Examining Social And Cognitive Aspects Determining Physician's Adoption Of Electronic Medical Records

Andy Weeger
Hochschule Neu-Ulm, Neu-Ulm, Germany, andy.weeger@hs-neu-ulm.de

Heiko Gewald
Hochschule Neu-Ulm, Neu-Ulm, Germany, heiko.gewald@hs-neu-ulm.de

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EXAMINING SOCIAL AND COGNITIVE ASPECTS
DETERMINING PHYSICIAN'S ADOPTION OF
ELECTRONIC MEDICAL RECORDS

Weeger, Andy, Neu-Ulm University of Applied Sciences, Wileystraße 1, 89231 Neu-Ulm, Germany, andy.weeger@hs-neu-ulm.de

Gewald, Heiko, Neu-Ulm University of Applied Sciences, Wileystraße 1, 89231 Neu-Ulm, Germany, heiko.gewald@hs-neu-ulm.de

Abstract

The primary health care IT-system (HIT) physicians in hospitals are exposed to is the electronic medical record (EMR) - the “information backbone” of all patient related activity and data. Despite the commonly acknowledged beneficial improvements through HIT, the level of EMR adoption in Germany is relatively low. Less than 20% of all hospitals have implemented a fully functional EMR. Apparently, the users have certain antipathies against the EMR. In order to identify the salient factors of these aversions and to provide a plausible explanation for the scarce penetration of EMR systems, a case study research in German hospitals has been conducted.

The research subjects were physicians as the most influential EMR users. Social Cognitive Theory (SCT) was applied to analyze their perceptions towards using the EMR. Findings indicate that performance-related outcome expectations and anxieties are the most relevant factors. However, as the majority of the subject group generally has high confidence in EMR systems, expected benefits seem to outweigh perceived risks of EMR usage.

Keywords: Social Cognitive Theory, Technology Adoption, Electronic Medical Record, Health IT
1 Introduction

Considering purchasing power parity per resident, the German spending on health related services has increased from $2,280 in 1995 to $4,340 USD in 2010, representing more than 10% of the German gross domestic product (Destatis, 2012). In addition to rising costs, powerful trends like increasing demand, uneven quality, and misaligned incentives are threatening healthcare globally (PricewaterhouseCoopers, 2005). In regard of these challenges, health information technology (HIT) is expected to play an indispensable role in reducing healthcare costs. To be specific, HIT is expected to increase physicians’ productivity, relieve scarce healthcare professionals from administrative tasks and avoid unnecessary treatments or double work etc. (Chaudhry, Wang, Wu, Maglione, Mojica, Roth, Morton, and Shkelle, 2006; Erstad, 2003; Hillestad, Bigelow, Bower, Girosi, Meili, Scoville, and Taylor, 2005; MacDonald, 2008). In addition, HIT is meant to improve quality of care (Chaudhry et al., 2006; Stead, 2007), enhance patient safety (Albrecht and Gaffney, 1983) and thus improving health and well-being for the population (Devaraj and Kohli, 2000). Therefore, it is not surprising that substantial parts of hospital investments are dedicated to information technology: ~14% of hospital investments (Blum and Schilz, 2005) are invested into information technology (IT).

Given the distinctive advantages of HIT and investments in these technologies, it is surprising that HIT diffusion in hospitals is relative slow. Delivering patient care, for example, is still supported by traditional paper files in most German hospitals. Only 22.6% of German hospitals implemented a fully functional electronic medical record (EMR) system in at least one department (Hübner, Hübner, Liebe, Egbert, and Frey, 2012). Unfortunately, literature does not offer any hints on the main barriers of EMR diffusion in German hospitals. However, a systematic review of HIT showed that costs are the biggest barrier to HIT introduction (Zhivan and Diana, 2012). In addition, there is a lack of business cases showing clear benefits from HIT adoption for healthcare providers like hospitals. Furthermore, there are no reports of restrictions to HIT adoption in Germany due to government policies. Hence, it could be suggested that costs and the inherent risk that investments do not pay off are main barriers of HIT diffusion. As several studies identified IT usage as a critical factor for drawing value from IT investments (DeLone and McLean, 1992; Doll and Torkzadeh, 1998), the willingness of healthcare staff to use HIT becomes vital. Building on the insights of these studies, Devaraj and Kohli (2003) identified proper IT usage as the missing link between investment into IT and performance effects. This means that, even if the right system is implemented, a suboptimal degree of usage has a negative impact on the value added by the system.

