3-1-2006

Attitudes and Behaviors of Clinical Staff Toward an Electronic Medical Record System

Robert Boncella
bob.boncella@washburn.edu

Carol Boncella

Ron Wasserstein

Follow this and additional works at: http://aisel.aisnet.org/sais2006

Recommended Citation
Boncella, Robert; Boncella, Carol; and Wasserstein, Ron, "Attitudes and Behaviors of Clinical Staff Toward an Electronic Medical Record System" (2006). SAIS 2006 Proceedings. 8.
http://aisel.aisnet.org/sais2006/8

This material is brought to you by the Southern (SAIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in SAIS 2006 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
ATTITUDES AND BEHAVIORS OF CLINICAL STAFF TOWARD AN ELECTRONIC MEDICAL RECORD SYSTEM

Robert Boncella, PhD
School of Business Washburn University
bob.boncella@washburn.edu

Carol Boncella, MA, RN
Lawrence Memorial Hospital
carol.boncella@lmh.org

Ron Wasserstein, PhD
Department of Mathematics Washburn University
ron.wasserstein@washburn.edu

Abstract

This paper presents some of the results of attempting to measure the attitudes and behaviors of clinical staff of a medium size community hospital toward acceptance of the EMR technology and determine if implied benefits were achieved. The research indicates that the clinical workers’ perception of improved patient care is affected by their perceptions of the ease of use and perceived usefulness of the EMR. Although the clinicians have adopted this EMR into their daily practice, they have not adopted alternative information technology that implements this EMR. We will report a preliminary analysis of this phenomenon as well.

Keywords: Electronic Medical Record Systems, Healthcare Informatics, Nursing Informatics, Technology Acceptance Model, Diffusion of Innovations Theory

Introduction

The ongoing introduction of information technology in the healthcare setting is accepted as a way to improve diagnostic capability, enable accurate assessment and foster favorable patient outcomes. These improvements to patient care enable hospitals to balance the expense of technology and the training involved against the benefits obtained.

Other technology, specifically an electronic medical record (EMR) system, is intended to facilitate caregivers in the documentation of care and assist in the retrieval of patient information. While the connection of technology such as CAT scanners and surgical lasers to patients and their subsequent care is seen easily, the same may not be said of the electronic medical record (EMR). The direct benefits of this information technology to patients are more obscure.

Capturing the benefits of the electronic medical record is essential since EMR systems may compete for dollars that might otherwise be spent for technology involved in direct patient care and progress. Implied benefits of an EMR are efficiency in documentation of patient care and improvement in communication among care giving disciplines. Furthermore, the expectation is that these will have a positive impact on patient care.

However, caregivers must incorporate the EMR into their clinical practices if benefits are to be seen. The purpose of our research is to understand the attitudes and behaviors of clinical staff toward an Electronic Medical Record system. In particular, the research is interested in discovering the clinical staff’s perception of how an EMR affects their perception of patient care. In addition, the research seeks to discover how well the clinical staff has adopted alternative information technology implemented with the EMR.

Theoretical Framework
The expenditure of the scarce resources of time and treasure creates an imperative for the organization to engineer the acceptance and adoption of the new technology (e.g. EMR) into the practice of its end users. The impact new technology has on end-users must be a consideration during the planning and implementation phases of an electronic medical record system. Two theories offer insight into the attitudes and behaviors that caregivers might exhibit regarding an electronic medical record system.

**Technology Acceptance Model**

The Technology Acceptance Model (TAM) explores the acceptance and use of information systems by users by examining the factors of Perceived Ease of Use and Perceived Usefulness. Perceived ease of use is defined as the “degree to which a person believes that using a particular system would be free from effort.” Perceived Usefulness is defined as the “degree to which a person believes that using a particular system would enhance his or her job performance.” (Davis, 1989)

This theory will be useful in explaining the relationship between the clinician’s attitude toward the EMR and their perception of improved patient care.

**Diffusion of Innovations Theory**

New ideas and technologies, no matter how scientifically sound, may be a hard sell to users. It is not the experts who need to accept the innovation; it is the user. The users’ perceptions affect the rate of adoption. Everett Rogers suggests that 49 – 87% of variance in the rate of adoption is explained by five attributes, viewed from the users’ perspective:

- Relative advantage – is the innovation a better idea than the one it replaces?
- Compatibility – is the innovation in alignment with the users’ existing values, past experiences and needs?
- Complexity – is the innovation easy or difficult to understand and use?
- Trialability – are users able to experiment with the innovation beforehand?
- Observability – are the results easily seen and communicated to others? (Rogers, 1995)

The usefulness of this theory was suggested after a presentation of this data in a working paper. Although the survey instrument was not design to measure these constructs they may be useful in understanding the clinicians’ reluctance to use alternative technology that implements the EMR they have accepted.

