EHR's role on Job Characteristics and Satisfaction of Indian Physicians

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Abstract

The purpose of this research is to identify the impact of Electronic Health Records (EHRs) on Job characteristics and job satisfaction of Physicians in India. EHR is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery settings. EHR is selected for this study because more and more organizations in developing nations are adopting it to manage patients' health information. Hence, healthcare professionals are familiar with its technological features and would be able to answer questions related to the adoption and usage of EHR. Consistent with the need to move beyond technology-centric constructs as the primary dependent variables of interest, recent perspectives on organizational consequences resulting from new systems have highlighted the emergent nature of technology implementation and use This research will also help in finding out the factors responsible for motivation and satisfaction of the physicians using EHR technology.

Keywords: Electronic Health Records, Healthcare, India, Job characteristics, Job satisfaction

1.Introduction

The business and practice of healthcare is the most pervasive change activities in the last decade or so has been the implementation of health information technologies in healthcare sector, such as electronic health records (EHR) systems that account for 30 percent of all major change activities in hospitals today. EHR system implementations typically involve an extensive redesign of business processes and the deployment of new software to support those new medical processes. Many healthcare organizations are convinced that to practice medicine in the digital era, they need clinical information and administrative tools that can be immediately accessible. Increasingly, healthcare providers are adopting various technologies to meet the complexities of today's healthcare demands, regulatory requirements, and ever rising consumers' expectations. Although underutilized systems continue to be a problem, there has been remarkable progress in illuminating the psychological mechanisms leading to initial acceptance and continued use decisions by physicians. However, given the maturity of research on technology adoption, some have suggested that we may be reaching the theoretical limits of our ability to predict individual-level technology use and have called for research that moves beyond treating technology use as the ultimate dependent variable (Venkatesh 2006). Consistent with the need to move beyond technology-centric constructs as the primary dependent variables of interest (Markus and Robey 1988), recent perspectives on organizational consequences resulting from new systems have highlighted the emergent

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nature of technology implementation and use (Boudreau and Robey 2005; Devadoss and Pan 2007).

1.1Electronic Health Records

The concept of storing health information via online repositories is now commonly known as EHR. In its most simple form, EHR is defined as computerization of health content and associated processes (Atreja et al., 2008). The term EHR has been used interchangeably with electronic medical record but significant differences exist between the two terminologies. The electronic medical record refers to the electronic record created in an ambulatory clinic, hospital or healthcare institution, whereas the EHR is a longitudinal record that receives information from multiple sources. The latter is broader in scope and offers a plethora of advantages for its potential to improve the quality of patient care, reduce cost, and ccommodate all types of administrative, transactional and educational needs (Mehta and Partin, 2007). Since both electronic medical record and EHR are considered e-health services, they can affect patients' satisfaction, perceived quality, and behavioural intentions (Hadwich et al., 2010; Whetstone and Goldsmith, 2009). Most importantly, it creates opportunities to improve provider-patient communication via messaging, and quick access to electronic record and alternative treatment options (Mukherjee and McGinnis, 2007). An electronic record may be created for each service a patient receives from an ancillary department, such as radiology, laboratory, or pharmacy, or as a result of an administrative action (e.g., creating a claim).

More than other systems, EHR systems have the potential to dramatically alter jobs and business processes. We use the job characteristics model (JCM; Hackman and Oldham 1980) as the theoretical lens to understand the impacts of an EHR system implementation on physicians' jobs. The basic thesis of the JCM is that various job characteristics together influence job satisfaction. Clearly, job satisfaction is an important outcome in its own right and has been linked to other key job outcomes, such as organizational commitment, turnover intentions, and job performance (e.g., Couger et al. 1979; Goldstein 1989; Griffeth et al. 2000; Singh et al. 1996; Tett and Meyer 1993; Thatcher et al. 2002). There is empirical support for the notion that changes in one's job are likely to have an influence on job attitudes (Ang and Slaughter 2000). Given that EHR system implementations have the potential to drastically alter jobs, thereby changing physician's reactions to their work situation, a fundamental argument that we make is that job perceptions and the implementation of an EHR system will interact to influence physician's job satisfaction.