Following these arguments, HIT does only pay off when the systems are used effectively (Holden and Karsh, 2009). If users reject using the IT systems as planned, consciously or unconsciously, this will inevitably lead to lower effectiveness and efficiency. These negative effects could impede HIT diffusion. Furthermore, inadequate usage could lead to inconsistent and/or incomplete data, which, in turn, can lead to fatal results. IT managers in German hospitals are well aware of these effects and are looking for ways to increase systems usage. In a survey of 2,030 German hospitals, users' retention towards IT systems was found to be the second most significant barrier for successful HIT implementation projects (VHitG, 2011). This aligns with Angst, Agarwal, Sambamurthy, and Kelley (2010) and Bhattacherjee and Hikmet (2007) who also found user's resistance as an important barrier for HIT diffusion.

As for most other HIT systems, the benefits of migrating from paper based records to an EMR have been well documented (Erstad, 2003; Menachemi and Brooks, 2006). Even though, EMR usage in hospitals employing an EMR system is mandatory, the actual degree of usage, data quality, and existence of secondary systems (paper file, notes, verbal communication) impacts the effectiveness of the EMR. Hence, physicians’ acceptance of these systems is a substantial barrier for widespread and meaningful use of EMRs (Boonstra and Broekhuis, 2010). We postulate the following research question to better understand the phenomenon of HIT acceptance and usage: What are the salient factors influencing physicians’ adoption of EMR systems?
This paper is structured as follows: In the next section applicable literature is reviewed to identify the salient factors influencing physicians’ adoption behavior. Based on the body of knowledge in HIT-adoption research and the barriers to physicians’ technology acceptance, applicable constructs are presented. Following this, the research approach is outlined, and the findings explicated and discussed. The paper closes with limitations, further research and a conclusion.

2 Literature Review and Research Propositions

There are several definitions and understandings of EMR systems. For this study, the definition provided by the Dick, Steen, and Detmer (1997) will be used: *A patient record system is a type of clinical information system, which is dedicated to collecting, storing, manipulating, and making available clinical information important to the delivery of patient care. The central focus of such systems is clinical data and not financial or billing information.* In other words, an EMR is an intra-institutional digital repository of information regarding the health of a subject of care containing all data created and collected in the course of medical care of one patient in one care facility (Leiner, 2006).

2.1 Technology Adoption

Technology adoption theories evolved over the years are based on a variety of theoretical perspectives from different disciplines. Each of these theories addresses the cognitive, affective and behavioral reactions of individuals to technology and innovation as well as the factors influencing these reactions and theorizes them into distinctive constructs. From a bird's-eye view, the models differ in their scope and character of the causal relationships among the determinants of usage. First, models like the Technology Acceptance Model (TAM) (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, and Davis, 2003) focus almost exclusively on beliefs about the technology and the results associated with its usage. In contrast, the TPB and the Social Cognitive Theory (SCT) (Compeau and Higgins, 1995a; Compeau and Higgins, 1995b) encompass other beliefs that might influence behavior independent of perceived outcomes. Second, the TAM conceptualizes the causal relationships as unidirectional, with the environment influencing cognitive beliefs. The SCT, in contrast, explicitly proposes the existence of a continuous reciprocal causation among the environment in which an individual operates, his or her cognitive perceptions, and his or her behavior (Carillo, 2010; Compeau, Higgins, and Huff, 1999).

2.2 Technology Adoption in Healthcare

Literature shows little consensus on how to measure IT adoption in healthcare (Bhattacherjee and Hikmet, 2007). Several studies focusing on the healthcare context found support for the general applicability of the TAM in a physician population (Chau and Hu, 2001; Chau and Hu, 2002; Hu, Chau, Sheng, and Tam, 1999). Nevertheless, TAM’s explanatory power is limited compared with studies that examined the TAM among non-professionals (Hu et al., 1999). Almost all reviewed studies showed that ease of use (EoU), one of TAM’s key construct, is no significant predictor of intention to use. Regarding perceived usefulness (PU), the second key construct, it seems as physicians’ PU perceptions, in particular systems’ ability to enhance their daily work, are the most significant determinants for their HIT adoption behavior. Despite the strong predictive power of PU, the uncertain significance of EoU does not account for the comparatively weaker explanatory power of the TAM as a whole (Hu et al., 1999). Therefore, Yarbrough and Smith (2007) called for a tailored approach that involves physician-specific variables. Likewise, Holden (2010) propose that the TAM may benefit from extensions. For instance, Dansky, Gamm, Vasey, and Barsukiewicz (1999) demonstrated the impact of contextual factors like physicians’ perceptions on organizational support, training and technical infrastructure. In addition, Pare, Sicotte, Poba-Nzaou, and Balouzakis (2011) as well as Ash, Gorman, Lavelle, Payne, Massaro, Frantz, and Lyman (2003) emphasize the importance of organizational readiness and supportive leadership in a clinical context.

