is comfort…some people are very worried about risk…people are worried about being sued…." A senior resident, R19, also mentioned "I don't put a whole lot of importance to charting. I am not very worried about being sued. It's just…that I am not. If I get sued…it happens. But I do put a lot of emphasis on the clinical care." While another resident, R32, of the same cohort, on being asked on what the primary objective of charting for her was, blurted "So I won't get sued…so I won't get sued. That's the reason for charting. Yeah. So that the lawyers can read it and understand my thoughts and rationale." Thus, the individual's level of risk propensity affects the charting activity, and hence the outcome chart to a large extent.

Overall, our data show that the charting routine is implicated by environmental factors: (1) Tools (2) Rules (3) Community (4) Roles and individual factors: (5) Computer self-efficacy and (6) Risk Propensity.

Discussion and Conclusion

There are four major implications from our findings which help us understand the evolution of the charting routine in a health care institution and warrant further discussion: (1) the goal or objective for charting of an individual during residency and the primary objective at different phases of the residency shape the charting routine of the individual, (2) the effective use of the IS artifact contributes substantially in shaping the charting routine, (3) personal factors influence how an individual imbibes the charting routine and (4) Context.

(1) Goal changes – Charting evolution (Activity Theory – Routines)

Due to the highly complex nature of the physician function and added complexity of the EHR, the resident physician is cognizant of the environment when setting her goals. Activity theory has been used to study an individual's goal orientation to IT use (Barki, Titah et al. 2007). According to Bandura (1995) individuals motivate themselves and act to realize anticipated outcomes. "They set goals for themselves and plan courses of action designed to realize valued futures" (Bandura 1995, p. 6). The physician sets different goals for the use of EHR at different phases of residency. A resident's charting routine also evolves as her goals evolve. For example, an intern's primary objective is to be able to communicate with the attending physician preceptor with patient details. For this purpose, she needs to be able to navigate the various sections of the chart within the EHR. However, when the resident becomes a junior, her goal shifts to minimizing the time taken for charting. Towards this goal, she learns advanced features of the system. As a senior, her goal includes compliance with billing and legal requirements. , she starts learning to use features like LOS that provides instant feedback for billing requirements to the resident to make informed decisions. This progression illustrates how changes in goals of a resident physician, over time, influence her charting routine. By examining the role of evolving goals in the evolution of a routine, our research responds to the call by Loch

et al. (2013) for further studies on how routines are influenced by contextual factors. With a deeper understanding of how goals influence routines, this investigation may contribute to the literature on organizational economics which is focused on understanding the purpose or motivation of routines (Parmigiani and Howard-Grenville 2011). Our findings reinforce views of Dionysiou and Tsoukas (2013) that routines are capable of adjusting and adapting to the environment (Feldman and Pentland 2003). Our study establishes that goals of an individual performing a routine as a critical element in adaptation.

Though Activity Theory has been used in the IS literature, our research represents an initial attempt at using Activity Theory to examine the evolution of routines. Additionally, this study is one of the few studies where the temporal dimension (Table 7 and Figure 6) has been added to implicate Activity Theory.

	Factors	Intern	Senior
1	Effective use of Tool	Transparent Interaction (e.g. Navigation)	Informed Action (e.g. better decision making)
2	Rules	Use of basic features (e.g. check boxes)	Use advanced features (e.g. LOS)
3	Community	Learn from	Share with
4	Roles	Student	Leader
5	Computer Self-Efficacy	Novice	Advanced
6	Risk-propensity	Does not change significantly	

Table 7 - Evolution of Charting routine

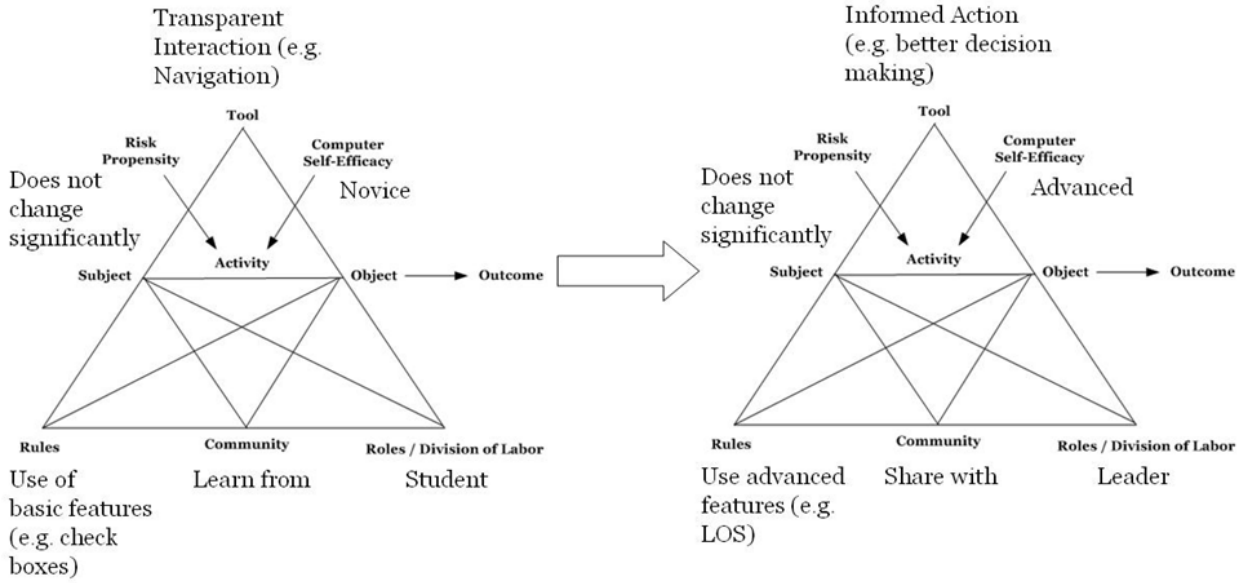

Figure 6 - Evolution of Charting routine

(2) IS artifact – Effective Use

Though computers have been in use in the health care domain for several decades (Collen 1994), the EHR is a very complex system to use for a first time user and especially without extensive training (Middleton, Bloomrosen et al. 2013). Even navigating through the multitudes of screens in the EHR can be a complex activity (DesRoches, Campbell et al. 2008). Effective use of EHR is critical in the enactment of the charting routine. While IT use has been extensively investigated in IS research (DeLone and McLean 2003, Venkatesh, Morris et al. 2003), only recently the importance of "effective use" has been recognized (Burton-Jones and Grange 2012). However, the dimensions of effective use have not yet been empirically investigated. Our study contributes to the literature on effective use explicating the dimensions as conceptualized by Burton-Jones and Grange (2012) in a real life setting. For example, as an intern, the resident physician navigates the EHR system to "access the representations" (transparent interaction). As a junior, she uses advanced features of EHR system to "obtain representations" (representational fidelity). Our findings suggest the addition of "create representations" at this level together with "obtain representations" since our residents were creating macros as well as using existing macros ones for obtaining representations. A senior resident uses the EHR to "act upon representations" (informed action). Our study also provides evidence for the proposed hierarchical structure of the various dimensions of effective use, confirming Burton-Jones and Grange (2012)'s conceptualization.

Summarizing, our study contributes to our knowledge on the influence of an IT artifact, the EHR application, on a routine (Feldman and Orlikowski 2011) which is of significance to organization theory scholars interested in understanding how people enact routines (Parmigiani and Howard-Grenville 2011).

(3) Personal Factors

Our study identifies personal factors that in conjunction with environmental influences affect an individual's behavior in the charting activity. According to Activity Theory, environmental influences, (like rules, community, roles) influence an activity (charting). We identify two additional factors, Computer Self Efficacy and Risk Propensity, that in this context, influence the charting activity (Figure 7). For example, our findings suggest that physicians who had higher computer self-efficacy were more apt in creating macros and helping peers. Additionally, physicians who are risk averse tend to prioritize patient care higher than charting for medico-legal documentation. Both these personal factors appropriate an individual's charting routine. Thus this study suggests that elements of Activity Theory may be enhanced with additional constructs.

Our findings confirm the work of Feldman and Pentland (2003) that the ostensive aspect of a routine might be the same for the organization or department, while different individuals might enact the same routine differently (performative aspect). Our findings add a new dimension by explicating that some part of this variation may be attributed to personal factors. For example, two residents may have diametrically opposite views in defining the primary objective of charting. For a risk-averse individual, legal needs may be the primary objective whereas for another the focus may be communication with peers.

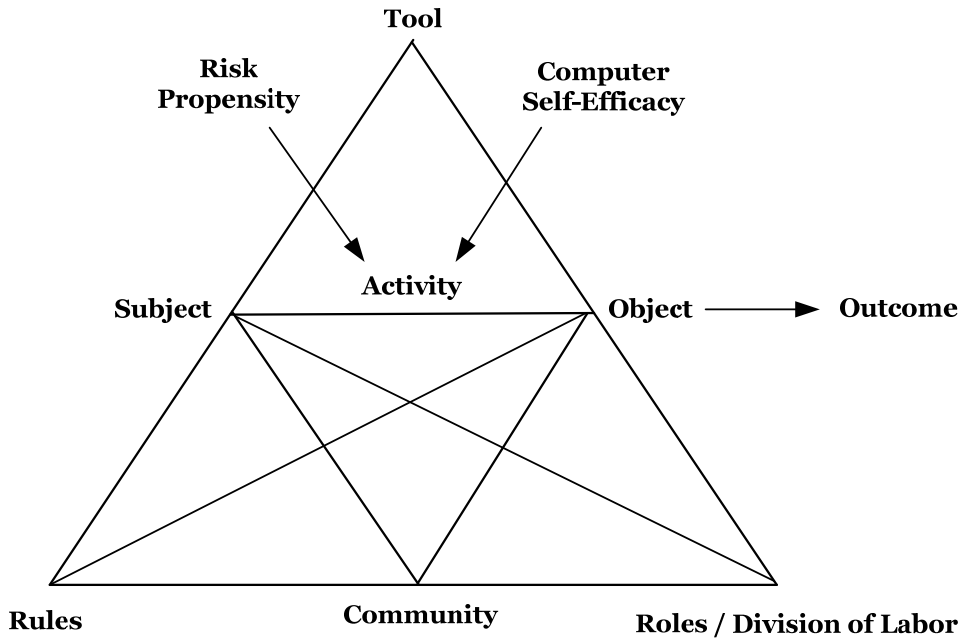

Figure 7 – Activity Theory adapted to our context.

(4) Context

Prior research on EHR in Information Systems have focused on privacy (Angst and Agarwal 2009), system use (Venkatesh, Zhang et al. 2011), assimilation (Mishra, Anderson et al. 2012), and adoption (Ozdemir, Barron et al. 2011). However, prior research has not examined how IT enabled routines evolve in a health care institution. This study is one of the first to examine how routines evolve in a health care institution with a HIT implementation contributing to the literature on organizational routines by developing an understanding of how routines evolve, and how users adapt and practice routines in complex processes (Abell, Felin et al. 2008) such as the delivery of health care. This perspective is significant in health care organizations because efforts to standardize routines to achieve operational efficiencies may be ineffective or even counterproductive if the evolution of routines is not taken into account. Additionally, by developing new theoretical perspectives to explain the phenomenon of evolution of routines, this research will add to the body of knowledge in category 3 of health information systems research (HISR) literature focusing on IS theory and context relationship (Chiasson and Davidson 2004).

Summarizing, we contribute to the existing knowledgebase of both routines and Activity Theory in connecting the two literature streams. We contribute to the literature of effective use by being one of the first studies to explicate the dimensions (Burton-Jones and Grange 2012). Additionally, we also propose that in addition to the factors already described in Activity Theory, two additional factors: Risk Propensity and Computer Self-Efficacy, also influence a routine, resulting in variations in object and the outcome. Lastly, we contribute to the HIT/EHR literature with rich description of evolution of routines.