1.2Construct Definitions

The three core sets of constructs in our model are EHR system implementation, job characteristics, and job satisfaction. EHR system implementation captures the hospital adoption of a firm-wide enterprise system and represents the preversus post-implementation phases. Job characteristics are drawn from JCM (Hackman and Oldham 1980) and comprise the following five constructs: task significance, defined as the extent to which a job has impact on the lives of people in an organization or society in general; task identity, defined as

the extent to which a job involves completing a whole identifiable outcome; skill variety, defined as the extent to which a job requires the use of different talents; autonomy, defined as the extent to which a job provides the employee with discretion to choose how the work is done and to set the schedule for completing the work activities; and feedback, defined as the extent to which carrying out the work activities provides the employee with clear information about his or her performance. Job satisfaction is defined as the extent of positive emotional response to the job resulting from an employee's appraisal of the job as fulfilling or congruent with the individual's values (see Janssen 2001).

2.Model Development

Background and Description of the Model

 Consistent with the approach of Ang and Slaughter (2001), we draw from Hackman and Oldham's (1980) JCM. Our model extends JCM by suggesting that the EHR system implementation moderates the relationships between job characteristics and job satisfaction. The notion that job characteristics have an important influence on job satisfaction or other job outcomes is well established in management and IS research (e.g., Ang and Slaughter 2001; Igbaria and Guimaraes 1993; Igbaria et al. 1994; Goldstein 1989; Thatcher et al. 2002; Wong et al. 1998). However, given that the deployment of new technology represents one of the most significant organizational change events in today's firms (Herold et al. 2007; Jarvenpaa and Stoddard 1998) and, likewise, because EHR systems can have such a profound impact on the nature of an individual physician's work (e.g., Devadoss and Pan 2007), we contend that the implementation of an EHR system will interact with job characteristics to influence job satisfaction. While studies examining only simple relationships (e.g., the direct influence of job characteristics on job satisfaction) are appealing for their parsimony, they are potentially problematic as they can mask deeper, more complex forces that are at work (Johns 2006; Singh 1998). Given that an EHR system implementation has a dramatic impact on work flow and physicians' jobs; it is possible that the changes brought about by an EHR system implementation may have a dynamic relationship with what was previously believed to be a static influence on job satisfaction. Consistent with the JCM, we believe the job characteristics job satisfaction relationship will be positive before an EHR system implementation. However, in contrast to JCM's basic tenets, we make the case that the different job characteristics will not have a direct positive influence following EHR implementation—in other words, we believe that the job satisfaction relationships will all be moderated.

 From a theoretical perspective, prior to an EHR system implementation, we expect each of the job characteristics to have a positive influence on job satisfaction, as predicted by the JCM. The JCM has served as an important theoretical basis for research on job design, redesign, and enrichment and the accumulated knowledge suggests that job (re)design strategies should focus on influencing key job characteristics because of their positive influence on job outcomes.

3.Hypotheses Development

In theorizing about how an EHR system implementation will alter the relationship between how work (tasks) are perceived and job satisfaction, we reiterate that the system often drastically alters physicians' jobs. It is, therefore, only logical to assume that the incorporation of technology and its embedded work flows will change the status quo for how physicians perceive their jobs and, thus, how satisfied they are with the work itself. The section that follows builds each of the individual hypotheses for how EHR system implementation moderates each of the relationships between each of the job characteristics and job satisfaction. While we believe that task significance and task identity will have a positive influence on job satisfaction (i.e., job satisfaction will move in the same direction as both job characteristics) prior to the implementation of an EHR implementation, for the reasons outlined above, we believe that EHR system implementation will interact with physician's perceptions of the job to negatively moderate the relationship with job satisfaction. Given the complexity of modern EHR systems, simply having to learn to use the new technology itself can be frustrating. Moreover, consistent with results for other broad-reaching types of systems employed in organizations, the new EHR system is likely to require new skills and competencies and, as a result, physicians may resent having to learn the new software, acquire new technical skills, and adapt to the new business processes enforced by the system (see Alvarez 2008; Hakkinen and Hilmola 2007; Nah and Delgado 2006; Orlikowski 1991). Such physicians may also feel overwhelmed by the adjustments required due to the increase in information available in a new EHR system and the complexity associated with accessing and manipulating that data. Similarly, as hospital implement technology in order to try to push decision-making responsibility and monitoring to lower levels in the hospital, many physicians—particularly those who are uncomfortable with technology or who are accustomed to more "traditional" or personalized oversight methods from senior managers— may not be comfortable with changes in autonomy resulting from the redesigned job. Thus, similar to the logic for changes in task identity, we believe EHR system implementation will moderate the relationship between autonomy and job satisfaction. Feedback is also a common concern with new automated systems, particularly given that most leading EHR systems routinely collect automated data about physicians performance and report it to managers using standard metrics (time on task, cycle time, number of orders processed, etc.). Therefore, we hypothesize

H1: The effect of task significance on job satisfaction will be moderated such that the relationship is more negative following EHR system implementation.