Chang, Hwang, Hung, and Li (2007) as well as Duyck, Pynoo, Devolder, Voet, Adang, and Vercruyssse (2008) demonstrated the fit of UTAUT, which incorporates additional constructs like social influence and facilitating conditions. In line with the TAM studies, the strongest predictor of
intention to use was usefulness, conceptualized as performance expectancy. This finding confirms the assumption that physicians’ adoption behavior is driven by a kind of medical pragmatism. The findings of the extended EoU construct, conceptualized as effort expectancy, are ambiguous: Chang et al. emphasize a significant influence on behavioral intention; Duyck et al. examined only insignificant influence. In both studies, social influence has at least a slightly significant impact on behavioral intention. Contrary to Chang et al. where the effect of facilitating conditions on actual usage was less significant than in prior studies, Duyck et al. (2008) found that the construct of facilitating conditions was an crucial predictor of the degree of actual system usage.

As UTAUT and TAM’s ability to explain adoption behavior in healthcare is— in contrast to other domains— limited, it is reasonable to consider other theoretical perspectives which address the examination of human behavior in a more general fashion. Theories employed for this purpose are for instance the Five-Factor Model (FFM), TPB and SCT. Although those approaches found less recognition in the IS community, there are some IS-related examples available: Pavlou and Fygenson (2006) used an extension of the TPB to examine electronic commerce adoption. Devaraj, Easley, and Crant (2008) enhanced the TAM by the FFM personality factors and showed that the FFM personality dimensions can be useful predictors of users’ attitudes and beliefs. Compeau and Higgins (1995b) as well as (Compeau et al., 1999) adopted SCT to explain the impact of psychological factors on IT usage behavior. Although those approaches found some application in IS-related contexts, especially empirical research in healthcare is scarce. Nevertheless, since SCT focuses on psychological aspects of the users and hence encompasses beliefs that might influence behavior independent of perceived outcomes (Compeau et al., 1999), having a closer look on the SCT seems reasonable.

### 2.3 Social Cognitive Theory

SCT (Bandura, 1986) follows a “triadic reciprocity” approach in examining and explaining human behavior where personal factors, behavior, and the environment mutually influence each other. In their application to the context of computer utilization, Compeau and Higgins (1995b) and Compeau et al. (1999) assume three determinants of usage behavior: outcome expectations, emotional reactions to computers, and self-efficacy. Outcome expectations are distinguished in performance outcome expectations and personal outcome expectations, emotional reactions to computers in affect and anxiety. Definitions of the SCT constructs and their causal relationships are given below.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome Expectations (Personal)</td>
<td>Personal consequences of the behavior, dealing with the individual esteem and sense of accomplishment (Compeau and Higgins, 1995b).</td>
</tr>
<tr>
<td>Computer Self-Efficacy</td>
<td>Judgment of one’s ability to use a technology to accomplish a particular job or task (Venkatesh et al., 2003).</td>
</tr>
<tr>
<td>Affect</td>
<td>An individual’s liking for a particular behavior (Venkatesh et al., 2003).</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Evoking anxious or emotional reactions when it comes to performing a behavior (Venkatesh et al., 2003).</td>
</tr>
<tr>
<td>Usage</td>
<td>The degree of use of the technology (Compeau and Higgins, 1995b).</td>
</tr>
</tbody>
</table>

![Figure 1: SCT according to Compeau et al. (1999)](image_url)
2.4 Research propositions

As laid out above, following SCT in formulating propositions seems a promising approach addressing the call for further research to examine factors influencing physicians’ adoption and usage behavior beyond the dominant technology adoption models. The following factors are expected to impact physicians’ EMR adoption behavior and influence each other to a certain degree. In contrast to Compeau and Higgins (1995b), we adopt the approach of Venkatesh et al. (2003) and use intention as a predictor of behavior as dependent variable instead of actual EMR-usage.