From a practitioner's point of view, this research will help identify factors that influence the adaptation of an IT-enabled routine application in health care organizations. The knowledge gained would also be beneficial to practitioners in developing training requirements, redesigning processes, identification of feature enhancements and developing guidelines for standardizing processes. For example, training modules can be designed for different groups of physicians based on the stage of their residency. The development of a repository for all macros and facilities for retrieving them based on unique individual needs will be beneficial.

Limitations and Further Research

This study has the inherent limitations of generalization as is common with qualitative case studies (Lee and Baskerville 2003). However, since the evolution of routines in HIT implementations are likely to have similarities with the evolution of routines in other enterprise system implementations, the rich, thick descriptions, and analysis of the phenomenon from this study are likely to be applicable in these settings as well. Since this research is set in one urban hospital, it remains unclear whether the findings will be applicable in other situation, like for example, EHR implementations in a small physicians' office (Lyytinen and Rose 2003). Future research in other hospital settings like rural, public owned or private owned can add more insights. Although all EHRs serve the same purpose, there could be differences between EHRs in the way a particular patient interaction might be captured. Some functionality that are unique to the EHR studied may not be available in others or vice-versa. Hence findings from this study may not generalize to other EHR implementations.

Study 2
Understanding IT Security Compliance Behavior in Health Care: An Empirical Study

Introduction

The importance of studying challenges in implementing information technology solutions in health care organizations is highlighted by the huge investment of nearly $36.5 Billion in health care information technology (HIT) which has been spurred by recent government mandates (Washington Post 2009, Romanow, Cho et al. 2012). Among the various challenges to implementing HIT, ensuring the security of patient data is significant. The storage of data on a computer network, (as opposed to paper records or charts), (Choi, Capitan et al. 2006) poses interesting challenges in this regard. Patient data now are more vulnerable to theft and misuse because of easier access (Angst and Agarwal 2009). The cost of health care data breaches has recently been estimated to be over $7 billion annually (McCann 2012). According to a recent research report from the Ponemon Institute (Ponemon 2012), 94 percent of hospitals surveyed have had data breaches in during the two year period 2010-2012.

It has been long accepted fact that insider threats are one of the biggest concerns for information security managers (Posey, Bennett et al. 2011, Willison and Warkentin 2012). A 2014 PricewaterhouseCoopers report (PwC 2014) suggests that the source of a vast majority of security breaches (at least 58 %), can be attributed to insiders. In health care organizations, nearly two thirds of the organizations face this problem (PwC 2014). In the same report, PwC report (PwC 2014), a Chief Information Security Officer aptly explained the phenomenon, "insider threats are not necessarily a 'bad guy' with bad intentions; it could be a good employee doing righteous work in an insecure manner. Our problems are more human than technological." Employees are still considered to be the weakest links in data security efforts in organizations (Guo, Yuan et al. 2011, Crossler, Johnston et al. 2013). The importance of making employees understand the implications of data protection and providing them with relevant tools have been underscored in research studies (Gaunt 1998). Most organizations dealing with sensitive information like patient data need to develop organizational strategies for effective "security countermeasures"(Straub 1990). Even when organizations have developed such strategies, employees often fail to comply with these strategies (D'Arcy, Hovav et al. 2009). Kumar et al. (2008) suggests that risk analysis of the business environment, identification of threats and disaster recovery plans, together with portfolios of countermeasures need to be considered in an integrated fashion for developing a strategy for information security. Ransbotham and Mitra (2009) describe a conceptual model of how countermeasures can play in information security compromise of a firm. Much of the research in this area focuses on organization-level strategies for achieving information security. However, the security compliance behavior of the individuals involved has received scant attention. Moreover, research on analyzing information security issues in health care (Appari and Johnson 2010), particularly focusing on the human side of IS security breaches (Parker 1998) is scant.

Research Objective and Question

While IT security compliance is critical for most organizations that are IT intensive, it is especially critical in health care organizations due to the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and other regulatory requirements (Warkentin, Johnston et al. 2011); hence our focus on this domain. Zuboff in her seminal work (1988) stressed the need for research on IT security compliance. Crossler et al. (2013) lament the lack of adequate attention to this important topic in recent research and call for more research on "improving information security compliance." Motivated by this call, this research seeks to examine factors that influence the IT security compliance behavior of employees in a health care organization. The culture of the group that an individual belongs to has a strong influence on his or her behavior (Srite and Karahanna 2006). Groups can be based on region (Robey and Rodriguez-Diaz 1989), nationality (Straub 1994, Walsham 2002), ethnicity (Straub, Loch et al. 2002), or organization (Robey and Boudreau 1999) and occupation (Barley 1983). Culture at the organization level can be different from culture of individual groups inside the organization (Schein 2010). For example, a hospital culture might not be the same as that of the physicians and/or the nurses. Specifically, this research attempts to analyze the differences in IT security policy violation behavior between different occupational groups (or subcultures) inside an organization with the following research question:

> ***How do differences in subculture among different occupational groups in a health care organization, influence behavior with regards to IT security policy violation?***

Theoretical basis and Related work

Recent research focuses on individual behavior and organizational strategies that promote compliance behavior (Kirsch and Boss 2007, Siponen, Pahnila et al. 2007). Boss and Kirsch (2007) build a model explaining an individual's security policy compliance behavior that centers on his or her precaution-taking behavior. Siponen et al.(2007) conclude that factors such as threat appraisal, self-efficacy and response efficacy have significant impact on an individual's behavioral intention to comply with information security policies. We define organizational IT security policy (ISP) as "a formal statement containing the security rules of the company and concerns all people who have access to the technology and information assets" (Vroom and von Solms 2004, p. 192).Bulgurcu et al.(2010) stress the importance of understanding employee compliance behavior as a key to protecting information assets in the organization. Siponen and Vance (2010) use Neutralization Theory to explain how employees rationalize non-compliance to security policies. Organizational strategies which are most effective in reducing the risk of misuse of information assets include deterrence, prevention, detection and remedies (Straub and Welke 1998). Organizational strategies to reduce vulnerabilities of technological assets (Kannan and Telang 2005), devising strategies to minimize external threats (Whitman 2004), and promoting information security governance mechanisms (von Solms and von Solms 2004) have also been examined by extant research. The objective of this research is to contribute to this literature by providing insights into the compliance behavior of employees in an

organization by examining the factors that influence the intention and behavior to not comply with IT security policies.

Theory of Reasoned Action (Fishbein and Ajzen 1975) has been used to understand individual behavior in a wide variety of contexts. One of the factors affecting an individual's behavior is the subjective norm that an individual believes in. According to Fishbein and Ajzen (1975), subjective norm is defined as "a person's perception that most people who are important to him think he should or should not perform the behavior in question." Subjective norms of an individual is driven by his or her normative beliefs, which are formed from the culture (Bagozzi, Lee et al. 2001) or social environment and the education that the individual has received. Normative belief of an individual gets formed by the culture he or she is exposed to (Cooke and Szumal 1993). Bock et al. (2005) postulate that organizational culture is an antecedent to subjective norm, leading to intent in sharing knowledge. In a related study, Bulgurcu et al. (2010) hypothesize that normative beliefs of an individual influences his or her subjective norms which affects intention to comply and hence behavior. This research seeks to extend this work to explore how culture influences subjective norm affecting compliance behavior (Montaño and Kasprzyk 2008)

The culture of the organization is a great influence on the employees complying with or violating IT security policies (Vroom and von Solms 2004, Chang and Lin 2007). The concept of organization culture in IS has been a subject of research for more than three decades (Schein 2010). However, based on a survey of literature, Leidner and Kayworth (2006) declare that despite the large body of literature on the topic, research on culture is still challenging because of its diverse definitions drawn from fields of anthropology, sociology, social psychology and cognitive psychology.

On a related note, there has been much debate on two closely related constructs - culture and climate – as to which better describes the organizational environment (Reichers and Schneider 1990, Denison 1996, Schneider, Ehrhart et al. 2011). Schein (2010) defines culture as "a pattern of shared basic assumptions learned by a group as it solved its problems of external adaptation and internal integration, which has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems." While Reichers and Schneider (1990, p. 22) defines climate as ". . . the shared perception of the way things are around here. More precisely, climate is shared perceptions of organizational policies, practices, and procedures." They both represent shared beliefs and values that influence behavior (Hann, Bower et al. 2007). We agree with Denison's (1996) argument that the difference between the two is "one of perspective rather than substance" since both describe the phenomenon of "creation and influence of social contexts in organization" (Bock, Zmud et al. 2005). However, in this research, we use the term culture for simplicity.

Centering on the topic of culture, this research specifically focuses on the influence of subculture on an individual in his or her compliance behavior. In this research, subculture is defined as culture inherent to "various occupational groups that make up organizations" (Schein 2010, p. 2). We reserve the term culture to be at the organizational level, and use subculture to be at the level of occupational groups, i.e., an organizational culture gets morphed from numerous

subcultures in the organization. Compliance behavior of an individual depends on the personal characteristics inherent to the individual, and the social norms and the culture of the group to which he or she belongs (Chen, Hui et al. 2006). Chen et al. compared the effects of national cultures of US, Poland and Hong Kong on compliance behavior. Similarly, Hovav and D'Arcy (2012) studied how national cultures influence IS misuse intention in two different countries (Korea and US). Related research (Srite and Karahanna 2006) compares national differences (Myers and Tan 2002, Ford, Connelly et al. 2003). Other research on the role of culture in the IS field have focused on organizational cultures (Alavi, Kayworth et al. 2005, Gallivan and Srite 2005, Leidner and Kayworth 2006). In contrast to the role of culture on compliance behavior centering on national culture, this study focuses on the role of subculture of different occupational groups in the same organization on compliance behavior.

This research is informed by the work of Hofstede (1980) which suggests that human behavior is highly influenced by the group to which the individual belongs, namely the culture of that group. The objective of this research is to investigate how culture or more precisely the culture of the group, or subculture, influences the IT security compliance behavior of the individual. Culture's influence on IT adoption has been studied in the past at the organizational level (El Sawy 1985, Galliers, Madon et al. 1998, Hasan and Ditsa 1999). Robey and Boudreau (1999) argue that an organization's culture comprises of a collection of subcultures and culture is the glue that holds the organization together. As Schein (2010, p. 55) explains what eventually goes on inside an organization is "a set of interactions of subcultures operating within the larger context of the organization culture." Barley (1983) suggests that individual action is guided by culture and is preserved at the group level. Sackmann (1992) also identified the potential existence of subcultures within an organization. In a subsequent study, Hofstede (1998) validated this finding by identifying several subcultures within an organization. These subcultures were dependent on the functional tasks they perform and their occupational training and background. Groups within an organization, because of their diverse subcultures react very differently to the same event. For example, Orlikowski and Gash (1994) investigate how different groups with varied subcultures in a large organization reacted differently to a new groupware system implementation depending on the level of their comfort with the technology. Von Meier (1999) explains how differences between the occupational culture of "engineers" and "operators" lead to conflicting interpretations of technological innovation in an organization. While the engineer's focus is to find innovative solutions and optimize performance, the operator's focus is to keep the system working. Similarly, Huang et al. (2003), using an exploratory case study, describe how sub cultural differences between teams (viz. top management as "warlords" and front office personnel as "frontline soldiers") in a multinational bank challenged the implementation of an integrative technology. Existence of subcultures has also been researched by Lok et al. (2005) where the researchers found a strong relationship of subculture with organizational commitment. However, to our best knowledge, no work has been done to study the effect of subcultures on IT security compliance behavior in a health care organization. The focus of this research is on the effect of occupational subcultures (Sinclair 1991) on the intent and the behavior of various occupational groups in a health care organization.