H2: The effect of task identity on job satisfaction will be moderated such that the relationship is more negative following EHR system implementation.

H3: The effect of skill variety on job satisfaction will be moderated such that the relationship is more negative following EHR system implementation.

H4: The effect of autonomy on job satisfaction will be moderated such that the relationship is more negative following EHR system implementation.

H5: The effect of feedback on job satisfaction will be moderated such that the relationship is more negative following EHR system implementation.

4. Methodology

The study was conducted over 6 month period in a healthcare institute. Data were gathered two months before the implementation of a hospital-wide EHR system to provide the pre-implementation baseline and four months after the implementation to capture physician's reactions in the shakedown phase. The researchers had no direct role in the EHR system implementation, but rather were passive observers throughout the process. The hospital set the time frames for the implementation and training, and limited the data collection opportunities to specified points in time during the implementation. However, this did not compromise the scientific goals of the study and was consistent with how we wanted to collect the data. In this section, we provide details about the participants, technology, measurement, and procedure.

4.1 Participants

The participants were physicians of a large-sized hospital in Punjab(India). The sampling frame was the list of 100 potential physicians of the new EHR system. We received 83 usable responses across all points of measurement, resulting in an effective response rate of just over 82 percent. Our sample comprised 26 women (32 percent approx). The average age of the participants was 34.7, with a standard deviation of 6.9. All levels of the hospital hierarchy were adequately represented in the sample and were in proportion to the sampling frame.

4.2 Measurement

EHR implementation was a dummy variable coded "0" for pre-implementation and "1" for post- implementation. The dummy variable allowed us to examine the moderating effect of EHR implementation on relationships between each of the job characteristics and job satisfaction. Job characteristics were measured using a version of the 15-item Job Diagnostic Survey (JDS; Hackman and Oldham 1974). We used a version of the JDS that was modified to remove the reverse-coded items, as there is some empirical evidence to suggest that replacing the reverse-coded items with positive items is better from the perspective of reliability and validity (e.g., Idaszak and Drasgow 1987). Job satisfaction was measured using a three-item scale adapted from Janssen 2001). Gender, age, organizational tenure, organizational position, and job type are important control variables given their impact on several key constructs related to technology adoption and job outcomes (Lefkowitz 1994; Morris and Venkatesh 2000; Venkatesh, Morris, and Ackerman 2000). Gender, age, and organizational tenure were measured using single-item scales. Organizational position was coded as an ordinal variable based on physician's grade used by the hospital. We also measured perceived job transformation, defined as the degree to which an individual believes all aspects of their job, including tasks, roles, and orientation, have been altered by the introduction of new technology—here, the EHR system. The purpose of measuring perceived job transformation was as a manipulation check to determine whether the EHR implementation created a change in jobs. We created four items to measure this construct by following the procedures for scale development recommended in DeVellis (2003).

5.Results

The first step was to examine the reliability and validity of the different scales. All scales were reliable, with Cronbach alphas greater than or equal to .70. A factor analysis, with direct oblimin rotation to allow for correlated factors, supported a five-factor solution for job characteristics data pooled across the pre- and post-implementation time periods. These results, presented in Table 1, show that all loadings were.71 or higher and all cross-loadings were .28 or lower, thus supporting internal consistency and discriminant validity of the scales. The descriptive statistics, reliabilities, and correlations are presented in Table 2. The average scores of the pooled job characteristics were between approximately 3.5 and 4.5, with standard deviations around 1. The average job satisfaction score was a little over 4.6. The various control variables were somewhat correlated with the job characteristics and job satisfaction. Likewise, the job characteristics were somewhat correlated among each other and with job satisfaction. We examined the mean and standard deviation associated with the manipulation check variable, perceived job transformation, and found that 4 months after EHR implementation, the mean was 5.11 and the standard deviation was .94, thus suggesting that physicians perceived a substantial change in their job following the implementation.