Self-Efficacy using EMR

Self-efficacy represents a physician’s beliefs about his/her capability to use an EMR system correctly and/or efficiently. Gans, Kralewski, Hammons, and Dowd (2005) as well as Boonstra and Broekhuis (2010) reported that physicians may have concerns about using the system correctly and efficiently. In addition, Holden (2010) examined an impact of self-efficacy perceptions on physicians’ technology adoption behavior.

Outcome Expectations (Performance)

Since the relative advantage of electronic documentation has been broadly demonstrated (Chaudhry et al., 2006; Miller and Sim, 2004), performance expectations appear to be the most significant determinant of physicians’ intention to use HIT (Chau and Hu, 2002; Hu et al., 1999). The pre-eminently discussed outcome expectations in literature are quality of care including patient safety and physicians’ productivity. In particular, the availability and readability of information, more precise data, and earlier awareness of patient status were considered as real advantages and thought to improve clinical decision making and reduce medical errors (Gans et al., 2005; Holden, 2010; Kumar and Aldrich, 2010; Miller and Sim, 2004). However, Kemper et al. (2006) reports that more than half of physicians in primary care perceive a lack of improvement in patient care or clinical outcomes. In addition, many physicians perceived EMR to make their work even more difficult and complex (Holden, 2010). Nevertheless, Holden (2010) showed that a majority of physicians believe that EMR can realize these advantages and save time or speed up the care process.

Outcome Expectations (Personal)

Personal consequences, such as promotions or occupational status enhancements are typical personal outcome expectations (Compeau et al., 1999). Previous work suggests that financial incentives might impact physicians’ adoption decision (Miller and Sim, 2004; Vishwanath and Scamurra, 2007). However, since physicians’ usage of deployed systems is mandatory, this effect is not expected for physicians in hospitals. As a result of a strict vertical hierarchy, physicians’ promotion is highly dependent on their supervisors’ assessment (Vogd, 2004). Hence, adoption or resistance –depending on the attitude of a physicians’ supervisor– can indeed lead to personal outcomes.

Affect

According to prior SCT studies, it is proposed that the degree to which a physician enjoys working with an EMR system might influence their adoption behavior. As literature does not report positive affective outcomes of EMR adoption, this effect has to be further examined.

Anxiety

According to literature, anxious reactions evoked by using an EMR can be due to the systems’ complexity (Boonstra and Broekhuis, 2010; Menachemi and Brooks, 2006), increasing medication errors (Han, Carcillo, Venkataraman, Clark, Watson, Nguyen, Bayir, and Orr, 2005; Koppel, Metlay, Cohen, Abaluck, Localio, Stephen E., and Brian L., 2005), temporary loss of data (Boonstra and Broekhuis, 2010; Kemper et al., 2006; Menachemi, Langley, and Brooks, 2007), security and privacy concerns (Simon, Kaushal, Cleary, Jenter, Volk, Orav, Burdick, Poon, and Bates, 2007; Weeger, Gewald, and Vriesman, 2011) and legal consequences due to corrupted patient data (Boonstra and Broekhuis, 2010). As hospital administration also view HIT as a method to control costs and standardize healthcare, physicians may perceive the implementation and usage of these systems as attacking their autonomy (FitzHenry, Salmon, and Reichelt, 2000; Ilie, Courtney, and Slyke, 2007; Morton and Wiedenbeck, 2009).
Peers’ use of EMR

Peers are defined as a physician’s reference group, which consists mostly of other physicians, such as colleagues and superiors, as well as nurses and hospitals’ management. Venkatesh et al. (2003) as well as Thompson, Higgins, and Howell (1991) suggested that co-workers system usage positively influence their peers’ intention also using this system. Regarding HIT, Ayers, Menachemi, Zo, Matthews, and Brooks (2009) highlighted the impact of the current level of EMR usage behavior on physicians’ behavioral intention using EMR. Additionally, literature and anecdotal evidence are showing that sufficient user involvement is a success factor for EMR implementation. For instance, the presence of a physician project champion seems to be critical to successful implementation projects (Paré, Elam, and Ward, 1997). This effect seems to be especially significant in large organizations like hospitals (Studer, 2005). Following this argument, a positive impact of peers’ use on physicians’ usage behavior is proposed.