It is recognized, that differences in behavior within different groups in a health care institution for the same organizational policies exist. This study focuses on one behavior, namely the noncompliance behavior, especially policy violation intention and actual behavior of different groups inside an organization. We study three essential groups of employees with different subcultures in a health care institution, who directly or indirectly provide care to patients. We review extant literature to describe their characteristics and relationship to noncompliance behavior.

Physicians: It is said that the authoritative power projected by a physician emanates mainly from his scientific knowledge and power conferred to him by the Hippocratic Oath (Kalisch 1975). As the title of the article "Of half gods and mortals: Aesculapian authority" (Kalisch 1975) signifies, physicians tend to command authority and expects everyone to follow it submissively. They are expected to be authoritative and decisive because they are trained (Smith 1987) to take "independent action" based on "quick thinking diagnosis" (Reifsteck and D'Angelo 1990). This group of employees is the most educated in the three groups. For them "patient care" is of primary importance and they would do everything for the advancement of this objective at the expense of non-clinical work (Abraham and Reddy 2008). Their high level of education promotes their authoritative decision making habits and a "no-care" attitude to other administrative activities (like following rules for compliance). This arrogance might go against them, and position them to be "out of the loop" as regards to organization safety procedures and promote noncompliance behaviors (Gershon, Vlahov et al. 1995). Additionally, as reported by Ash and Bates (2005), security concerns are not of major importance to physicians.

Nurses: In a hospital, nurses are aware of their lower power in the institution and hence are cautious of the risks and uncertainties associated with their job (Degeling, Kennedy et al. 2001). Literature refers them to be as the oppressed group, in contrast to the physician who is referred to as omnipotent (Roberts 1983, Jewell 1994). For this group, employment security overrules personal autonomy and therefore they always abide by work process-control model. Nurses tend to be more aware, than physicians, of safety efforts in the hospital and hence tend to show more compliance behavior (Pronovost, Weast et al. 2003). It is hence argued that they would tend to be more compliant to formal IS security policies, due to the certainty and severity of sanctions if found guilty. They would take preventive steps in reducing policy violations.

Support: While physicians and nurses are engaged in the clinical treatment of the patient in some way, this group is mostly involved in supporting them in tasks like patient registration, movement of patients, checking vitals etc. They would be generally the lowest educated among the three groups, typically with high school education and/or a certification. Their departmental goals are different from that of the clinical groups and there is a perceived status difference between the clinical groups and this group (Abraham and Reddy 2008). The support staff are the most focused on transparent accountability and resource management (Degeling, Kennedy et al. 2001) since their primary job is to administratively manage the hospital, comply with policies and mandates (Feldman 1976), reduce costs unlike the clinical staff whose focus is primarily curative in nature.

While the differences in behavior within subcultures can be attributed to many factors, we focus on four dimensions that influence the behavior of an individual in this setting namely (1) Education (2) Power hierarchy (3) Occupational prestige and (4) the prioritization of work in polychronic work environment. Education is one of the greatest drivers in shaping the culture of a group (Schein 2010) and hence their behavior. Values and beliefs created in the formative years of education and training influence the culture of a group (van Maanen and Schein 1979, Schein 2010). Also power commanded by a group directs behavior (Crozier 1964). Additionally, behavior is influenced by occupational group prestige (Mettlin 1976). Lastly, the culture of the group as regards to time use (monochronic or polychronic) shapes the behavior of that group (Bluedorn, Kaufman et al. 1992).

Research Model

This research examines how occupational subculture affects the compliance behavior of an individual and identifies differences in compliance behaviors of different occupational subcultures in the same organization. D'Arcy et al. (2009) predict that IS misuse intention can be controlled by increasing the awareness of security policies through education and training. Extending D'Arcy's et al. (2009) work, we posit that occupational subculture moderates the various relationships in their model. Figure 1 shows the research model that has been developed by extending their research.

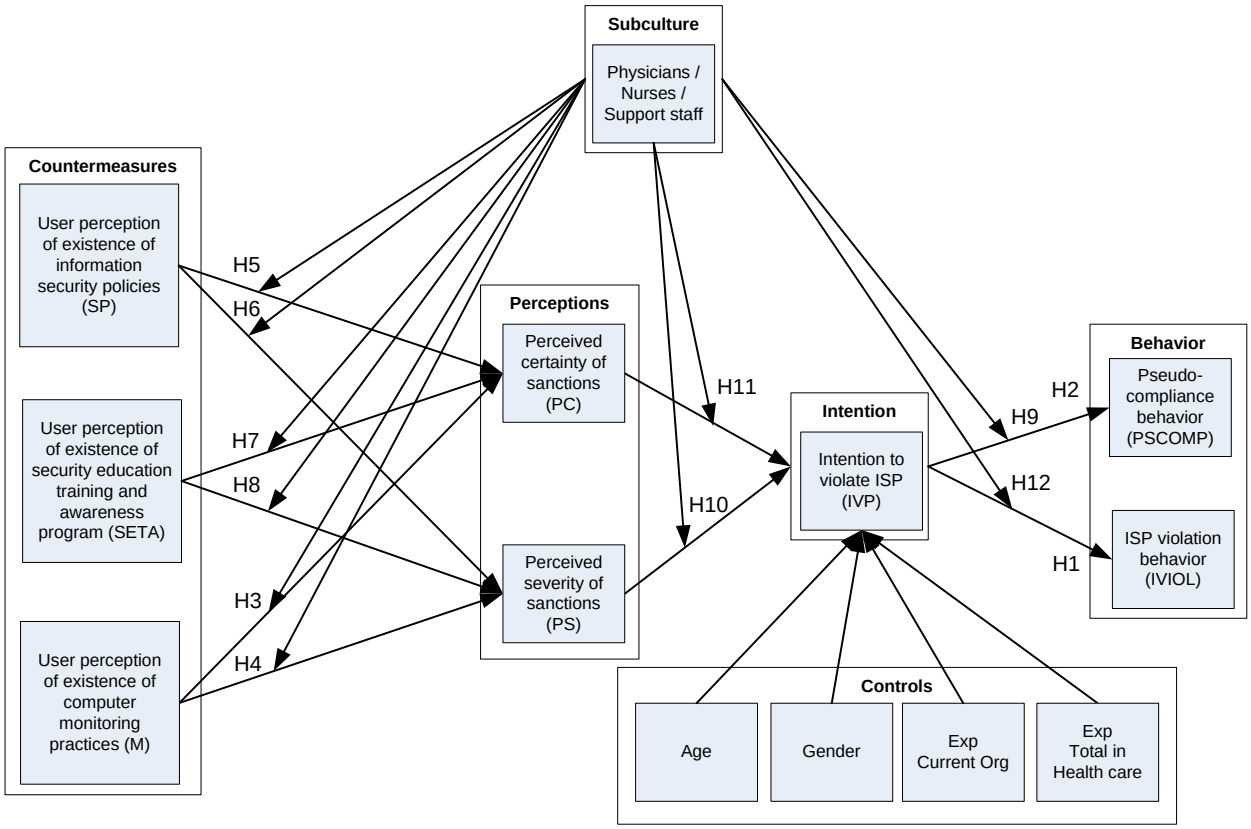

Figure 1: Research Model (Adapted from D'Arcy et al. 2009)

In this research, the dependent variable is "intention to violate ISP" (IVP) as has been used by Bulgurcu et al. (2010) rather than the more generic "IS misuse intention" used in D'Arcy et al. (2009) model.

It is well established in the literature that intention leads to behavior (Ajzen and Fishbein 1980, Ajzen 1985). Hence higher the intention (of policy violation), stronger will be the behavior (i.e. higher will be ISP violation behavior). Hence, we hypothesize:

H1. Intention to violate ISP is positively associated with ISP violation behavior.

Intentions have been established as predictors of actual behaviors (Ajzen and Fishbein 1977). Hence, if an individual's intent is to violate policy, the behavior expected will be actual violation of policy. Even if the individual tries to portray that he or she is trying to comply with the policy, his or her actual behavior will be otherwise. Pseudo-compliance behavior is defined here as a behavior demonstrated by an individual, who acts to the world as if he or she is in compliance. The behavior displayed is similar to "window dressing" - a pretty display that is intended to impress people who are observing. Pseudo-compliance lulls the observer into a false sense of compliance. Consider an organization in which IS security policies state that employees should lock their workstations when leaving their desk. Pseudo-compliance practice occurs when employees would minimize the EHR screen when leaving the workstation, giving a false sense to the observer that the workstation is locked and unauthorized access to the EHR is not possible, suggesting compliance when that is not the case. In an organizational setting like health care, where HIPAA and other privacy concerns are so predominant, a health care provider is acutely aware of the confidentiality and privacy of the patient record (Gaunt 2000). He or she is expected to be compliant with ISP and hence should exhibit compliant behavior. However, if, he or she has any intention to violate policy, he or she will always try to cover up his or her intention by displaying a pseudo-compliance behavior which suggests policy compliance. Hence we hypothesize:

H2. Intention to violate ISP is negatively associated with pseudo-compliance behavior.

Thus, two more dependent variables have been added to the D'Arcy et al. (2009) model, namely Pseudo-compliance behavior (PSCOMP) and ISP violation behavior (IVIOL)

At work, employees normally use and sometimes misuse IT systems (Dhillon 1999). Organizational policies and procedures prescribe guidelines on expected behavior, use and activities that amount to misuse. When employees misuse the system they do not comply with the organizational policies (Parker 1998). Implementation of organizational strategies through policies does not have the same desired effect on all groups in the organization (Martin and Siehl 1983, Palthe and Kossek 2003). One of the prominent factors for a strategy to be effective on a group is based on its subculture (Victor and Cullen 1988, Hovav and D'Arcy 2012). Adding to Schein's definition of subculture we use subculture in the context of this research as the culture of a set of organizational employees, "who interact regularly with one another, identify themselves as a distinct group within the organization, share a set of problems, and routinely

take action on the basis of collective understandings unique to the group" (Palthe and Kossek 2003, p. 295). The subcultures are based on shared assumptions within their group, might be stemming from a common need for satisfying an occupational requirement such as getting a license for practice. Subcultures can also exist in an organization based on gender (Eberle 1997), age (Lok, Hung et al. 2005b), hierarchical level (Schein 1986), tenure (Lok, Westwood et al. 2005) or functional role (Dougherty 1990).

Many explanations for a particular behavior of an individual can be attributed to the culture he or she belongs to (Skinner 1974, Harris 1980). As explained by Baum (2005), behaviors get formed where individuals would "imitate practices that occur frequently in the culture pool, so we are more likely to follow rules that occur frequently in the culture pool." Extant literature demonstrates that an individual's attitude and behavior depends greatly on the subculture of the group he belongs to (Lok, Westwood et al. 2005). Huang et al. (2003) describe how in an organization, different occupational groups with different subcultures, though motivated by a common interest, can view the same strategic objective differently. Specifically dissimilar subcultures of these groups in the organization might react very differently to the same organization level strategy (von Meier 1999, Huang, Newell et al. 2003).