**Motivation**

The motivation for this study is to determine if an organization has benefited from the use of the EMR in its first phase and to gather insight as it proceeds into its second phase of the project. Although the expected benefits of the EMR project had not been formally stated by the organization, the understood benefits include a more comprehensive clinical documentation system, improved communication among caregivers and more time devoted to actual patient care. It is hoped that the ripple effect of these benefits is improved patient outcomes.

Additional motivation arises from the casual observation that hardware purchased specifically for the implementation of the EMR for the clinical staff often is unused. This relatively idle hardware consists of three types: 1) computers on wheels (COWs) stored near the nurses’ station and available to roll into any patient room; 2) alcove computers strategically mounted along hallways near patient rooms and; 3) tablet PCs purchased to accommodate clinicians traveling from unit to unit, such as respiratory therapists, dietitians or social workers.

In light of the fact that much of the current mobile hardware is unused, the concern is that the purchase of additional hardware providing point of care documentation proposed for Phase 2 would be wasteful. Therefore, a study of the impact of Phase 1 ought to provide insights to enhance success of Phase 2.
Methodology

The Setting

The study was conducted at 170 bed community hospital 18 months after the implementation of its electronic medical record (EMR) system that introduced computerized clinical documentation to caregivers. The new system was integrated with legacy applications that continued to process admission procedures and laboratory reporting. A computer competency was established to assure that all users had basic computer skills prior to beginning EMR training. All caregivers received between two and eight hours of training on the new documentation system and completed a written and hands-on competency after training. The difference in training length was determined by the extent to which caregivers would use the system. That is, those who needed the system to look up information had less training need than those who actually documented on the EMR. Go-live took place for all units using the online documentation at the same time.

The Instrument

The instrument used to study the impact of the EMR was a survey. The intent of the survey was to uncover the attitudes and behaviors of clinicians involved with the electronic medical record, either those responsible for the actual documentation of patient care or those needing to retrieve and review patient data, such as laboratory results, vital signs, etc.

The survey consisted of 52 questions. Questions that measured attitude toward the EMR dealt with perceived ease of use, the degree caregivers trusted the system and the perceived usefulness of the system to them. Questions measuring behavior focused on the percent of time current devices were used by caregivers (see Table 1 below), reasons identified for not using available devices (see Table 2 below), the type of devices caregivers thought they would use in the future, specifically, those scheduled for Phase 2 and the time frame for documentation on the EMR after patient care was delivered. Lastly, demographic questions sought to uncover the experience in and comfort toward computers in general that caregivers possessed. Not all the information collected is reported on in this paper.

Data Collection Procedures, the Sample, & Reliability of the Survey

The survey was distributed to caregivers with a cover letter explaining the intent of the research and confidentiality of the survey. Participation was voluntary. Individual return envelopes were provided and convenient drop off points identified. The data collection took place over a three week period. The completed surveys were collected by the primary researcher.

The survey sample consisted of 450 caregivers, which were nurses, nurse aides, pharmacists, respiratory therapists, social workers and dietitians. All were responsible for direct patient care and either charted directly on the EMR or used the EMR to retrieve and review patient data. Caregivers on all shifts and inpatient and outpatient areas using the EMR were included. The response rate was 37%.

The survey was internally consistent with a Cronbach’s alpha of 0.82 (N cases = 83 and N items =16).

Results

Results from the study were examined from the perspective of implied organizational benefits achieved as the result of instituting the computerized patient record - the perceived effect the EMR has on patient care and the choice of device on which caregivers select to document care.

Response Variables

Originally our response variables were group into three classes: documentation, information retrieval and lookup, and patient care. These would measure the clinicians’ perception of characteristics of the EMR. Originally we were interested in the descriptive results of these variables. However subsequent exploratory factor analysis indicated
another classification could be made (see Table 3 below). This classification suggested that the TAM model might be of explanatory use. Listed below are the original classifications with their response variables and what it measures followed by the TAM classification: Ease of Use (EOU) and Usefulness (U). Initially we thought some of these response variables measured the degree of trust the clinicians’ have in the EMR. These variables are denoted with a “T”.