3 Research Method and Execution

Examining contemporary phenomena, the case study approach has a strong tradition in the IS discipline (Benbasat, Goldstein, and Mead, 1987; Markus, 1983). In particular, research questions which are exploratory in nature (“how” and “why”) frequently lead to an explorative case study approach aimed to investigate the phenomenon within its natural setting. This kind of research is in particular suitable when the boundaries between phenomenon and context are not clearly evident (Yin, 2009), and there is few a priori knowledge of what the variables of interest will be and, in particular, how they can be measured (Benbasat et al., 1987). As in other disciplines, case study research is frequently applied in IS (Benbasat et al., 1987; Markus, 1983) to accomplish different goals such as description of phenomena, capturing knowledge, testing initial propositions or generating theories (Eisenhardt, 1989; Yin, 2009). As there is little a priori knowledge of what salient factors influence physicians’ HIT adoption behavior in German hospitals and as the ability of quantitative research methods is limited for investigating a phenomenon in its natural setting, we build a positivist case research methodology similar to Lee (1989) focusing the relevance of the a priori constructs derived from literature.

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Provider</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital A</td>
<td>non-teaching</td>
<td>nonprofit provider</td>
<td>&gt; 500 beds</td>
</tr>
<tr>
<td>Hospital B</td>
<td>teaching</td>
<td>public provider</td>
<td>&gt; 500 beds</td>
</tr>
<tr>
<td>Hospital C</td>
<td>teaching</td>
<td>public provider</td>
<td>&gt; 500 beds</td>
</tr>
<tr>
<td>Hospital D</td>
<td>non-teaching</td>
<td>public provider</td>
<td>200-500 beds</td>
</tr>
<tr>
<td>Hospital E</td>
<td>non-teaching</td>
<td>nonprofit provider</td>
<td>200-500 beds</td>
</tr>
<tr>
<td>Hospital F</td>
<td>non-teaching</td>
<td>nonprofit provider</td>
<td>&gt; 500 beds</td>
</tr>
</tbody>
</table>

Table 1: Research sites

Yin (2009) proposes that research sites must predict either similar or contrasting results for predictable reasons. Subsequently, six hospitals with different stages of EMR implementation have been selected carefully. To gather data, semi-structured interviews with 20 physicians have been conducted. The proposed factors influencing physicians’ adoption behaviour discussed above have been framed in a semi-structured questionnaire. For instance, the questionnaire encompasses questions on their outcome expectancies and how they influence their willingness to use EMR systems compared to the paper-based approach. The interviews lasted between 45 and 90 minutes and concluded with an open question to make sure that topics beyond the initial propositions could be addressed by the interviewees. Unfortunately, only 80% of the physicians have agreed with transcribing the interviews. The statements of the other 20% doctors have been reconstructed and served as a complement to the data sets. In addition, usage of EMR systems was observed in the hospitals which have deployed at least a parts of an EMR system to ensure data source triangulation. Including observation notes and interview transcriptions, the data collected consists of about 75,000 words.
Case study data were analyzed by using a mixed-approach consisting of the pattern-matching technique (Yin, 2009) and tactics for drawing and verifying conclusions by Miles and Huberman (1994). Supported by a QDA-software (NVivo 9), data were coded and assigned to the proposed constructs, which served as a template for classifying and comparing empirical results. Following a triangulated research strategy, two researchers independently coded the data and formed clusters. As a part of this process, the researchers analyzed if categories beyond the proposed constructs emerge. To minimize bias, coding rules based on the proposals for the qualitative content analysis were applied (Gläser and Laudel, 2009). The process of sorting data, assigning them to the constructs and, in a second step, forming sub-categories was completed as both researchers concluded that no more evidences are being found. Finally, both researchers analyzed and discussed coded data for each case to identify important topics within each construct and to evaluate the influence on physicians’ adoption decision-making and usage behavior. In order to identify patterns within a case and/or between several cases, the pattern matching technique has been employed (Yin, 2009). Avoiding hasty conclusions, data were examined carefully to determine whether any disconfirming evidence appeared. In this regard, coded data were scanned for patterns that are matching the initial propositions and explanations for the observed effects. If necessary, the initial hypothesis have been revised and compared against rival patterns (Eisenhardt, 1989). This process was repeated until all rival findings could be resolved or explanations for these could be found.