In the health care domain, existence of wide variety of subcultures in a single institution is widely accepted (Morgan and Ogbonna 2008, Callen, Braithwaite et al. 2009). As Hall (2005) explains "each health care profession has a different culture, including values, beliefs, attitudes, customs and behaviors." The roots of their individual subcultures can be traced back to their values and beliefs created in their formative years of training, via strong socialization into their occupational communities (van Maanen and Schein 1979, Schein 2010). It is argued to be this way because of the differences in learning environment of each profession; for example, team spirit is imbibed in nurses at a very early stage because of the need for continuity of care for patients whereas physicians are taught to be independent (Hall 2005). Because of the differences in learning, it is opined that the behavior of a particular group of health care providers is dependent on the particular "cognitive map" that an individual belonging to that group visualizes since "Quite literally, two opposing "disciplinarians" can look at the same thing and not see the same thing" (Petrie 1976). Such variations in behavior often result in conflict.

In providing care to the patient, though all health care providers are expected to work in a collaborative fashion, research has recognized that the relationship between the different groups (physicians, nurses, support) are not always positive (McMahan, Hoffman et al. 1994, Blickensderfer 1996, Pavlovich-Danis, Forman et al. 1998). Because of the cultural difference between the groups, the reasons for the conflicts can be explained through differences in educational level (Mackay 1993), culture (Hojat, Nasca et al. 2001), social status (Hofling, Brotzman et al. 1966), legal jurisdiction (Sweet and Norman 1995), language or communication style (Leonard, Graham et al. 2004), professional elitism (Markowitz and Rosner 1973), role stereotypes (Keddy, Gillis et al. 1986) and role ambiguity (Devine 1978). Devine also reported that due to cultural differences, the degree of conflict between nurses and physicians varied between junior and senior physicians.

Based on a survey of physicians, nurses and support managers, Degeling et al. (2001) demonstrated how individual identities of the groups though latent, do manifest themselves in day-to-day work. Research also suggests that a subculture does not necessarily need to be aligned to the organization culture and such misalignment may result in conflicts (Martin and Siehl 1983, Brown 1995). It is also possible that subcultures can be stronger than the organization culture, in which case subcultures will influence employee attitudes and behaviors more than the overarching organization culture (Harris and Ogbonna 1998). As Schein (2010) summarizes an organization culture is a potpourri consisting of "interactions of subcultures operating within the larger context of the organizational culture." (p 55)

Original Constructs (D'Arcy et al. 2009)	**Physicians**	**Nurses**	**Support**
SP - User perception of existence of IT Security policies	SP_p	SP_n	SP_s
SETA - User perception of existence of IT Security Education Training and Awareness program	$SETA_p$	$SETA_n$	$SETA_s$
M - User perception of existence of computer monitoring practices	M_p	M_n	M_s
PC - Perceived certainty of sanctions	PC_p	PC_n	PC_s
PS - Perceived severity of sanctions	PS_p	PS_n	PS_s
IVP - Intention to violate ISP	IVP_p	IVP_n	IVP_s
PSCOMP – Pseudo-compliance Behavior (new construct)	$PSCOMP_p$	$PSCOMP_n$	$PSCOMP_s$
IVIOL – ISP violation behavior (new construct)	$IVIOL_p$	$IVIOL_n$	$IVIOL_s$

Relationships (D'Arcy et al. 2009)	**Physicians**	**Nurses**	**Support**
SP → PC	$(SP \rightarrow PC)_p$	$(SP \rightarrow PC)_n$	$(SP \rightarrow PC)_s$
SP → PS	$(SP \rightarrow PS)_p$	$(SP \rightarrow PS)_n$	$(SP \rightarrow PS)_s$
SETA → PC	$(SETA \rightarrow PC)_p$	$(SETA \rightarrow PC)_n$	$(SETA \rightarrow PC)_s$
SETA → PS	$(SETA \rightarrow PS)_p$	$(SETA \rightarrow PS)_n$	$(SETA \rightarrow PS)_s$
M → PC	$(M \rightarrow PC)_p$	$(M \rightarrow PC)_n$	$(M \rightarrow PC)_s$
M → PS	$(M \rightarrow PS)_p$	$(M \rightarrow PS)_n$	$(M \rightarrow PS)_s$
PC → IVP	$(PC \rightarrow IVP)_p$	$(PC \rightarrow IVP)_n$	$(PC \rightarrow IVP)_s$
PS → IVP	$(PS \rightarrow IVP)_p$	$(PS \rightarrow IVP)_n$	$(PS \rightarrow IVP)_s$
IVP → PSCOMP (new relationship)	$(IVP \rightarrow PSCOMP)_p$	$(IVP \rightarrow PSCOMP)_n$	$(IVP \rightarrow PSCOMP)_s$
IVP → IVIOL (new relationship)	$(IVP \rightarrow IVIOL)_p$	$(IVP \rightarrow IVIOL)_n$	$(IVP \rightarrow IVIOL)_s$

Table 1 – Constructs and Relationships

We seek to test how the subculture of each of the individual groups moderates non-compliance behavior. The research model is tested individually with different subcultures. The original constructs from D'Arcy et al. (2009) model are suffixed with $_p$, $_n$ and $_s$ denoting that constructs

are being tested in a “physician,” “nurse” or “support” subculture respectively as described in Table 1.

The Effect of Education on Monitoring Awareness across Roles

Education is one of the greatest drivers in shaping the culture of a professional group in domains like law, engineering or medicine (Schein 2010, p 21). In a hospital, differences in education and training create differences in subcultures. For example, physicians’ subculture is different from nurses which are different from that of the support staff. The roots of the cultures (or subcultures) can be traced back to the values and beliefs created in the formative years of education and training, via strong socialization into their occupational communities (van Maanen and Schein 1979, Schein 2010). While the education of physicians is primarily based on physical sciences and biochemistry focused on curative orientation, training of nurses is based on social sciences and is focused on person-environment interaction (Baer 1999). The education level of the three groups also varies remarkably. A physician usually holds an MD degree after spending a minimum of 20 years in formal education and 3 years in residency. A typical nurse would have 16 years of formal education, leading to an undergraduate degree. While a typical support staff would have 14 years of education leading to an associate degree or certificate. The profiles of students in each of these groups also vary remarkably. Students in the MD program typically would have earned very high GPAs, graduated near the top of their classes and scored very highly on admission tests. While entry into a nursing program doesn’t require such a high level of academic achievement, nursing students have a much higher level of achievement when compared to support staff. Considering the significant differences between the education levels and the aptitudes of people belonging to the three groups, significant differences in their capabilities between these groups is also expected. For example, the intense education of a physician, compared to a support staff member, makes him or her aware of the latest developments in technology which in turn gives him or her confidence to anticipate potential capabilities of newer technologies, more than the support personnel. The awareness and the confidence of a nurse, in terms of advances in technology, while unlikely to be at the same levels as a physician, but better than that of support personnel. Since they have higher levels of education, physicians are potentially more aware than nurses (and nurses more aware than support staff) of monitoring and surveillance techniques that can be used to detect IS security policy violations. Studies from sociology and criminology have shown that monitoring increases perceived certainty of sanctions and perceived severity of sanctions (Williams and Hawkins 1986, Kinsey 1992). Extending this argument, we anticipate that higher levels of education increase awareness of monitoring techniques, which in turn increase the perceived certainty and severity of sanctions of an individual. Therefore, physicians can anticipate, better than nurses (and nurses better than support), that computer monitoring can lead to certainty of punishment and severity of punishment. Hence the hypotheses:

> *H3a. User perception of existence of computer monitoring practices will have stronger positive association with perceived* ***certainty*** *of sanctions for physicians than for nurses.*

*H3b. User perception of existence of computer monitoring practices will have stronger positive association with perceived **certainty** of sanctions for physicians than for support staff.*

*H3c. User perception of existence of computer monitoring practices will have stronger positive association with perceived **certainty** of sanctions for nurses than for support staff.*

*H4a. User perception of existence of computer monitoring practices will have stronger positive association with perceived **severity** of sanctions for physicians than for nurses.*

*H4b. User perception of existence of computer monitoring practices will have stronger positive association with perceived **severity** of sanctions for physicians than for support staff.*

*H4c. User perception of existence of computer monitoring practices will have stronger positive association with perceived **severity** of sanctions for nurses than for support staff.*

The Effect of Power Hierarchy on ISP Awareness across Roles

Organizations design and implement IS security policies to prevent misuse of organizational assets (Whitman, Townsend et al. 2001). However, merely having IS security policies does not necessarily result in compliance behavior among employees (Bulgurcu, Cavusoglu et al. 2010). Employees are made aware of the existence of IS security policies, and the implications of non-compliance through security awareness initiatives. IS security awareness needs to be promoted in an organization to encourage IS security compliance behavior (Whitman 2003). IS security awareness initiatives are similar to quality improvement initiatives such as those that promote awareness of patient safety policies (Nieva and Sorra 2003). As patient safety improvement initiatives in a hospital promote behavior that "do no harm" to the patient (Morath and Turnbull 2005), IS security awareness initiatives promote do no harm to the patient record, i.e., protect the patient record (Collmann 1995).

However, the commitment attached to these efforts from different groups in the organization are not the same. Not all groups within an organization will react similarly to the same initiatives for promoting security awareness (D'Arcy and Hovav 2009). Physicians have challenged safety improvement initiatives like incident reporting (Waring 2005) because an adverse incident can be perceived very differently by a physician and a nurse. Whereas a physician might consider an incident to be too trivial and unworthy of reporting (Waring 2005), nurses may not. Evans et al. (2006) report that nurses are more aware of policies and used the incident reporting system for adverse event reporting than physicians. Physicians feel that errors are inevitable, and hence complying with processes, like reporting adverse incidents can be regarded as a waste of time and hence do not give much importance to it (Kingston, Evans et al. 2004). This difference in attitude stems from physician culture which is built around individualism, discretion and autonomy (Freidson 1970, Lupton 1998) in contrast to compliance

to policy from higher authorities that characterize the nursing culture (Grosch, Gershon et al. 1999, Evans, Berry et al. 2006).

Security awareness can be advocated by education and training. Individuals who have attended awareness training will have greater knowledge regarding expected behavior and hence will uphold higher safety by complying with policies (Arboleda, Morrow et al. 2003).

IS security awareness can be increased by two initiatives: (1) development of organizational IS security policy and (2) commitment to SETA (Security Education, Training and Awareness) programs (Whitman 2003). To inculcate positive security awareness, and deter potential IS security policy violators, the severity of the punishment and capabilities to detect policy violations should also be highly advertised as a part of the SETA program (D'Arcy, Hovav et al. 2009). Employees that do not attend SETA programs will not improve their security awareness.

Awareness programs such as HIPAA are mandatory for all hospital staff (Erlen 2004). However, employees can attempt to defy organizational policies if they hold powerful positions or occupations. As an example, Crozier (1964) reported that the maintenance engineers of a French factory held the most power, since they were the only ones who had the knowledge to repair the equipment. Similarly, in a hospital, power lies with the physicians and they can choose not to attend training programs. In contrast, support staffs do not have similar options. This is confirmed by a study on improving safety measures in a hospital, reported by Kim et al. (2001), where the attendance rate of physicians was 20% lower than that of nurses for a security training session that everyone was required to attend. Similarly, to the attendance of physicians in user awareness programs on IS security policies will be lower than that of the other two groups. In terms of power commanded inside the organization, nurses are between support staff and physicians since they are a part of the clinical team which gives them the power over support staff, but below the physicians.