**Documentation**

- Easier – EMR easier than paper - EOU
- Faster – EMR faster than paper - EOU
- Accurate – EMR documentation more accurate than paper - U (T)
- Complete – EMR information more complete than paper – U (T)
- No_wrkfl – EMR no interruption of workflow - EOU

**Information retrieval and lookup**

- Find_easy – Easy to find information in EMR - U
- Md_accr – MD Review tab information accurate – U (T)
- Krdx_accr – Kardex review tab information accurate – U (T)

**Patient Care**

- More_tm – EMR provides more time for patient care - EOU
- Imprv_cm – EMR improves communication - EOU
- Imprv_cr – EMR improves patient care – purpose of survey

**Choice of Device**

A point of care study done early in the EMR project projected the number and type of devices for each area, resulting in the purchase and availability of multiple types of devices for clinicians to use to document patient care. Computers were placed in nurses’ station, in alcoves along the hallways and, in some units, directly in the patient’s room. Portable devices, laptops and tablet PCs, were made available to traveling clinicians and computers on wheels (COWs) were placed strategically in patient care units. Table 1 shows the frequency of use for each of the devices from which the EMR could be accessed and the approximate number of devices available. The data suggests that the preferred device was the computer in the nurses’ station. The reasons for non-use of devices are shown in Figure 1.

<table>
<thead>
<tr>
<th>Computer Used</th>
<th>% used 100%</th>
<th>% used 80%</th>
<th>% used 50%</th>
<th>% used 20%</th>
<th>Available and not Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>In nurse station (approx. 6 per unit)</td>
<td>28.1</td>
<td>40.6</td>
<td>10.9</td>
<td>7.8</td>
<td>12.5</td>
</tr>
<tr>
<td>In hallway alcoves (approx. 6-8 per unit)</td>
<td>1.6</td>
<td>4.7</td>
<td>4.7</td>
<td>10.9</td>
<td>78.1</td>
</tr>
<tr>
<td>Tablet PC at nurse station (issued per clinician)</td>
<td>6.3</td>
<td>3.1</td>
<td>0</td>
<td>3.1</td>
<td>87.5</td>
</tr>
<tr>
<td>COW (approx. 4-5 per unit)</td>
<td>3.1</td>
<td>0</td>
<td>0</td>
<td>14.1</td>
<td>82.8</td>
</tr>
<tr>
<td>Laptop in patient room (issued per clinician)</td>
<td>3.1</td>
<td>0</td>
<td>0</td>
<td>3.1</td>
<td>93.8</td>
</tr>
<tr>
<td>Computer in patient room (ICU and Same Day Surgery only)</td>
<td>3.1</td>
<td>1.6</td>
<td>1.6</td>
<td>6.3</td>
<td>89.1</td>
</tr>
</tbody>
</table>
The PC at the nurses’ station and the mobile devices are functionally equivalent and as such were not identified as being difficult to use. Clinicians did not perceive the usefulness of the mobile devices as high. For example, crowded patient rooms were an impediment to the usefulness of the devices. Caregivers were unlikely to take a mobile device into the patient room since it offered no advantage to them and interfered with their work processes. As a result, they returned to the nurses’ station, as they were accustomed to doing, to document care. This behavior supports the Relative Advantage and Compatibility constructs of Diffusion of Innovation theory. One can argue that the mobile devices were not seen as an improvement over the PC at the nurses’ station and that the use of the mobile devices conflicted with the previously held value of congregating at the nurses’ station to complete work.

**Data Analysis**

A relationship exists between clinicians’ perception of improved patient care and attitudes toward the EMR. Conducting a correlation test among the 11 response variables resulted in 52 significant (at the 0.01 or 0.05 level) correlations out of a possible 55. As a result, Factor Analysis was carried out and the results are displayed in Table 2.

**Table 2. Rotated Component Matrix**

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>EASIER</td>
<td>.856</td>
<td>.142</td>
</tr>
<tr>
<td>FASTER</td>
<td>.874</td>
<td>.142</td>
</tr>
<tr>
<td>ACCURATE</td>
<td>.507</td>
<td>.589</td>
</tr>
<tr>
<td>COMPLETE</td>
<td>.450</td>
<td>.667</td>
</tr>
<tr>
<td>NO_WRKFL</td>
<td>.795</td>
<td>.289</td>
</tr>
<tr>
<td>FND_EASY</td>
<td>.120</td>
<td>.838</td>
</tr>
<tr>
<td>MORE_TM</td>
<td>.783</td>
<td>.257</td>
</tr>
<tr>
<td>IMPRV_CM</td>
<td>.286</td>
<td>.681</td>
</tr>
<tr>
<td>NEW8</td>
<td>5.193E-02</td>
<td>.692</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 3 iterations.
On the basis of this two variables were created C1 and C2. Where

\[ C1 = \text{EASIER} + \text{FASTER} + \text{NO_WRKFLW} + \text{MORE_TM} \]