<table>
<thead>
<tr>
<th>ID</th>
<th>Department</th>
<th>Position</th>
<th>Sex</th>
<th>Age</th>
<th>EMR-Experience</th>
<th>EMR implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>A01</td>
<td>Internal Medicine</td>
<td>Assistant physician</td>
<td>M</td>
<td>25 - 35</td>
<td>1 &lt; 5 years</td>
<td>Partly</td>
</tr>
<tr>
<td>A02</td>
<td>Internal Medicine</td>
<td>Assistant medical director</td>
<td>M</td>
<td>35 - 45</td>
<td>&lt; 1 year</td>
<td></td>
</tr>
<tr>
<td>A03</td>
<td>Internal Medicine</td>
<td>Assistant physician</td>
<td>F</td>
<td>25 - 35</td>
<td>1 &lt; 5 years</td>
<td></td>
</tr>
<tr>
<td>A05</td>
<td>Radiology</td>
<td>Assistant physician</td>
<td>F</td>
<td>25 - 35</td>
<td>1 &lt; 5 years</td>
<td>Yes</td>
</tr>
<tr>
<td>B01</td>
<td>Ophthalmic Clinic</td>
<td>Assistant physician</td>
<td>F</td>
<td>25 - 35</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>B02</td>
<td>Otolaryngological Clinic</td>
<td>Assistant physician</td>
<td>M</td>
<td>25 - 35</td>
<td>1 &lt; 5 years</td>
<td>Yes</td>
</tr>
<tr>
<td>B03</td>
<td>Otolaryngological Clinic</td>
<td>Assistant medical director</td>
<td>F</td>
<td>35 - 45</td>
<td>1 &lt; 5 years</td>
<td></td>
</tr>
<tr>
<td>B05</td>
<td>Urogynecology</td>
<td>Ward physician</td>
<td>M</td>
<td>25 - 35</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>B06</td>
<td>Haematology Oncology</td>
<td>Assistant medical director</td>
<td>F</td>
<td>45 - 55</td>
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<td>No</td>
</tr>
<tr>
<td>C01</td>
<td>Intensive Care</td>
<td>Assistant physician</td>
<td>F</td>
<td>25 - 35</td>
<td>&lt; 1 year</td>
<td>Yes</td>
</tr>
<tr>
<td>C02</td>
<td>Otolaryngological Clinic</td>
<td>Ward physician</td>
<td>M</td>
<td>25 - 35</td>
<td>1 &lt; 5 years</td>
<td>No</td>
</tr>
<tr>
<td>D01</td>
<td>Surgery</td>
<td>Medical director</td>
<td>M</td>
<td>&gt; 55</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>D02</td>
<td>Accident Surgery, Orthopedy</td>
<td>Medical director</td>
<td>M</td>
<td>35 - 45</td>
<td>1 &lt; 5 years</td>
<td>No</td>
</tr>
<tr>
<td>D03</td>
<td>Gastroenterology, Endocrinology</td>
<td>Medical director</td>
<td>M</td>
<td>&gt; 55</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>E</td>
<td>Internal Medicine</td>
<td>Assistant physician</td>
<td>M</td>
<td>25 - 35</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>F</td>
<td>Internal Medicine</td>
<td>Assistant medical director</td>
<td>M</td>
<td>35 - 45</td>
<td>1 &lt; 5 years</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 2: Sample interviewees
4 Findings

The data analysis was driven by two objectives: (a) examine the validity of the proposed constructs and (b) discover salient factors beyond these propositions. Based on this analysis some initial propositions were supported and some others were found to be not as relevant as expected.

Intention to use

Surprisingly, physicians’ statements regarding their intention to use EMR were very positive. In depth analysis showed that approx. 20% of the data refer to hospitals and corresponding physicians which are using a fully implemented EMR system (reflecting the degree of EMR-diffusion in Germany).

Large parts of the data were gained interviewing and observing physicians working in hospitals, where no EMR-system was deployed. Hence most of the interviewees have none or at least few EMR-experiences. Nevertheless, it is remarkable that the intention to use EMRs is higher than literature or weak EMR-diffusion in German hospitals suggests. Empirical evidence based on the initial propositions is discussed in the remainder of this section to examine salient factors influencing the samples behavioral intention.