Awareness of IS security policies can be increased primarily by training programs and awareness initiatives. User awareness of security policies is the highest for support staff, followed by nurses and then physicians. Awareness initiatives on security policies discuss the severity of sanctions and certainty of sanctions. People who do not attend the initiatives are not aware of the perceived certainty and severity of sanctions that are discussed in these gatherings. It is anticipated that perceived certainty and severity of sanctions will also be highest for support staff, followed by nurses and physicians respectively. Hence the hypotheses:

*H5a. User perception of existence of ISP will have weaker positive association with perceived **certainty** of sanctions for physicians than for nurses.*

*H5b. User perception of existence of ISP will have weaker positive association with perceived **certainty** of sanctions for physicians than for support staff.*

*H5c. User perception of existence of ISP will have weaker positive association with perceived **certainty** of sanctions for nurses than for support staff.*

*H6a. User perception of existence of ISP will have weaker positive association with perceived **severity** of sanctions for physicians than for nurses.*

*H6b. User perception of existence of ISP will have weaker positive association with perceived **severity** of sanctions for physicians than for support staff.*

*H6c. User perception of existence of ISP will have weaker positive association with perceived **severity** of sanctions for nurses than for support staff.*

Users can be made aware of the implications of not following the policy by increasing awareness (Whitman, Townsend et al. 2001). Awareness initiatives like SETA discuss the severity of sanctions and certainty of sanctions. In fact, fear appeals in the form of SETA programs are known to have increased policy compliance (Siponen 2000, Warkentin and Johnston 2008). However, people who ignore SETA communication and do not attend SETA initiatives are not aware of the certainty and severity of sanctions. Due to the power hierarchy in a hospital, physicians can afford to ignore such communication and initiatives without being penalized (Kim, Jeffe et al. 2001). The most disciplined in the three groups is the support staff since they are lowest in the hierarchy. They are more cognizant of the initiatives and attend all SETA initiatives. In terms of power hierarchy, nurses fall between physicians and support staff. Hence, it is anticipated that perceived certainty and severity of sanctions will also be highest for support staff, followed by nurses and physicians respectively. Hence the hypotheses:

*H7a. User perception of existence of SETA programs will have weaker positive association with perceived **certainty** of sanctions for physicians than for nurses.*

*H7b. User perception of existence of SETA programs will have weaker positive association with perceived **certainty** of sanctions for physicians than for support staff.*

*H7c. User perception of existence of SETA programs will have weaker positive association with perceived **certainty** of sanctions for nurses than for support staff.*

*H8a. User perception of existence of SETA programs will have weaker positive association with perceived **severity** of sanctions for physicians than for nurses.*

*H8b. User perception of existence of SETA programs will have weaker positive association with perceived **severity** of sanctions for physicians than for support staff.*

*H8c. User perception of existence of SETA programs will have weaker positive association with perceived **severity** of sanctions for nurses than for support staff.*

Since physicians are high in the power hierarchy, they do not feel the need to create a false impression of compliance when they are not in compliance and demonstrate pseudo-compliance. Nurses command less power than physicians and hence tend to hide their intent through pseudo-compliance behavior. Support staff who have the lower level of power than nurses will show even higher pseudo-compliance behavior than nurses. Hence the hypotheses:

H9a. Intention to violate ISP will have stronger negative association with pseudo compliance behavior for physicians than for nurses.

H9b. Intention to violate ISP will have stronger negative association with pseudo compliance behavior for physicians than for support staff.

H9c. Intention to violate ISP will have stronger negative association with pseudo compliance behavior for nurses than for support staff.

Nurses dread reprimand from physicians for any error they commit and sometimes even fear losing their license (Stratton, Blegen et al. 2004). Support personnel, who are even lower in the power hierarchy, are even more fearful. Hence, nurses are more diligent in ensuring that they do not commit errors or violate any policy, for fear of severity of sanctions. Perceived severity of sanctions for support staff is even higher than that of nurses. Hence we hypothesize that:

H10a. Perceived severity of sanctions will have weaker negative association with intention to violate ISP for physicians than for nurses.

H10b. Perceived severity of sanctions will have weaker negative association with intention to violate ISP for physicians than for support staff.

H10c. Perceived severity of sanctions will have weaker negative association with intention to violate ISP for nurses than for support staff.

The Effect of Occupational Prestige on Intention to Violate ISP

Behaviors of individuals are influenced by the social structure and the culture of the group that an individual belongs (Mettlin 1976). For example, Mettlin (1976) found that occupational prestige of an individual had a significant association with health related behavior. Physicians occupy very high occupational prestige (Shortell 1974). Their fear of losing their prestige is the most among the three groups in a hospital. Hence the fear of certainty of sanctions, in the form of losing prestige, affects them the most which, in turn, drives intention to violate IS security policies. The fear of losing prestige is lower for nurses followed by support staff. Hence, we hypothesize that:

H11a. Perceived certainty of sanctions will have stronger negative association with intention to violate ISP for physicians than for nurses.

H11b. Perceived certainty of sanctions will have stronger negative association with intention to violate ISP for physicians than for support staff.

H11c. Perceived certainty of sanctions will have stronger negative association with intention to violate ISP for nurses than for support staff.

The Effect of Emergency on ISP Violation Behavior across Roles

According to the Theory of Planned Behavior, intent leads to behavior (Ajzen and Fishbein 1980, Ajzen 1985). For a physician, patient care takes precedence over all other activities (Chisholm, Collison et al. 2000). Their work is time sensitive. Health care providers, especially in a emergency department, are also known to be displaying polychronicity (i.e., engaged in simultaneous tasks) (Chisholm, Collison et al. 2000). Chishholm et al. (2000) describes how a physician might be involved in inserting a central venous line and at the same time answering queries from a nurse about some other patient. They are also often interrupted in their work. For example, a sudden shift in their actions can be expected on arrival of a patient with a "gun-shot" wound because attending to this patient will take precedence over a lower acuity patient with a toe pain, even if the health care provider was treating this patient at that time. The prioritization of work in this work environment is dependent on the culture of the group (Bluedorn, Kaufman et al. 1992, Kaufman-Scarborough and Lindquist 1999). Extending the above logic, attending to a critically ill patient in the emergency department takes precedence over locking the patient chart in the EHR in order to comply with IS security policies. A physician does not place higher priority to complying to IS security policies than his clinical responsibility. Therefore, his intent and behavior would be in sync. A nurse has lower levels of responsibility for patient care, and the support staffs do not have any patient care responsibilities. Hence the display of intention and behavior of nurses and support staff will be lower than that of physicians. Hence the hypotheses:

H12a. Intention to violate ISP will have stronger positive association with ISP violation behavior for physicians than for nurses.

H12b. Intention to violate ISP will have stronger positive association with ISP violation behavior for physicians than for support staff.

H12c. Intention to violate ISP will have stronger positive association with ISP violation behavior for nurses than for support staff.

A summary of all the hypotheses is given below in Table 2.

No.	Hypotheses		
H1	IVP	(+)→	IVIOL
H2	IVP	(-)→	PSCOMP
H3a	$(M \rightarrow PC)_p$	>	$(M \rightarrow PC)_n$
H3b	$(M \rightarrow PC)_p$	>	$(M \rightarrow PC)_s$
H3c	$(M \rightarrow PC)_n$	>	$(M \rightarrow PC)_s$
H4a	$(M \rightarrow PS)_p$	>	$(M \rightarrow PS)_n$
H4b	$(M \rightarrow PS)_p$	>	$(M \rightarrow PS)_s$
H4c	$(M \rightarrow PS)_n$	>	$(M \rightarrow PS)_s$
H5a	$(SP \rightarrow PC)_p$	<	$(SP \rightarrow PC)_n$
H5b	$(SP \rightarrow PC)_p$	<	$(SP \rightarrow PC)_s$
H5c	$(SP \rightarrow PC)_n$	<	$(SP \rightarrow PC)_s$
H6a	$(SP \rightarrow PS)_p$	<	$(SP \rightarrow PS)_n$
H6b	$(SP \rightarrow PS)_p$	<	$(SP \rightarrow PS)_s$
H6c	$(SP \rightarrow PS)_n$	<	$(SP \rightarrow PS)_s$
H7a	$(SETA \rightarrow PC)_p$	<	$(SETA \rightarrow PC)_n$
H7b	$(SETA \rightarrow PC)_p$	<	$(SETA \rightarrow PC)_s$
H7c	$(SETA \rightarrow PC)_n$	<	$(SETA \rightarrow PC)_s$
H8a	$(SETA \rightarrow PS)_p$	<	$(SETA \rightarrow PS)_n$
H8b	$(SETA \rightarrow PS)_p$	<	$(SETA \rightarrow PS)_s$
H8c	$(SETA \rightarrow PS)_n$	<	$(SETA \rightarrow PS)_s$
H9a	$(IVP \rightarrow PSCOMP)_p$	<	$(IVP \rightarrow PSCOMP)_n$
H9b	$(IVP\text{-}PSCOMP)_p$	<	$(IVP\text{-}PSCOMP)_s$
H9c	$(IVP\text{-}PSCOMP)_n$	<	$(IVP\text{-}PSCOMP)_s$
H10a	$(PS \rightarrow IVP)_p$	>	$(PS \rightarrow IVP)_n$
H10b	$(PS \rightarrow IVP)_p$	>	$(PS \rightarrow IVP)_s$
H10c	$(PS \rightarrow IVP)_n$	>	$(PS \rightarrow IVP)_s$
H11a	$(PC \rightarrow IVP)_p$	<	$(PC \rightarrow IVP)_n$
H11b	$(PC \rightarrow IVP)_p$	<	$(PC \rightarrow IVP)_s$
H11c	$(PC \rightarrow IVP)_n$	<	$(PC \rightarrow IVP)_s$
H12a	$(IVP \rightarrow IVIOL)_p$	>	$(IVP \rightarrow IVIOL)_n$
H12b	$(IVP \rightarrow IVIOL)_p$	>	$(IVP \rightarrow IVIOL)_s$
H12c	$(IVP \rightarrow IVIOL)_n$	>	$(IVP \rightarrow IVIOL)_s$

Table 2 – Summary of Hypotheses

Research Method

A field study using a hypothetical scenario method (Weber 1992) was used to test the model. In this approach, subjects are given vignettes which describe "realistic situations" and are requested to respond on rating scales which measure dependent variables (Trevino 1992). The use of vignettes has been practiced in social sciences (Wallander 2009) because it uses realistic scenarios, is non-intrusive, and uses an unintimidating way to get user feedback on sensitive issues (Nagin and Pogarsky 2001), thereby improving internal validity (Harrington 1996).This method has widely been used to rate social standing (Rossi, Sampson et al. 1974) and to investigate behavior arising from beliefs and judgment (Jasso 2006). In IS research, this approach has been used to examine attitudes (Constant, Kiesler et al. 1994), ethical behavior intention (Banerjee, Cronan et al. 1998), ethics and moral issues (Gattiker and Kelley 1999), IS misuse intentions (D'Arcy, Hovav et al. 2009). This approach has also been used to examine IS security policy non-compliance (Siponen and Vance 2010), and therefore is appropriate for this research.

Interviews were conducted to understand the general IT security policy awareness culture of the institution. The vignettes were developed based on real-world stories that were narrated by informants and thus have been validated for contextual relevance (Siponen and Vance 2014). Publications by the U.S Department of Health and Human Services (HHS) on enforcing HIPAA privacy rules (HHS Gov 2014), practitioners feedback in American Health Information Management Association (Sheber 2012), consultant reports (Keckley 2011, Coughlin and Carter 2014) and newspaper articles (McGee 2011) were also consulted to develop the vignettes. Several experts in the domain including the Chief Medical Information Officer, senior physicians, nurses and support staff from the health care institution provided feedback on the appropriateness of the vignettes. The following four vignettes were developed for the study: workstations not locked when leaving desk, unauthorized access to celebrity patient data, sharing of passwords and unauthorized sharing of confidential patient data.

