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## What Influences the Adoption of Electronic Medical Record Systems? An Empirical Study with Healthcare Organizations Executives

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# 1 Introduction and Motivation

An aging worldwide population and rising healthcare costs have contributed to the emergence of healthcare as an important area of research (Agarwal et al., 2011). In 2013, the global healthcare information systems (HIS) market was valued at USD 35.2 billion and it is expected to reach an estimated value of USD 53.2 billion in 2019 (Persistence Market Research, 2014). Electronic medical record systems (EMRS) are part of HIS. An EMR is a comprehensive record of patients' health-related electronically maintained medical information (Ludwick and Doucette, 2009; Bates et al., 2003). EMRS provide the opportunity to digitize patient records and enable the creation, storage, and access to healthcare information at the patient level and point of care (Davidson and Chiasson, 2005). A broad adoption of EMRS can improve the quality of care, lead to major health care cost savings and reduce medical errors (Hillestad et al., 2005). However, healthcare executives are often faced with high initial investment costs, uncertain revenues and high initial time investment during the implementation phase (Ford et al., 2006; Miller and Sim, 2004). User resistance and cost-benefit asymmetry reported as major barriers to EMR adoption and success (Fichman et al., 2011; Leidner et al., 2010). Executives might also risk of losing productivity during transition from paper-based records to electronic records (Gans et al., 2005).

In this study, we explore a comprehensive EMRS solution from a leading system and software manufacturer in Germany that is used for different outpatient healthcare services, i.e., elderly care, nursing, intensive care and rehabilitation. The manufacturer reported that in this healthcare sector in Germany most medical records are still stored on paper, but reasons for the rejection of this technology are still largely unexplored (Goh et al., 2011). Many healthcare organizations are lagging behind in the adoption of electronic documentation (Venkatesh et al., 2011). Therefore, the purpose of this paper is, to investigate critical factors affecting the adoption of EMRS for outpatient healthcare organizations in Germany from the executive perspective. In preliminary qualitative interviews, we asked executives from different outpatient healthcare organizations in Germany, who are already using EMRS, about their experiences and particular benefits and failures of different software solutions to identify important success factors. It became apparent that price value and technology readiness might play an important role in measuring IS success in this research context. According to Venkatesh et al. (2012), price value represents the users' cognitive tradeoff between the perceived benefits of the EMRS and the monetary cost of purchase. Technology readiness refers to person's propensity

to adopt and use new technologies to accomplish goals at work and in leisure time (Parasuraman, 2000). In this research, context technology readiness takes an executive's personality traits regarding the tendency to use EMRS into account. Whether an EMRS becomes a meaningful and successful implementation depends on various factors. The research field of IS success measurement is a heterogeneous and complex area that represents different definitions and perspectives of IS success. The central theoretical basis in this field of research is the DeLone and McLean IS success model (DeLone and McLean, 1992).

We examine the IS success of EMRS for outpatient healthcare organizations for several reasons. First, in IS literature, the IS success model has been shown to be an important instrument, because evaluation of the effectiveness or success of IS is a crucial aspect of research and practice (Petter et al., 2012). Given the extensive application of the IS success model to evaluate different types of IS (Petter et al., 2008), it was expected that it would be useful in the healthcare context. A few studies have shed some light on IS success in healthcare (Raghavan et al., 2010; Bossen et al., 2013; Petter and Fruhling, 2011, Win et al. 2008) and critical success factors for the implementation and use of EMRS (Tong and Teo, 2009; Ben-Zion et al., 2014; Fritz et al., 2015; Davidson and Chiasson, 2005). This paper can be seen as a first step towards understanding the influence of IS success and related factors price value and technology readiness on a comprehensive EMRS. Second, because researchers have called for more rigorous empirical research from the perspective of healthcare executives to advance the quality and its impact on user satisfaction of EMRS (Chang et al., 2012; Eysenbach et al., 2002), these factors have been shown to be main predictors of success (Barody and Hansen, 2012). Third, due to the global demographic changes of an aging population, treatment and care in different areas of outpatient healthcare is becoming increasingly important (Singh, 2008). We believe that in this emerging research context a global orientation is beneficial for researchers and practitioners alike.

This paper makes a theoretical contribution by conceptualizing the adoption of EMRS and that the perceived price value and the technology readiness of healthcare executives play an important role. To evaluate the findings of the preliminary interviews, we conducted an empirical quantitative survey with healthcare executives in Germany based on an adapted IS success model. In this study, we focus on the quality dimensions of the IS success model and the influence on the intention to use and user satisfaction. Therefore, net benefits are not considered in our research model. This is due to the quantitative nature of our model. We explore the following research question:

- Which are important factors affecting the adoption of electronic medical record systems for outpatient healthcare organizations?

This paper is structured as follows: first, we provide a theoretical basis and outline the results of the preliminary qualitative survey with executives from different outpatient healthcare organizations. As a result of the findings of the interviews and perceptions from literature as well, we derive the hypothesis of our conceptual model. After presenting the model development and analysis, we report and discuss the results of our empirical study. Together with findings we obtain from preliminary interviews with executives from outpatient healthcare organizations we give implications for research and practice. Finally, limitations and conclusions are provided.

