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COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE): A STUDY OF PHYSICIAN TECHNOLOGY ACCEPTANCE

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Abstract

Computerized Physician Order Entry (CPOE) represents a monumental step forward for healthcare organizations because it embodies a shift from traditional, paper-based care coordination activities to automation of the order entry processes. Although many hospitals have recognized the medical, fiscal, and overall strategic advantages associated with investing in such technology, to date very few hospitals have implemented automated order entry systems. This study seeks to lay the framework for a new model of technology acceptance; one that incorporates the unique features of physicians and physician extenders, and the complex environments in which they work. Through the use of semi-structured interviews, direct observation, field notes, and archival record analysis, a longitudinal, instrumental case study will be undertaken, which will track technology acceptance among practitioners with varying specializations. Of particular interest is the degree to which organizational culture, the work values of achievement, autonomy, recognition and patient relationships, and the values of justice, beneficence, non-malfeasance, and autonomy - essential components of the physician's code of ethics - may be facilitators of technology acceptance.

Keywords: technology acceptance, computerized physician order entry, perceived usefulness, perceived ease-of-use

Introduction

Healthcare organizations can pragmatically improve clinician workflow processes and resource utilization by implementing automated clinical decision support interventions, such as Computerized Physician Order Entry (CPOE). CPOE embraces the precepts embodied within the concept of "evidence-based medicine" (Hieb & Handler, 2001), and minimizes the risk to a medical organization's reputation and financial viability.

CPOE represents a monumental step forward for healthcare organizations because it embodies a shift from traditional, paper-based care coordination activities to automation of the order entry processes. This shift can be an agent for change, eliminating confusing or illegible hand-written order documentation, minimizing transcription errors and fundamentally reducing clinical mistakes.

Physician workflow also becomes more efficient with CPOE thanks to the embedded rules and artificial intelligence technology that incorporate knowledge tools and clinical decision support capabilities, ultimately enabling physicians to spend more quality time with their patients.

Most hospitals and healthcare organizations in this country have recognized the medical, fiscal, and overall strategic advantages associated with investing in technology that places physicians at the center of the order entry process. But despite the obvious advantages and documented improvements to patient outcomes that have been associated with the use of CPOE, in 2000 only one third of all U.S. hospitals had installed automated order entry systems – with a mere 1 percent of those organizations mandating its use by physicians (Ferren, 2002).

The explanation for this paradox is multi-pronged, in that CPOE represents a major operational and cultural shift for healthcare organizations regardless of their size or scope. Expenses related to upgrading existing order entry systems for enhanced medication order processing, funding for additional workstations and resources, specialized system training, and the challenges associated with achieving and maintaining physician buy-in and acceptance have all contributed to the lackluster reception that CPOE has received thus far. It is within the context of the latter of those factors – physician acceptance of the Computerized Physician Order Entry technology – that we base this study.

Research Objective

The study of technology acceptance within the healthcare environment is an important vehicle for understanding the dynamics of the man/machine interface as it relates to patient care and clinical outcomes, and contributions to this body of knowledge may ultimately improve interventional efficacy. Moreover, we posit that physicians in particular, accept technology based not solely upon the variables of perceived usefulness (PU) and perceived ease-of-use (PEU) – the integral constructs of Davis' technology acceptance model (TAM) (1989) - but upon specific occupational interests, work values, and work needs associated with the medical profession.

It is without question that the technology acceptance model (TAM) (Davis, 1989) remains an important and viable tool for researchers, and its utility is evidenced by the numerous modifications and augmentations that have been made by researchers to address the question of technology acceptance as it relates to other variables such as gender differences (Gefen & Straub, 1997; Venkatesh & Morris, 2000), user inexperience (Taylor & Todd, 1995), and culturally induced beliefs (Veiga, Floyd, & Dechant, 2001).

Insofar as technology acceptance research has made valuable inroads into the complexities of the how and why humans choose to accept or reject technology - and the pace at which that acceptance or rejection occurs - many of the studies utilizing the TAM (Davis, 1989) or some variant thereof have centered on the technology acceptance dynamics associated with non-descript user populations working in varying occupational settings, utilizing a wide spectrum of information technology solutions.

Physicians and physician extenders (i.e. physician assistants and nurse practitioners) however, are highly educated, highly trained professionals, working in stressful and highly politicized environments. Given the complexity of the healthcare industry and its unique occupational dynamics, we feel that the TAM (Davis, 1989) in and of itself, may not be an appropriate methodology for explaining technology acceptance as it applies to medical practitioners.

The research proposed here will instead draw in part from the theory of planned behavior (Ajzen, 1988), which suggests that all behavior is motivated by individual decisions that are based on the constructs of attitude, subjective norms (i.e. peer influence), and perceived behavioral control. The use of other psychometric studies related to physician personality profiles that may contribute to the development of the instrumentation used within this initiative is also warranted. In addition, we will explore the level to which the values of justice, beneficence, non-malfeasance, and autonomy – essential components of the physician's code of ethics - may be potential motivators for technology acceptance.

Based upon the data collected from our investigations conducted at the various hospitals and healthcare organizations within the health system under observation, we hope to create a model of technology acceptance that is specific to physicians, and medical practitioners.

Methodology

Our goal is to understand the physician technology acceptance phenomenon in today's rapidly changing and complex healthcare environment however, the complete diffusion of CPOE to all of the units within our research platform will take many months, and perhaps years. For this reason we have chosen to approach each separate hospital unit implementation of CPOE as an individual, bounded case study, unique in and of itself.