Wherever possible, the measurement items for constructs in this model were adapted from extant literature (Straub 1989, Boudreau, Gefen et al. 2001). Specifically, the items used were adapted to the health care domain from a validated instrument used by D'Arcy et al. (2009) (Refer to the Appendix for the instrument). Additionally, the validity of the instrument items in the health care context was evaluated by three IT security and compliance experts from the health care domain. Pilot tests of the adapted instrument were then conducted with physicians, nurses and support staff to check for clarity and contextual validity. Feedback received was incorporated to refine the instrument as was deemed necessary.

In the survey instrument, the first section consists of four vignettes with six items each to measure the dependent variables perceived certainty of sanctions (PC), perceived severity of sanctions (PS) and intention to violate ISP (IVP). Following the procedure followed by D'Arcy et al. (2009), composite measures of PC, PS and IVP were created by summing up the responses across the four vignettes and were used for subsequent analysis. The second section consists of items to measure independent variables seeking to understand the security awareness of the informant. They inquired the informant's perception on existence of security policies (SP), security education training awareness (SETA) programs and computer activities monitoring (M)

capabilities. The last section captured the demographics of the informant inclusive of the professional group that he or she belonged to. Two more dependent variables were captured by observation namely pseudo-compliance behavior (PSCOMP) and ISP violation behavior (IVIOL). The primary researcher observed the working of the informant and took notes. Each informant was observed for 30 minutes and IS security policy violation behavior noted. Behaviors that were noted were the following: Did the informant (1) lock the desktop (2) minimize the application screen when he/she left the desk, and the duration the informant was away from the desk. PSCOMP was measured as a binary variable indicating whether the screen was minimized when the informant left the workstation. IVIOL was operationalized as a range, captured in four ordinal groups: Informant returned to the desk (1) within five minutes, (2) between five to ten minutes, (3) between ten to twenty minutes and (4) twenty minutes and beyond.

Data collection

Paper based survey instruments were distributed to the informants in their work setting. The survey pool comprised of physicians, nurses and support staff in one of the premier 950+ bed hospital located in the south eastern part of the US. This hospital had implemented one of the largest EHR systems in the world, at a cost of about $40 million. Specifically, the study was conducted in the Emergency department (ED) which is an urban Level I trauma center. The ED receives nearly 120,000 patient visits per year. There are approximately 120 emergency attending physicians, 50 resident physicians and 150 nurses working in this department. Each of these health care providers use the EHR application.

The survey was distributed by the primary researcher, in the working shifts of the informants and was collected once the participant indicated that he or she has completed the survey. This method was chosen since past studies report that achieving high response rates through mail or internet surveys from health care providers is difficult (Hikmet and Chen 2003). The researcher also observed the participants in their work setting and collected data on actual behavior. Of the 123 responses collected two were incomplete leaving 121 complete usable responses. A summary of the demographics of the informants is given in Table 3:

		Physicians	Nurses	Support
1	Number of informants (121)	47	48	26
2	Highest qualification	MD – 44 MBBS – 2 MBChB - 1	Undergrad – 21 Masters - 18 Associate – 7 MSPAS – 1 PhD - 1	Associate – 13 High School – 9 Undergrad - 3
3	Age	Min – 29 Max – 51 Mean – 34.62 Std. Dev – 6.80	Min – 24 Max – 57 Mean – 36.69 Std. Dev – 8.86	Min – 30 Max – 60 Mean – 41.54 Std. Dev – 7.47
4	Gender	Male - 22 Female - 25	Male - 11 Female - 37	Male - 4 Female - 22
5	Experience	**Current Org** Mean – 4.85 Std. Dev - 4.80 **Total** Mean – 7.02 Std. Dev – 5.70	**Current Org** Mean – 4.22 Std Dev – 4.69 **Total** Mean – 9.81 Std. Dev – 8.09	**Current Org** Mean – 8.36 Std Dev – 6.40 **Total** Mean – 13.21 Std. Dev – 7.78

Table 3 – Demographics of the data

Analysis and Results

To test the hypotheses, data were analyzed using tests for equality of means and Partial Least Squares analysis.

Test for Equality of Means

The objective of this research is to investigate the differences in intent and subsequent behaviors related to IS security policy between different cultures in an organization. Means of all dependent variables, perceived certainty of sanctions (PC), perceived severity of sanctions (PS), pseudo-compliance behavior (PSCOMP), intention to violate ISP (IVP) and ISP violation behavior (IVIOL) are compared across the groups through ANOVA tests. The graphical representation of the difference in means and the results are given below in Figure 2 and Table 4. All results are significant and confirm the hypotheses 3 to 12.

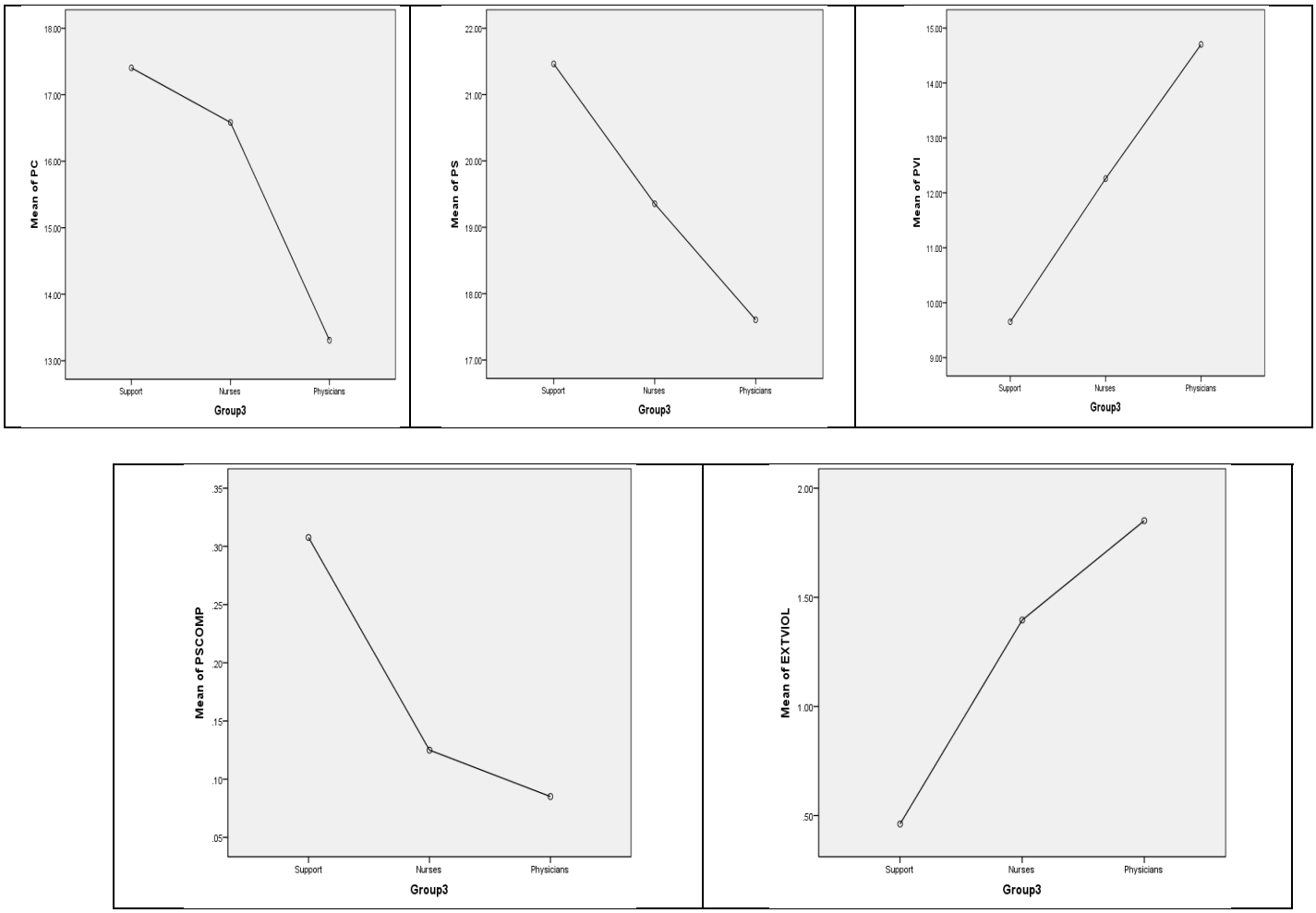

Figure 2 – Comparison of Means

	Physicians	Nurses	Support	Significance
PC	13.309	16.583	17.404	$p < 0.001$
PS	17.606	19.354	21.461	$p < 0.001$
IVP	14.702	12.260	9.653	$p < 0.001$
PSCOMP	0.085	0.125	0.308	$p < 0.05$
IVIOL	1.851	1.396	0.462	$p < 0.001$

Table 4 – Mean of the dependent variables across groups (ANOVA)

Partial Least Squares Analysis

Partial least squares (PLS) was used for data analysis because the theoretical models and/or measures are in the early stages of development (Chin 1998). It was used as the method for analysis since the model has formative indicators (Chin 1998b), and it has minimal demands on measurement scales, sample size, and residual distribution (Fornell and Bookstein 1982). It also does not impose normality requirements on data, is more prediction-oriented and seeks to maximize the variance explained in constructs. Hence it is "closer to data, more exploratory and more data analytic" (Barclay, Higgins et al. 1995). Compared to older covariance-based SEM techniques like LISREL and AMOS, it uses a component-based approach and can handle both formative and reflective constructs. The specific tool used was SmartPLS (Ringle, Wende et al. 2013). As suggested by Anderson and Gerbing (1988), we first assess the measurement model followed by testing the structural model.

Measurement Model

Although the instrument had been validated earlier, it is a good practice to test the instrument (Straub 1989). Analysis was conducted on the measures to test for psychometric properties. Different validity and reliability criteria were used for reflective and formative scales (Diamantopoulos and Winklhofer 2001, Jarvis, Mackenzie et al. 2003, Diamantopoulos and Siguaw 2006). Reliability test is performed to check how consistent the items are with each other for a construct. The convergent validity checks how well do the items correlate within the construct. Discriminant validity on the other hand, checks how the items of one construct are closely related to each other than to the items of some other construct.

For reflective measures, PLS was used for testing convergent validity, discriminant validity and reliability. The factor loadings for each construct exceeded 0.7 and the average variance extracted (AVE) is more than 0.5, as shown in Table 5,which confirms convergent validity (Fornell and Larcker 1981, Gefen and Straub 2005, Vinzi, Chin et al. 2010).

	Items	Intention to violate ISP (IVP)	Perceived Certainty (PC)	Perceived Severity (PS)	AVE
Intention to violate ISP (IVP)	IVP1	**0.979**	-0.181	-0.471	0.960
	IVP2	**0.980**	-0.201	-0.452	
Perceived Certainty (PC)	PC1	-0.112	**0.936**	0.443	0.891
	PC2	-0.248	**0.952**	0.633	
Perceived Severity (PS)	PS1	-0.466	0.560	**0.967**	0.934
	PS2	-0.443	0.554	**0.966**	

Table 5 - Loadings, Cross Loading and AVE for Reflective measures

One of the requirements for discriminant validity is to check if the square root of AVE for each construct is larger than the inter-construct correlations, which is met as is shown in the Table 6. The other check for discriminant validity is to check whether items load stronger on their corresponding construct than on other constructs (i.e., loadings should be higher than cross loadings) which is also met as per Table 5. Hence discriminant validity requirements are satisfied.

	Composite Reliability	**Intention to violate ISP (IVP)**	**Perceived Certainty (PC)**	**Perceived Severity (PS)**
Intention to violate ISP (IVP)	0.979	**0.980**		
Perceived Certainty (PC)	0.943	-0.195	**0.944**	
Perceived Severity (PS)	0.965	-0.471	0.577	**0.966**

Square root of AVE is shown in bold

Table 6 - Reliability and inter-construct correlations in Reflective measures

Composite reliabilities of all the constructs are above 0.7, as shown in Table 6, meeting Fornell and Larcker (1981) minimum requirements. Hence the items measuring the constructs are reliable.