Table 1. Factor Analysis with Direct Oblimin Rotation

	1	2	3	4	5
Task significance 1	.71	.24	.13	.14	.10
Task significance 2	.74	.28	.12	.12	.14
Task significance 3	.80	.17	.10	.12	.11
Task identity 1	.13	.73	.07	.07	.03
Task identity 2	.20	.79	.08	.07	.10
Task identity 3	.21	.71	.04	.03	.02
Skill variety 1	.08	.07	.80	.02	.19
Skill variety 2	.03	.04	.84	.05	.12
Skill variety 3	.05	.09	.85	.02	.11
Autonomy 1	.22	.24	.04	.79	.23
Autonomy 2	.23	.28	.13	.71	.21
Autonomy 3	.20	.21	.20	.73	.24
Feedback 1	.02	.02	.07	.21	.75
Feedback 2	.04	.03	.04	.24	.71
Feedback 3	.01	.02	.05	.28	.73

Given our repeated measures design, we used a generalized estimating equations (GEE) method (Liang and Zeger 1986; Zeger and Liang 1986; Zeger et al. 1988) to test our model. GEE is appropriate because it accounts for the correlation of responses within measures from the same subjects over time, thus reducing the potential for inefficient and biased regression estimates (Ballinger 2004). GEEs can be used to test main effects, interactions, and categorical and continuous independent variables (Ballinger 2004). Although GEE models

are somewhat robust to misspecification of the correlation structure of the dependent variable, such misspecifications can result in inefficient estimates. Therefore, we specified an unstructured correlation model (Fitzmaurice et al. 1993) where observations across time are allowed to freely correlate within subjects. Such an approach is consistent with Ballinger (2004) who suggests that this is the optimal correlation modelling structure because it is the least restrictive in terms of modelling the true within-subject correlation structure and there is no reason to expect within-subject correlations to decrease over time when individuals are performing the same behaviour over time. The other important assumption of the GEE estimation approach is the distribution of the dependent variable, which we noted was normally distributed (per Ballinger). We mean-centered the variables in the model
before computing the interaction terms to reduce multicollinearity (Aiken and West 1991).

Table 2. Descriptive Statistics, Reliabilities, and Correlations

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender (1 = men)	0.68	0.47	NA												
2. Age	34.71	6.93	.14*	NA											
3. Org position	NA	NA	−.23**	.40***	NA										
4. Org tenure	9.94	5.66	.23***	.22***	.24***	NA									
5. Admin (1) v. other	0.25	0.44	−.17**	.16**	−.27***	.25***	NA								
6. Kdge wrkr (1) v. others	0.53	0.50	.23***	−.18**	.08	.09	.09	NA							
7. Mgmt (1) v. others	0.22	0.42	.30***	.33	.29***	.29***	.10	.03	NA						
8. Task significance	3.95	1.24	.17*	.22**	.21**	.17*	.05	.08	.14*	.79					
9. Task identity	3.86	1.08	.16*	.16*	.20**	.16*	−.01	.11*	.10	.14*	.76				
10. Skill variety	4.12	1.10	.17*	.15*	.18**	.17*	.02	.11*	.14*	.10	−.04	.75			
11. Autonomy	3.54	1.13	.19**	.19**	.23**	.19**	−.15*	.15*	.13*	.13*	.12*	.13*	.71		
12. Feedback	4.49	1.31	.20**	.20**	.04	.07	−.07	.12*	−.11*	.08	−.07	−.10	−.16*	.71	
13. Job satisfaction	4.67	0.95	.22**	.21**	.20**	.17*	.06	.07	.10	.24***	.28***	−.07	−.08	−.05	.75

Notes: 1. Diagonal elements are Cronbach alphas.

2. NA: Not applicable; *p < .05; **p < .01; ***p < .001.

With job satisfaction as a dependent variable, we pooled the pre- and post-implementation data that resulted in two records per individual. The EHR implementation dummy variable was used to test for moderation—here, the change in the pattern of relationships between job characteristics and job satisfaction before and after implementation. Table 3 shows the results related to the prediction of job satisfaction using the pooled data set (i.e., pre- and post implementation data). Most of the hypotheses were supported; however, contrary to our expectations that all of the job characteristics would be moderated by EHR implementation, two job characteristics—namely, task significance and task identity (H1, H2)—did not have a significant interaction effect. The effects of the other three characteristics— namely, skill variety, autonomy, and feedback were moderated as evidenced by significant interaction terms, thus supporting H3 through H5. In order to understand the pattern of interactions, we plotted the effects at the two different levels of EHR system implementation (pre and post) and found that the effects of skill variety, autonomy,

and feedback on job satisfaction were positive before implementation and negative after implementation. The moderated model explained 47 percent of the variance in job satisfaction, an increase of 16 percent over the main effects-only model and an increase of 30 percent over the control variables model.