We intend to observe and document all aspects of the medical unit activity, regardless of perceived importance. Each case (unit) will be classified as *instrumental* in nature (Stake, 2000), in that we will build upon the data collected from each case to facilitate and support our understanding of physician technology acceptance.

Data collection will take place initially in a 755-bed tertiary-care, level-1 trauma center, and then move out to the healthcare enterprise in conjunction with the CPOE implementation plan. Data collection will be accomplished utilizing the following combination of proven qualitative techniques widely used in healthcare research (Al-Jafar, 2002):

- *Semi-structured interviews* – used to gather information about organizational dynamics, workforce identify, and the order entry (OE) challenges/problems faced by physicians and physician extenders within patient care units (interview instrument located in Appendix B).
- *Direct observations* – used to gain a first-hand understanding of technology usage practices by physicians and physician extenders within patient care units.
- *Field notes* – used in conjunction with technology usage observations to provide an historical perspective of the CPOE project dynamics.
- *Documentation/record analysis* – used to establish a baseline for physician and physician extender technology usage and acceptance.

Participants will be chosen for this study based upon availability and clinical specialization. Technology acceptance will be observed longitudinally, across the continuum of care, and will ultimately encompass practitioners with varying specializations assigned to all hospitals within a six-hospital health system.

Limitations

This study is subject to the following contextual limitations:

1. The utilization of CPOE within the subject hospital is very limited in scope, and is currently only available on one medical unit where the treatment protocols are not complex and yet fairly consistent among the patients under care.
2. The number of physicians and physician extenders actually utilizing the CPOE technology at the beginning of this study is not statistically significant.
3. This study will be accomplished over a period of 2 -3 years, depending on the speed and efficacy with which CPOE is implemented across the specific healthcare enterprise.

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Appendix A – CPOE Physician Consent Form

I agree to participate in the research initiative entitled "Computerized Physician Order Entry (CPOE): A Study of Physician Technology Acceptance" which is being conducted as an instrumental case study by the East Carolina University College of Business, East Carolina University, Greenville, NC, 27858; Telephone (252) 328-5349.

This project has been sanctioned by University Health Systems of Eastern Carolina, Pitt County Memorial Hospital, and the East Carolina University Institutional Review Board (IRB). I understand that my participation is entirely voluntary. I can withdraw my consent at any time and have the results of the participation, to the extent that it can be identified as mine, returned to me, removed from the investigators' records, or destroyed.

I understand that:

1. The purpose of this case study is to provide insight into physician technology acceptance as it relates to CPOE, and then to ultimately develop a technology acceptance model for physicians. This model may include the constructs of perceived usefulness, perceived ease-of-use, physician occupational values and needs, organizational culture, and/or others.
2. Participation in this study may include face-to-face interviews, direct observation by the researchers, or completion of a survey instrument.
3. Results of this participation will be confidential and will not be released in any identifiable form without prior written consent of the participant.
4. Any questions about this research should be addressed to Dr. David Rosenthal, principle investigator, or to either Dr. Elaine Seeman or Dr. Shanan Gibson, secondary investigators.

_____ _____

(printed name) (signature)

Date _____

Please sign both copies of this form. Keep one and return the other to the investigator.

Appendix B – CPOE Physician Interview Form

Background Data Form for CPOE Participants*

Name_____

Age_____ Sex_____

Work Address_____

Telephone_____

Email_____

The following questions pertain to your work experience, current job, and technology usage.

1. Medical specialty_____
2. Do you have any secondary specializations within your area? Yes_____ No_____

   If yes, what are they?_____
3. Number of years as a practicing physician _____
4. Number of years at PCMH _____
5. Have you ever served as the PCMH Physician Chief-of-Staff? _____
6. Time in current position _____
7. Is your practice limited to PCMH? If not, where else within the UHS enterprise do you practice and how frequently?
8. Please describe your personal computer usage, both at home and on the job.

* A similar instrument is being developed for physician extenders and may also be used for non-CPOE participants

General Interview Instrument*

Date _____

Participant Name _____

Participant Position _____

Organization _____

1. How would you describe the organizational culture at PCMH? Would you describe the hospital leadership/administration here as more task or relationship oriented?

2. To what degree do you feel the culture and/or leadership embraces technology?

3. Do you know why Computerized Physician Order Entry (CPOE) is being implemented at PCMH?

4. How was that communicated to you, and by whom?

5. Are you directly involved with the CPOE project? If so, please explain.

6. To what degree do you feel individual physicians will influence the decisions regarding CPOE?

7. In your opinion, what is the primary benefit of CPOE?
   If the physician response does NOT address "patient safety" then ask the follow-up question:

   Would you relate the Physician Code of Ethics and the responsibility to "*Do no harm*" to CPOE? If so, how?

* Interviewer may deviate from this list of questions as participant answers warrant

8. Have you read about successful CPOE implementations at other hospitals in the U.S.? If so, does this influence how you feel about CPOE?

9. Do you think it will be a success at PCMH? If yes, what factors do you think have contributed to its success? If no, why not?

10. Do you think CPOE will be successfully implemented at the other UHS hospitals? Why or why not?

11. To what degree to you think the following concepts are important to physicians in general and how do you perceive CPOE impacting them (if at all)?
    a. Physician achievement/success

    b. Physician independence

    c. Recognition from leadership

    d. Patient relationships

12. Do you feel that CPOE is an appropriate tool for physicians?

13. Do your feelings of responsibility toward your patients impact your acceptance of this technology? How so?

14. Do you think that CPOE will influence your malpractice risk? If yes, how?

15. Is there anything else you'd like to share?