Formative constructs need not necessarily be tested for validity (Jarvis, Mackenzie et al. 2003, Patnayakuni, Rai et al. 2006) and there is little guidance on how formative constructs should be tested (Loch, Straub et al. 2003). However, convergent validity and discriminant validity were evaluated by analyzing the item-construct correlations (Chin 1995, Diamantopoulos and Winklhofer 2001). Reliability tests do not make sense for formative constructs since, unlike reflective constructs, the items are not necessarily correlated, as each item captures a different aspect of the construct and a combination of all the items will specify the construct (Petter, Straub et al. 2007). Item weights were analyzed for each construct and SP2, SETA4 and M2 were found to be non-significant at 0.10 level. Structural models were run after dropping these which did not change the directions or the path coefficients significantly (the maximum change was 0.03). Hence, no items were dropped for analysis since in formative constructs dropping an item might omit a unique part of the construct (Jarvis, Mackenzie et al. 2003)

Convergent validity and discriminant validity was tested as per the process suggested by Loch et al. (2003). The item-to-construct correlation matrix and correlation with other construct is given in Table 7. All the items demonstrated that the loadings on their respective construct were higher than loadings on other constructs, thus meeting the requirements for both tests.

	Items	Security Policy (SP)	SETA Program (SETA)	Computer Monitoring (M)
Security Policy (SP)	SP1	**0.850**	0.314	0.277
	SP2	**0.642**	0.284	0.237
	SP3	**0.684**	0.307	0.136
	SP4	**0.814**	0.306	0.202
	SP5	**0.640**	0.372	0.392
SETA Program (SETA)	SETA1	0.337	**0.691**	0.577
	SETA2	0.448	**0.655**	0.512
	SETA3	0.367	**0.963**	0.666
	SETA4	0.398	**0.595**	0.510
	SETA5	0.421	**0.824**	0.558
Computer Monitoring (M)	M1	0.326	0.604	**0.739**
	M2	0.218	0.517	**0.705**
	M3	0.283	0.583	**0.770**
	M4	0.229	0.592	**0.930**
	M5	0.337	0.557	**0.773**
	M6	0.246	0.531	**0.857**

All item-to-construct correlations are shown in bold

Table 7 - Item-to-Construct Correlation Vs Correlation with other constructs (for Formative measures)

While multi-collinearity is expected in reflective constructs, it is not desirable in formative constructs (Jarvis, Mackenzie et al. 2003). Multi-collinearity tests were conducted for formative constructs by running multiple regression models making each item as the dependent variable and all others as the independent variable (Li, Browne et al. 2006) for each construct. The variance inflation factors (VIF) ranged from 1.504 to 4.744 which is less than the conservative cutoff level 5.0 (Hair, Anderson et al. 1998). Hence no multi-collinearity is assumed to exist in the formative items.

Additionally, common method variance (CMV) was checked using two methods. Harmon's one factor test (Podsakoff and Organ 1986) was conducted where a principal component factor analysis was performed with all the reflective items. Three factors were identified and on running for one factor, the variance explained was 39.85 % which is less than majority. Additionally as suggested by Lindell and Whitney (2001) where a theoretically unrelated construct (prevention focus in this research), also called a marker variable was used to test for high correlation among the study's principal constructs and the marker variable. The average correlation and the maximum shared variance found between the marker variable and the

principal constructs was 0.018 and 0.024 and the maximum shared variance value ranged between 0.001 to 0.07. This indicated that common method bias not likely affected the study.

Structural Model

Structural models were run to test the hypotheses. Three dimensions of the model are analyzed: (1) the path coefficients (β) which denotes the strength of the relationship between the independent and the dependent variables (2) whether the path is statistically significant and (3) the R^2 value which is the variance explained by the independent variables (Hair, Hult et al. 2013). While β and R^2 values are derived on running the model, a bootstrapping re-sampling (500 samples) procedure is separately run to test for significance.

For testing H1 and H2, the model was run with the complete data set to check for significance and the effects of intention to violate ISP (IVP) on pseudo-compliance behavior (PSCOMP) and the extent of violation (IVIOL). Values of the path coefficient together with their siginificance level are given in table 8. INT has significant effect on both IVIOL ($\beta = 0.419$, $p < 0.001$) and PSCOMP ($\beta = -0.270$, $p < 0.001$) as hypothesized. Hence both hypotheses H1 and H2 are supported. The R^2 value for the dependent variable IVIOL is 0.176 which is greater than 0.10 indicating that INT explains a substantive portion (18 %) of the variance (Falk and Miller 1992) while $R^2 = 0.073$ for PSCOMP implying that INT explains only 7.3% of the variance. As per the knowledge of the researchers, capturing actual IT security policy violation behavior as the dependent variable, as done in this research has not been attempted in the past. Hence the explanatory power of 7.3 % is greater than any attempts to date and makes the significance of the path coefficient meaningful.

No.	Hypothesis and Direction	Path Coefficient (β)	t-value	Significance (One-tailed)	Supported?
H1	INT → IVIOL (+)	0.419	4.915	p < 0.001	Yes
H2	INT → PSCOMP (-)	-0.270	2.875	p < 0.001	Yes

Table 8 – Hypotheses Test Summary – 1

For testing the variation of the moderation effect with the three different cultures (physicians, nurses and support), the model is tested thrice in a multiple-group approach, as per procedures suggested by Frazier, Tix et al. (2004). Complete data are split into three groups and the model run each time with data for one group (Keil, Tan et al. 2000). For each group, the variances explained for each of the dependent variables are given in the following table:

	All data	Physicians	Nurses	Support
PC	0.383	0.420	0.365	0.487
PS	0.398	0.193	0.619	0.696
IVP	0.281	0.109	0.301	0.396
PSCOMP	0.073	0.032	0.105	0.004
IVIOL	0.176	0.167	0.004	0.032

Table 9 – Variance Explained in each of the models

Sample mean and standard errors of the path coefficients are noted for each run (Lowry and Gaskin 2014). The path coefficients and the standard error values were compared between groups in a t-test suggested by Wynne Chin (Chin 2000) which has been used in past IS research (Keil, Tan et al. 2000). The results are given in Table 10. Hypotheses H3b, H3c, H4c, H5a, H6b, H6c, H7b, H7c, H9c, H10a, H10b, H11a, H11b, H11c, H12a and H12b are all supported since they meet criteria for significance and directionality. Hypotheses H4b, H5b, H6a, H7a, H8a, H8b and H9b are not supported because though the directions are supported, they are not significant. If the direction is not supported then in most cases the result is not significant leading to hypotheses H3a, H4a, H8c, H9a, H10c and H12c not supported. In hypothesis H5c the direction is not supported but the result is significance leading to this hypothesis not supported.

No.	Hypotheses			Path Coefficient (β) – Sample Mean		Direction Supported?	t-value	Significance (One-tailed)	Hypothesis Supported?
	Group A - β		**Group B - β**	**Group A**	**Group B**				
H3a	$(M \rightarrow PC)_p$	>	$(M \rightarrow PC)_n$	0.445	0.447	No	0.109	Non-sig	No
H3b	$(M \rightarrow PC)_p$	>	$(M \rightarrow PC)_s$	0.445	-0.044	Yes	3.384	$p < 0.001$	Yes
H3c	$(M \rightarrow PC)_n$	>	$(M \rightarrow PC)_s$	0.447	-0.044	Yes	3.039	$p < 0.005$	Yes
H4a	$(M \rightarrow PS)_p$	>	$(M \rightarrow PS)_n$	0.393	0.458	No	0.484	Non-sig	No
H4b	$(M \rightarrow PS)_p$	>	$(M \rightarrow PS)_s$	0.393	0.227	Yes	0.986	Non-sig	No
H4c	$(M \rightarrow PS)_n$	>	$(M \rightarrow PS)_s$	0.458	0.227	Yes	1.868	$p < 0.05$	Yes
H5a	$(SP \rightarrow PC)_p$	<	$(SP \rightarrow PC)_n$	-0.287	-0.027	Yes	1.740	$p < 0.05$	Yes
H5b	$(SP \rightarrow PC)_p$	<	$(SP \rightarrow PC)_s$	-0.287	-0.255	Yes	0.192	Non-sig	No
H5c	$(SP \rightarrow PC)_n$	<	$(SP \rightarrow PC)_s$	-0.027	-0.255	No	1.699	$p < 0.05$	No
H6a	$(SP \rightarrow PS)_p$	<	$(SP \rightarrow PS)_n$	0.177	0.286	Yes	0.629	Non-sig	No
H6b	$(SP \rightarrow PS)_p$	<	$(SP \rightarrow PS)_s$	0.177	0.576	Yes	1.750	$p < 0.05$	Yes
H6c	$(SP \rightarrow PS)_n$	<	$(SP \rightarrow PS)_s$	0.286	0.576	Yes	3.027	$p < 0.005$	Yes
H7a	$(SETA \rightarrow PC)_p$	<	$(SETA \rightarrow PC)_n$	0.217	0.225	Yes	0.076	Not-sig	No
H7b	$(SETA \rightarrow PC)_p$	<	$(SETA \rightarrow PC)_s$	0.217	0.808	Yes	4.500	$p < 0.001$	Yes
H7c	$(SETA \rightarrow PC)_n$	<	$(SETA \rightarrow PC)_s$	0.225	0.808	Yes	3.599	$p < 0.001$	Yes
H8a	$(SETA \rightarrow PS)_p$	<	$(SETA \rightarrow PS)_n$	0.102	0.223	Yes	0.686	Not-sig	No
H8b	$(SETA \rightarrow PS)_p$	<	$(SETA \rightarrow PS)_s$	0.102	0.167	Yes	0.299	Not-sig	No
H8c	$(SETA \rightarrow PS)_n$	<	$(SETA \rightarrow PS)_s$	0.223	0.167	No	0.478	Not-sig	No
H9a	$(IVP \rightarrow PSCOMP)_p$	<	$(IVP \rightarrow PSCOMP)_n$	-0.177	-0.326	No	1.139	Not-sig	No
H9b	$(IVP\text{-}PSCOMP)_p$	<	$(IVP\text{-}PSCOMP)_s$	-0.177	-0.071	Yes	0.675	Not-sig	No
H9c	$(IVP\text{-}PSCOMP)_n$	<	$(IVP\text{-}PSCOMP)_s$	-0.326	-0.071	Yes	2.049	$p < 0.05$	Yes
H10a	$(PS \rightarrow IVP)_p$	>	$(PS \rightarrow IVP)_n$	-0.157	-0.610	Yes	3.154	$p < 0.005$	Yes

H10b	$(PS \rightarrow IVP)_p$	>	$(PS \rightarrow IVP)_s$	-0.157	-0.542	Yes	2.655	$p < 0.005$	Yes
H10c	$(PS \rightarrow IVP)_n$	>	$(PS \rightarrow IVP)_s$	-0.610	-0.542	No	0.490	Not-sig	No
H11a	$(PC \rightarrow IVP)_p$	<	$(PC \rightarrow IVP)_n$	-0.046	0.231	Yes	1.873	$p < 0.05$	Yes
H11b	$(PC \rightarrow IVP)_p$	<	$(PC \rightarrow IVP)_s$	-0.046	0.488	Yes	3.226	$p < 0.001$	Yes
H11c	$(PC \rightarrow IVP)_n$	<	$(PC \rightarrow IVP)_s$	0.231	0.488	Yes	1.810	$p < 0.05$	Yes
H12a	$(IVP \rightarrow IVIOL)_p$	>	$(IVP \rightarrow IVIOL)_n$	0.411	0.055	Yes	3.378	$p < 0.001$	Yes
H12b	$(IVP \rightarrow IVIOL)_p$	>	$(IVP \rightarrow IVIOL)_s$	0.411	0.181	Yes	1.953	$p < 0.05$	Yes
H12c	$(IVP \rightarrow IVIOL)_n$	>	$(IVP \rightarrow IVIOL)_s$	0.055	0.181	No	1.079	Non-sig	No