Outcome expectations (performance)

In general, the emerged themes and findings are in line with those discussed in the literature review: expectations about stable, flexible, and reliable access to patient information, contributions to patient safety and enhanced productivity. In particular, the availability and data quality were emerging themes: “With the paper record I permanently have the problem that something is missing, something got lost, is filed at another place or that a diagnosis made in another department is not included” (B02). These expectations are strongly coupled with patient safety: “[...] it happens that the radiology people forget to indicate that a patient has a cardiac pacemaker; and if that would be somewhere noted it would be very helpful to get this information before you put the patient in an NMRI and kill her or him. So, it increases patient safety, yes”; and quality of care: “sometimes I have to call my colleagues because I just cannot read what they have written” (A05). Physicians’ performance expectations, covering about 13% of the entire transcript, provide support for the proposition that physicians’ outcome expectations impact their behavioral intention. In addition, interviews with physicians showing particularly high intentions were largely dominated by their performance expectations. Analyzing the implicit and explicit remarks of physicians’ behavioral intention, it turns out that especially the physicians with few or no EMR-experience have expressed clear requirements. These statements about the functionality of EMR systems often represent a kind of idealized conceptions. Analyzing the data, it becomes obvious that outcome expectations such as those reported above contribute significantly on physicians’ adoption decision-making process. This finding is also supported by cross case analysis: two of three physicians showing lower behavioral intention towards EMR usage, also had relatively low outcome expectations. Summarizing the findings, physicians’ perceptions about EMR’s potential to improve job performance have an impact on their adoption behavior.

Outcome expectations (personal)

As the subjects could not imagine any personal benefits using an EMR system, case study data do not indicate personal outcome expectation as a salient factor influencing physicians’ usage intention. One physician representatively stated: "I do not expect that it would improve or weaken my status or my reputation. I think there is no major influence" (E01). Regarding the substantial influence of supervisors over the careers of their subordinates, the data collected through this research seems not to be sufficient. For instance, case study data do not provide indications of how physicians with low intention using EMR are influenced by supervisors with a positive attitude toward EMR systems. Although some physicians were faced with this hypothetical case, no reasonable results were received. Turning a sharper focus on personal outcome expectations could be a valid recommendation for further research.

Self-efficacy

Self-efficacy was found to play an important role forming behavioral intention as well as influencing the performance-related outcome expectations. Physicians which outlined their general computer
self-efficacy with statements like “I have grown up with PC’s, that’s not a problem” (A03), “I would prefer typing into a PC system” (B03) or “for me a computer is always something helpful” (A02), altogether expressed very high intentions to use EMRs. In addition, these physicians have outstanding expectations about gains in their job-performance due to EMRs. For instance, a physician showing rather moderate outcome expectations also expressed relatively low self-efficacy perceptions. Furthermore, training using IS turns out to increase physicians’ self-efficacy perceptions.

Affect
This case study suggests that usability, reliability and short response-time significantly contribute to physicians liking for using EMRs or their aversions. In addition, almost all physicians stated that they enjoy systems which are easy to use. Physicians who are enjoying their work with an EMR reported an intense use of the system. Therefore, it can be stated that affect has a slight impact on physicians’ behavioral intention; at least to the extent that joy of use impacts the degree of willingness to use.

Anxiety
In contrast to affect, case study data indicate anxiety as a strong factor influencing physicians’ behavioral intention. Even though some physicians expressed anxieties like “The greatest anxiety in a clinic is always that the EMR crashes and thus, causes the whole clinic to halt” (B02), reliability and data security as well as privacy related anxieties are less dominant. These anxieties seem actually to be surpassed by the potential benefits of EMRs and a fundamental faith in technology, especially in technology-heavy operative disciplines such as surgery, radiology and intensive care units. Nevertheless, case study data provide evidence that anxieties like the fear of a higher probability of legal and liability consequences (e.g. knowingly or unknowingly falsified entries) and the fear of restrictions in their professional autonomy has an impact on physicians’ intention to use EMRs. With respect to the latter, on the one hand, physicians perceive a threat to their autonomy from a higher dependency on IT due EMR usage. For instance, physicians argued that they have to hand important elements of their work over to the IT (e.g. the content of forms). On the other hand, physicians fear also limitations in their decision-making authority due to regulations on their work induced by an EMR system. For instance, one physician (A02) had concerns that an EMR system may limit his control over drugs (e.g. dosage or drug selection). Physician C02 claimed that EMRs have the potential to push hospitals in a direction where administration and IT departments are able to specify the principles of their work. In his point of view, this form of limiting a physicians’ autonomy is one of the major aberrations in German. Medical director D01 thought this idea even further. He argued that EMR systems’ have the potential to disclose their working methods and structure. Hence, he fears that the diffusion of EMRs could lead to cost pressure and, in turn, to a larger burden to treat patients even faster. In the long-term, this could lead physicians to abandon their territories, and, thus, to a loss of autonomy and a loss of authority. Although the strength of the impact of these anxieties on behavioral intention could not be examined sufficiently, 75% of the physicians reported anxieties related to EMR usage. Overall, there is strong evidence that anxieties, in particular anxieties related to decrease professional autonomy, do indeed impact physicians’ adoption behavior.