## **2 Foundations, Conceptual Basis, and Hypotheses Generation**

### **2.1 Electronic Medical Record**

An EMR is a computerized health information system focusing on patients. It is defined as the medical detailed record about patient's information and conditions such as medical history, medications, allergies, intolerances, laboratory test results, vital signs, checkup reports, and patient demographics like age and weight etc. (Ludwick and Doucette, 2009; Bates et al., 2003). EMRs mostly gather, create, and manage data about a patients' treatment process by employees from a single healthcare facility, outpatient environment and clinicians (Bhargava and Mishra, 2014; Garets and Davis, 2006). Healthcare professionals use EMRs to perform operational functions such as order entry, test result reporting, and clinical guidelines practices depending on which functions are implemented in a given healthcare organization (Davidson and Chiasson, 2005). Therefore, EMRS can potentially play an important role in the performance and productivity discourse. Even as the adoption rates of EMRS grow (McInnes, 2006), many healthcare organizations are lagging behind in the adoption of electronic documentation (Venkatesh et al., 2011). Most medical records are still stored on paper, which means that they cannot be used to coordinate care, routinely measure quality, or reduce medical errors (Hillestad et al., 2005). Perry et al. (2014) compared EMR vs paper-based records in emergency departments and found out that electronic recording took longer than paper records and that practitioners were not satisfied with using EMRS. The reasons for the partial rejection of EMRs are still largely unexplored (Goh et al., 2011). EMRS have the potential to reduce the workload of healthcare professionals (Barkhuysen et al., 2014) and a broad adoption of EMR may improve the quality of care (Aron et al., 2011; Devaraj and Kohli, 2003), enhance the efficiency of care delivery (Agarwal et al., 2010; Dranove et al., 2012; Goh et al., 2011), lead to major healthcare cost savings and reduce medical errors (Hillestad et al., 2005). So far, the greatest importance in research articles is attached to measuring and forecasting

organization. The EMRS manufacturer reports that there is a tendency to large outpatient healthcare organizations as opposed to several small ones, which changes the requirements on EMRS. In large organizations, coordination of multidisciplinary care could play a more important role. To adapt the EMRS to these changing requirements is a major challenge (Oborn et al. 2011). As the results of our empirical study show, the EMRS has to fulfill certain quality criteria considering the cost-benefit ratio. The higher the executives perceive price value, the higher their intention to use. According to Dodds et al. (1991) it is essential that the EMRS manufacturer communicates the high quality of the product to address and increase the perceived value. In this regard, it is of decisive importance to support the transition process. As the preliminary interviews revealed, the majority of executives had difficulties with the transition from paper-based records to the EMRS. The empirical research results further show that the intention to use is significantly influenced by technology readiness. According to this, it is mandatory to support the executives to implement the EMRS in their organizations. Additionally, there is still a need for specific and targeted employee training seminars to push through this adoption barrier. For executives, it is substantial to include the employees in the decision-making process and therefore they should not pursue a top-down-approach. Satisfied healthcare professionals might be an important factor for an enduring success of an EMRS. Furthermore, it might be a good strategy of an EMRS manufacturer to offer solutions suitable for any size of organization. If the application is too complex and the transition from a paper-based to an IT-based documentation system too difficult, partial solutions could help both, organization and manufacturer.

## **5 Limitations and Conclusion**

This study is subject to the following limitations, which offer perspectives for further research. First, considering the focus of the study, one limitation refers to the context of the EMRS, which was chosen for the survey. The EMRS of choice is being applied in outpatient healthcare organizations in Germany. Other application forms of EMRS might present different results. Further research is recommended to repeat this study with healthcare executives from other healthcare services in order to gain further insights for IS healthcare research in general. Second, the data was collected through an online survey, which was sent to healthcare executives with an email newsletter of the EMRS manufacturer. Hence, it must be taken into consideration that online surveys are considered to be liable to a self-selection bias (Kim et al., 2002). Third, with regard to generalizability, another limitation relates to cultural and regulatory differences between distinct countries and regions, which is not part of this study.

The respondents of the survey are customers of the specific EMRS manufacturer in Germany, distributing products and services to German healthcare organizations. Therefore, measures in other countries and regions may lead to different results. Further research should be conducted in other countries to generate insights into the context of cultural and regulatory differences in terms of the examination of adoption and success factors of EMRS.

In this paper, we analyze adoption and success factors of electronic medical records by surveying healthcare executives. For this reason, the DeLone and McLean IS success model is extended by the factors price value as well as technology readiness and tested within a healthcare context with a focus on outpatient healthcare organizations in Germany. The role of price value and technology readiness for IS success is identified by conducting preliminary qualitative interviews with outpatient healthcare executives. To address the research question, hypothesized relationships of the proposed causal model are tested to analyze collected data using structural equation modelling. We find out that price value and technology readiness are significant determinants of intention to use and further indicate that system quality is a stronger predictor of user satisfaction and the intention to use than information quality from the perspectives of healthcare executives.

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