Table 10 – Hypotheses Test Summary - 2

Discussion

Overall, our results indicate that there is a substantial effect of subculture of the different groups on IT security compliance intent and behavior in a health care institution. Subculture moderates most of the relationships of the extended D'Arcy et al. (2009) model. Analysis of the data shows that there is a hierarchy among physicians, nurses and support staff though these groups do not have a formal reporting structure to each other. This is an interesting finding since health care organizations are organized collaboratively (Adler, Seok-Woo et al. 2008) in contrast to most business organizations which are organized hierarchically. Organization structure influences the behavior and actions of the employee. According to Mintzberg (1979) there are five types of organizational structure configurations: simple structures, machine bureaucracy, professional bureaucracy, divisionalized form and adhocracies. A hospital structure is an example of professional bureaucracy where grouping by occupational skills is the prime coordination mechanism compared to machine bureaucracy (e.g. automobile manufacturers with production lines) where standardization of work processes is the prime coordination mechanism. Because the focus is on standardization of skills, hospitals tend to have a structure which is decentralized both vertically and horizontally providing autonomy to professionals. This is in contrast with limited horizontal decentralization in a machine bureaucracy where decisions are centralized and the organization has a strict chain of command. Our analysis seems to suggest that in this health care institution, there is an informal hierarchy in the context of IS security policy behavior even if the institution tends to formally follow a professional bureaucratic structure. A potential explanation might be, for a professional bureaucracy power resides in the skill or the expertise which possibly justifies this hierarchy since the physicians are the most educated and is on the top of the skill level followed by nurses and support.

While testing the model with complete data set and data of individual groups, it is interesting to note that the relationship path from perceived certainty of sanctions (PC) to intention to violate ISP (IVP) has been found to be positive and significant in three models, namely for complete data, nurses and support. D'Arcy et al (2009) had hypothesized this to be a negative relationship which was validated only for the physicians model but not significant. In fact, D'Arcy et al. (2009) too found the path to be insignificant and rejected the hypothesis. So is it that in a health care institution, probability of being punished for IT security policy violation is so minimal that majority of the employees are certain that there will never be reprimanded? There might be an underlying truth in this since policies on adverse event and error-reporting in most hospitals are voluntary and self-reporting (Classen, Resar et al. 2011, Su 2013). Su (2013) notes that repercussions are so huge that very few errors get really reported. Additionally anecdotal evidence suggests that no hospital would want to acknowledge an employee's violation of IT security policy in public and reprimand the individual in public since that might draw attention of the media and tarnish the reputation of the health care institution.

	Physicians		Nurses		Support	
	R^2	Power	R^2	Power	R^2	Power
PC	0.420	99.88	0.365	99.39	0.487	97.88
PS	0.193	77.74	0.619	99.99	0.696	99.99
IVP	0.109	54.24	0.301	98.27	0.396	94.43
PSCOMP	0.032	23.02	0.105	65.29	0.004	5.21
IVIOL	0.167	85.91	0.004	6.14	0.032	13.96

Table 11 – Post-hoc power Calculation at p = 0.05 (Soper 2014)

In our analysis, many of the relationship paths were found insignificant. Post-hoc power analysis was done (at p = 0.05) to find whether the model was strong enough to detect actual existence of significant effects. According to Cohen (1988) power should be at least equal to 0.80 to claim whether a relationship is significant. Cells highlighted in Table 11, indicate that power is not enough for some relationship paths. Power analysis shows that more informants were needed for getting sufficient power in all paths when the models are tested for each subculture separately. The sample of physicians should have been 235, and nurses and support sample sizes 1950 each, to reach 0.80 whereas the present sample sizes were 47, 48 and 26 respectively. However, the primary focus of this research was to identify differences in relationships between subcultures which were satisfied, and not to test validity of the model in each subculture.

As Kotulic and Clark (2004) point out, IT security research is scant since it is difficult for a researcher to get access to the actual IT security behaviors and practices followed in an organization. Hence, in most research on IT security compliance behavior, use intention is the dependent variable (D'Arcy, Hovav et al. 2009, Bulgurcu, Cavusoglu et al. 2010, Siponen and Vance 2010). They use Theory of Planned Behavior (Fishbein and Ajzen 1975, Ajzen 1991) which suggests that behavioral intent is an indication of actual behavior. Though literature acknowledges that intention is a key antecedent to behavior, it also acknowledged that there is a gap between intentions and behavior (Sheeran 2002). Acknowledging the difficulty of collecting data on intention and actual behavior, this is one of the first studies where data have been collected on both simultaneously, which is a very significant contribution to the literature on IT security.

From a methodological perspective, studies capturing intentions and behavior have used self-reporting surveys (Moores and Chang 2006); in consumer research Norberg et al. (2007) used repeated measures where intention was captured in one phase followed by data on actual behavior in a subsequent phase after a period of time. Repeated measures have been used in IS (Lam and Lee 2006) for investigating behavior, but past research has not examined intention and behavior with repeated measures. This study will be one of the first in the IS field where data on intention and actual behavior have been collected simultaneously and therefore has higher external validity than most studies on this topic.

Contributions

This research has strong theoretical and practical implications. Prior research has focused on the effect of national culture on IT adoption and IT security compliance, but did not adequately study the effect of culture within an organization on IT security compliance. An organization culture consists of many group subcultures that can behave differently in response to IT security policies. This is one of the first studies which recognize that, within an organization, different groups with varied subcultures exist; and they can behave very differently in response to a common IT security policy. This research contributes to the literature on IT security compliance by developing insights on subcultures influencing compliance behavior. Secondly, this study adds two constructs to the IT security policy compliance literature: (1) "Pseudo-compliance behavior" to examine behaviors which are advertised as compliant behavior but are not actually compliant and (2) "Extent of Violation" which measures the extent that an individual violates a security policy. Both constructs open new avenues in IT security compliance research. Lastly, it contributes to the Health IT literature by improving our understanding of a critical challenge faced by organizations while implementing HIT solutions.

From a practitioner's perspective, recognizing that there are different subcultures in an organization, this research will help top management and IT security teams focus specifically on how security policies are drafted and security culture promoted through training and other programs. The findings help IT security team design awareness programs for focused groups since, as inferred from this research, not all groups behave in the same fashion to a common organization-wide IT security policy. The research findings also makes the organization aware of the fact that not all policies are implemented as designed and gives them an opportunity to review and revise security policies. Based on these findings, managers can develop incentives for promoting IT security compliance.

Limitations and future research

A critical issue in culture research is the wide variations even in the way culture is defined. According to Kroeber and Kluckhohn (1952) there are 164 definitions of the concept of culture. In a more recent work, Rosaldo (2006) explains how the original definition of Kroeber and Kluckhom has been reshaped and changed over the years. However, it still remains "that there is not a single, eternal definition of culture, but rather provisional definitions that will be revised as debates unfold through time" (Rosaldo 2006). Kappos and Rivard (2008) reaffirm that researchers differ in their perspectives of defining culture. Hence, Walsh et al. (2010) observe that "defining culture is a challenge in itself." This is going to be a limitation of not only this research but any research on culture.

As this study is one of the first studies examining subcultures in an urban public teaching hospital, the findings of this study might not be readily generalizable. More studies are needed to compare these results in different settings like rural, private, non-teaching hospitals and other HIT settings. This study focused only on subcultures. Other dimensions like "universal" and "individual" factors also influence behavior (Hofstede 1980) simultaneously which has not been accounted for in this study. While the focus of this research is on culture, further studies are needed to understand the combined effect of the other dimensions as well. Secondly, since

data for two of the dependent variables was collected through observation, one can argue that data could be influenced by the "Hawthorne Effect." However, the influence of this effect is minimal because of the following reasons: (1) the primary researcher was introduced to the key members in the health care institution by the CMIO about two years before the quantitative study was conducted. The researcher conducted extensive interviews and observations on the work floor. The CMIO had informed all the staff members that about the researcher will be observing their work for an extended period of time. Indeed, the researcher spent more than 200 hours on work shifts with the physicians, nurses and support staff to gain familiarity and observe their usage of HIT application before the survey was administered. Hence, the observation of the informants was unlikely to be perceived as intrusive, (2) since the study site was a teaching institution, several researchers were routinely working with the staff, and (3) in contrast to the Hawthone experiments in which the environment was manipulated, the staff were informed that they would be observed as they perform their regular work and the study involved no manipulations (Adair 1984).

Conclusion

This research examined how different subcultures influence IT security policy violation intention and the actual behavior of an individual in a health care institution. The results suggest that though there is no formal hierarchy in the reporting structure between the physicians, nurses and support group, there is an informal hierarchy as regards to intention and behavior. The hierarchy is based on professional bureaucracy where skill and expertise of an individual gives him/her the power in the organization structure.

Appendix - I

Scenarios:

William, one of your colleagues, is at his workstation documenting a patient's chart. Another colleague calls him for immediate help with another patient. William assists his colleague, but leaves his computer unattended and the patient's chart open**.**

Linda, one of your colleagues, has heard from another colleague that a celebrity has been admitted as a patient. Even though Linda is not on the patient's treatment team, she is curious to learn more about the patient and logs into the EHR application to find information about the patient.

Alexander, one of your colleagues, is working with a student. He sends the student to interview and examine a patient. Alexander is very busy when the student returns with patient history and examination details. Alexander gives his login ID and password to the student so that the student can enter the details into the EHR.

Mary, one of your colleagues, is treating a patient with a major complication. She remembers that a friend from another hospital talked about treating a similar case last month. She calls her friend for help and her friend asks her to send more details about the case. Mary copies and pastes the details of the case into an email. She later realizes that the name and the medical record number of the patient have also been included in the email.

What is the likelihood that one of your colleagues, Mary would have shared patient information with outsiders? (Extremely Unlikely to Extremely likely)
I could see my colleague, Mary sharing patient information with outsiders in this situation. (Strongly Disagree to Strongly Agree)
Your colleague Mary would probably be found, eventually, for sharing patient information with outsiders. (Strongly Disagree to Strongly Agree)
The likelihood the organization would discover that your colleague Mary shared patient information with outsiders is (Very Low to Very High)
If found sharing patient information with outsiders, your colleague Mary, would be severely reprimanded: (Strongly Disagree to Strongly Agree)
If found sharing patient information with outsiders, your colleague Mary's punishment would be: (Not Severe at all to Very Severe)

Measurement scale (Strongly Disagree to Strongly Agree)

Construct	Definition	Number of items	Source
SP	User perception of existence of information security policies	5	Adapted from D'Arcy et al. 2009
SETA	User perception of existence of security education training and awareness program	5	Adapted from D'Arcy et al. 2009
M	User perception of existence of computer monitoring practices	6	Adapted from D'Arcy et al. 2009
PC	Perceived certainty of sanctions	2	Adapted from D'Arcy et al. 2009
PS	Perceived severity of sanctions	2	Adapted from D'Arcy et al. 2009
IVP	Intention to violate ISP	2	Adapted from D'Arcy et al. 2009
PSCOMP	Pseudo-compliance behavior	Data collected through observation	New
IVIOL	ISP violation behavior	Data collected through observation	New

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