Peers’ use of EMR
Following the analysis of the transcripts, it seems as peers’ use of EMR does not have any impact on their behavioral intention: only physician B01 mentioned that his peers’ usage behavior influences him. On the other hand, we found something remarkable analyzing the outcome expectations of physicians of different departments in the hospital. Physicians using an EMR system and physicians working with traditional paper-based records expressed very similar outcome expectations. Coding reveals particularly high expectations for improvements in availability and quality of data. It is likely that the experiences of the physicians working with an EMR influence the expectations of the ones using paper-based records. Hence, even if there is no recognizable impact of peers’ use of EMR on physicians’ behavioral intention, peers’ use might impact their outcome expectations.
Organizational IT capability

Beyond the proposed constructs, analysis revealed another salient factor: organizational IT capability, to be specific physicians’ quality perceptions on infrastructure and technical support. For instance, imaging that an EMR replaces the paper file, a physician claimed that she is concerned about the competence of the IT-responsible in her department: “one sometimes has the feeling as if he does not fully understand it” (B01). Another example for physicians’ perceptions of the responsiveness of their IT support, physician A02 complained that their IT-responsible stated that computers have no business being in a hospital. In addition, almost all the physicians actual not using an EMR addressed the need of sufficient hardware, both in qualitative and quantitative sense. In particular, they underlined the need of PC workstations, better mobile solutions, for every working physician and sufficient infrastructure with short response-times when traditional paper-based records are replaced by EMRs. Summing it up, case study data bring forth strong empirical evidence that physicians’ perceptions on the hospitals respectively departments’ IT capabilities influences their adoption behavior.

5 Limitations and Further Research

Although research sites have been selected carefully, the number of interviews (20 physicians) cannot be regarded as representative for all physicians in German hospitals. While, the qualitative approach was reasonable and the subject group provided a suitable sample of age, gender and position of the interviewees, the next step should be to conduct quantitative research to test the validity of the findings of this research. Furthermore, some other implications for possible further researches derived from this current study. An adapted SCT model based on the empirical evidences supporting the initial propositions and an additional construct reflecting physicians’ perceptions of organizational IT capability can serve as a starting point for further research, especially for a quantitative evaluation of the proposed constructs. For instance, a structural equation model based on the SCT by Compeau et al. (1999) needs to be developed. Beyond physicians and their adoption behavior, the case study data also suggest that a general resistance to change is present in German hospitals. This finding is supported by the results of a user survey in German hospitals, which revealed that 44% of IT users in German hospitals expressed a fear of change (VHitG, 2011). This general fear of change could be due to strong hierarchies and subtle demands for perfection especially to and among physicians (Vogd, 2004). We suggest that these characteristics may be caused by an organizational culture dominated by risk-avoidance strategies, which even mitigates if apparent benefits. Therefore, it seems applicable to focus explicitly on the resistance to change approach, either as a part of the more comprehensive adoption model or isolated from other constructs in a specific study. In addition, further cross-cultural research should examine if the suspected culture against change is special to organizational culture in German hospitals (e.g. rooted in the Prussian military tradition).

This case study also reveals that currently provided EMR systems often do not cover physicians’ needs and demands. Some physicians claimed that there is a gap between what vendors offer (in terms of EMR functionalities, for example) and what the users need. So, naming those factors, further research may be necessary to find out how hospitals may be sensitized regarding the necessity of EMR systems, how the IT department of a hospital should be equipped (technical and in personnel matter), which requirements an EMR system should meet to fulfill the needs of the users, and which training efforts are needed.

6 Conclusion

This study revealed insights on the influential factors for physician’s adoption of EMR systems. The analysis examined salient factors influencing physician’s usage behavior. Performance-related outcome expectations and anxieties have been identified as the most relevant cognitive and emotional factors, whereby the expected benefits clearly outweigh the potential risks and threats. As it provides usable findings about relevant factors shaping physician’s perception of EMR systems, this paper can provide a basis for further research in this particular field. Furthermore, the findings
highlight the effect of physician’s sensitivity for organizational conditions, which should be examined further.

References


VHitG "Branchenbarometer 2011: Marketerhebung Zur Bewertung Und Verteilung Von It in Deutschen Gesundheitseinrichtungen."