And

\[ C2 = \text{ACCURATE} + \text{COMPLETE} + \text{FND_EASY} + \text{IMPROVE_CM} + \text{NEW8}, \text{where NEW8 = MD_ACCR + KRDX_ACC} \]

C1 may be interpreted as EMR human factors (ease of use) and C2 is EMR quality (usefulness). A correlation of \( r = .667 \) was found between IMPRV_CR and C1 and a correlation of \( r = .653 \) was found between IMPRV_CR and C2.

Regression analysis was performed with IMPRV_CR as the dependent variable and C1 and C2 as the independent variables. The result was a significant regression model (\( F(2,99) = 56.5607; \ p < .000 \)) where for C1: Beta = .414, \( t = 5.064, \text{Sig.} = .000 \) and for C2: Beta = .421, \( t = 5.149, \text{Sig.} = .000 \).

**Clinicians Reluctance to Use Alternative Technology that Implements the EMR**

The records in the data set were given additional classifications based on if clinicians considered the alternative devices “too bulky” and the timeliness of their charting. If a respondent gave at least one of the three reasons (“too bulky”, “hard to roll”, or “room too crowded”) for not using alternative technology, the record was classified as a TYPBLKY = 1. Those that did not respond with any of those three were assigned – TYPBLKY = 2. In addition, records were classified as to their timeliness of charting as follows: if they responded that 80% of the time they performed documentation within 15 minutes of delivering patient care they were classified as an “early charter” - TYPCHRTR = 1 otherwise TYPCHRTR = 2. Table 3 below is the cross tabulation of the results of this classification.

<table>
<thead>
<tr>
<th>TYPCHRTR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TYPBLKY</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>1.00</td>
<td>26</td>
</tr>
<tr>
<td>2.00</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
</tr>
</tbody>
</table>

A Chi-square analysis of this distribution indicated a significant difference (\( \chi^2[\text{df} = 1] = 7.411, \ p = .006 \)).

**Discussion**

Clinicians who rated the EMR as easy to use (Perceived Ease of Use) and found it useful (Perceived Usefulness) were more likely to perceive an improvement in patient care than those who had a lower Perceived Ease of Use and Perceived Usefulness toward the EMR.

Choosing “EMR improves patient care” as the dependent variable is not standard in TAM models. It appears that “EMR improves patient care” is a measure of the usefulness of the EMR and should be treated as an independent variable. However in this case the variable is a measure of the outcome of having to use this EMR. The clinicians have no choice to either accept or not accept the EMR. Their choice is to determine if it does improve patient care. The EMR’s usefulness and ease of will determine the perception of improved patient care. If it does not then modification of this EMR will be made or perhaps another EMR will be chosen. In some sense it is no longer technology “acceptance” as technology “adaptation” either on the part of the EMR or the clinicians.

The results of Table 1 show that by and large the alternative technologies of mobile devices are not used for charting. And Table 2 suggests these devices being “too bulky” may an explanation. However, Table 4 shows that those who chart soon after patient care (TYPCHRTR = 1) was given tend to perceive the mobile devices as not being “too bulky” (TYPBLKY = 2). Yet, a slightly larger number who chart well after patient care delivery (TYPCHRTR = 2) tend to think these devices are “too bulky” (TYPBLKY = 1). This suggests that DOI theory
construct of compatibility may be useful in explaining this phenomenon. Further data analysis is needed in order to determine if this is the case.

**Conclusions**

The results of this research have implications for this institution as it begins its next phase of the EMR. Because hand-held devices, which will be used to assure more safe administration of medication, are being purchased for Phase II, the organization will be best served if it proceeds carefully and thoughtfully. The five constructs of Rogers’ Diffusion of Innovations can guide the planning, training and implementation of hand-held devices so the caregivers actually will use these mobile devices. Likewise, the Technology Acceptance Model suggests that the perception of a technology’s usefulness will influence its use. Therefore, the institution has an opportunity to influence its caregivers by stressing the usefulness of these hand-held devices, that is, patient safety aspect.

**List of Works Consulted**