Table 3. Predicting Job Satisfaction	Control Variables	Main Effects	Moderated Model
R^2	.17	.31	.47
ΔR^2		.14	.16
Gender	.16**	.02	.14**
Age	.14**	.05	.11*
Organization position	.12**	.03	.12*
Organization tenure	.12**	.03	.02
Task significance		.14**	.14*
Task identity		.21***	.17**
Skill variety		.09	.04
Autonomy		.04	.04
Feedback		.06	.02
EHR (0: Pre-implementation; 1: Post-implementation)		−.23***	−.13*
Task significance × EHR			.02
Task identity × EHR			.01
Skill variety × EHR			−.22***
Autonomy × EHR			−.25***
Feedback × EHR			−.25***

Notes: 1. *p < .05; **p < .01; ***p < .001.
        2. All ΔR^2 were signfiicant.

6. Discussion

Many have cited the need for greater interaction between technology and organization research (e.g., Orlikowski and Barley 2001). To that end, we developed and tested a model of how and why an EHR implementation affects the relationship between physicians' job characteristics and their job satisfaction. We theorized that the relationships between the five job characteristics in JCM and job satisfaction would be moderated by EHR system implementation. Our study indicates that, in addition to being a challenging technological endeavour, EHR implementation moderated the effects of skill variety, autonomy and feedback on job satisfaction. In contrast, task identity and task significance had direct, positive effects on job satisfaction and these effects were not moderated. Perhaps the most significant contribution of the current work is the integration of key job-related constructs into a comprehensive nomological network around EHR implementation. In highlighting the dynamic and complex influences of a new EHR implementation on perceptions of job characteristics and job satisfaction, this research helps extend current theoretical perspectives associated with technology adoption and use. It responds to calls in the research literature for theoretical frameworks and research examining EHR implementations and assimilation in

organizations, particularly during the challenging shakedown phase. The current work is responsive to suggestions that researchers begin to move beyond focusing on technology-centric variables as the end in itself and puts a spotlight on the downstream consequences of technology implementations.

7. Limitations and Suggestions for Future Research

There are many unanswered questions and we hope our research spurs further debate and theorizing that builds on the model and results reported here. For instance, there are many models that explain job satisfaction and it is important to determine which model is best suited in various situations. Of particular interest to IS researchers is the fact that none of the existing models include any technology related constructs. It is possible that certain models, such as the dynamic model presented in the current work, may be more appropriate for EHR implementations and/or other major organizational change activities, while more static models that are common in much of the prior IS and management literature may be more appropriate in a stable organizational environment. While this work focuses on job characteristics and job redesign, future research should explore established determinants of technology use and other outcomes associated with job characteristics. Further, research shows that the some of the predictor variables in this work (i.e., job characteristics) may have a complex, nonlinear effect on different outcomes of interest. Future research could explore the influence of stress on job satisfaction or other outcomes, particularly as it is induced by technological change in the workplace. Performance outcomes should also be studied because they may help researchers relate technology use and job-related constructs to performance at the individual level. Obviously, despite the large sample size, this research represents the experience of a single hospital going through a large scale EHR implementation, other EHR/technologies, other organizational changes and other geographic socio-cultural differences is uncertain and should be studied. Furthermore, the findings from our study provide insights to the shakedown phase of EHR implementation, when individual and hospital adaptations to the new system are most in flux. Care should be taken in generalizing the findings beyond this context and future research is needed to further identify the degree to which these effects on job characteristics and job satisfaction persist beyond the shakedown phase.

8. Conclusions

The process of implementing EHR in a hospital is complex. While often hailed as a way to make physicians more effective and efficient in their jobs, this research illustrated a contingent relationship between the implementation of an EHR and well-established theoretical linkages between job characteristics and job satisfaction. Although researchers and practitioners have studied optimal system design aimed at increasing the overall acceptability of systems, this research underscored the importance of going beyond only a technical analysis of system requirements and functionality to a deeper analysis of the impact that an EHR system is likely to have on the day-today jobs of affected physicians. Our results suggested that the influence of EHR system implementation may be more complex than previously thought, at least in the immediate aftermath following implementation. According to the WHO report, Asian region has lesser physician-population ratio, thus making it a

physician deficit region. Our results suggest that managers should not only consider EHRs as an important technological artefact in the organization, but also view it as a key driver of job design and hospital change strategies as well to keep the physicians motivated and satisfied to work and reduce brain drain.

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