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The Use of Case Studies in Systems Implementations Within Health Care Settings: A Scoping Review

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Abstract. There is little evidence available in the research literature as to how to undertake an implementation process that ensures electronic medical record (EMR)/electronic health record (EHR) implementation success (i.e. high levels of clinician adoption). The research literature has documented the presence of a direct relationship between how systems are implemented and their level of adoption by clinicians after implementation. In order to develop recommendations for systems implementation to enhance the level of clinician adoption and to ensure EHR/EMR success, researchers need to analyze implementation failures (i.e. where there has been a low level of adoption among clinicians) and successes (i.e. where there has been a high level of clinician adoption). This paper examines EMR/EHR system implementation in the context of adoption success, by conducting a scoping review of the EMR/EHR case study literature. The paper attempts to answer the following: "How does the published, case study research literature provide insights into the success and/or failure of EMR/EHR implementations?" Case studies can provide insights that allow researchers to identify best practice approaches to EMR/EHR implementations that may turn the tide towards reducing the number failed EMR/EHR implementation projects.

Keywords. Case Study, electronic health record, electronic medical record, implementation, success and failures

1. Introduction

It is no secret that Information Technology (IT) is recognized as an important tool for improving patient safety and the quality of patient care that is delivered. Health care organizations are investing in system solutions that can be leveraged across the continuum of care [i.e. electronic medical records (EMRs) and electronic health records (EHRs)]. The importance of EMR's and EHR's and how they have evolved over the past 30 years has been well researched and much literature is available in this area. The value and benefits of an EMR/EHR are therefore well known; however, implementation methodologies, change management approaches and adoption processes all need further research into their use to increase future clinician adoption of health technologies. Kitzmiller et al., [1] estimates that 80% of healthcare information

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technology (IT) projects fail. One third of healthcare IT are never installed and most projects are typically 100% over budget and a year behind schedule. Research is required in the project management field in order to reduce the number of project failures so that healthcare IT projects do not continue to drain resources away from the healthcare system, where resources are already scarce. The research literature has documented that implementations of information systems continue to be a struggle and challenge. Therefore, researchers need to study what management approaches, implementation methodologies and processes are used in healthcare IT projects. There is little literature available about healthcare IT failures (i.e. what failed, why it failed, what strategies organizations employed to turnaround a failed project, and what to do differently next time when implementing a healthcare IT system). More longitudinal and qualitative studies need to be conducted. Case studies offer an opportunity to learn about what leads to success or failure where IT implementation processes in health care are concerned.

Case study research is gaining increasing credibility as a suitable research methodology in the software engineering field McGloin; Verner, [2, 3]. Case studies are a form of qualitative research that is concerned with explaining a phenomenon focusing on human behavior, opinions and attitudes, and the effects that events have on people and cultural influences. All of these aspects of healthcare IT implementations need to be considered when attempting to understand more about implementation processes Baxter & Jack; Verner [3,4]. Therefore, a sociotechnical approach is needed. Sociotechnical approaches allow for an understanding of the independent linkages between complex social and technical components of IT implementation processes. There is a need to focus on both human actions and interpretations surrounding the development of system implementation methodologies, and case studies allow for this Feldman et al., [5]. According to Verner [3], successful implementations are not solely concerned with technical solutions, but with organizational issues, project management and human behavior. Case studies provide an understanding of what actually happens in the real world. This knowledge is required in order to make the adjustments needed in implementation strategies and processes (only then can an attempt be made at reducing such high failure numbers in the implementation of systems within health care). To understand implementation strategies and processes being applied to successful and failed systems projects in healthcare IT and to identify project management approaches that can improve systems implementation of EMR/EHR's, case studies represent an opportunity to look at real world examples of how to gather data and answer questions about healthcare IT implementation successes and failures.

2. Data Sources and Selection

2.1. Search Strategy

A search strategy was developed to retrieve relevant studies from MEDLINE, Psychlit® and Google® Scholar databases. The databases were searched using two queries that combine terms related to case studies, the "EMR" or "EHR", implementation and "case study". The search was limited to English language material

from 01/01/2010 to 31/12/2015. These dates were used to collect more recent articles around implementations.

2.2. Selection

To be included in the review, each research article needed to meet the inclusion criteria set out by the researchers. First, the study had to discuss the implementation process of an EMR/EHR (i.e. prior to implementation, during the implementation or post implementation). Secondly, only primary studies were considered. Thirdly, a case study method was used to evaluate and discuss system implementation, and fourthly, the case could consist of single or multiple units. Articles relating to specific illnesses and diseases, and articles relating to the implementation of other systems (i.e. not EMR/EHRs) as well as newspaper articles, book reviews and dissertations were all excluded. A single reviewer performed an initial review of all the results of the search and rejected those that did not meet the criteria based on that initial review of the titles and abstracts (n = 276).

2.3. Data Extraction

Once a final set of studies was identified, general study characteristics were extracted from those papers discussing case study methods and EHR/EMR implementations. Next, the actual case study papers were reviewed and data were extracted based on the evaluation criteria identified. Data sources being used were extracted and analyzed as well as the setting in which the case study took place, including participants and sample sizes used. This information was helpful in understanding if the current literature on EMR/EHR implementation that used the case study method was done using criteria that were used to judge the quality of case study research. If the study was consistent with these criteria and published data on EMR/EHR implementations as a basis for developing a systems implementation approach the information extracted from the study was entered into a table.

3. Data Synthesis

3.1. Selected Articles and Characteristics

Overall the search yielded 276 potential articles for consideration, of which 57 were selected for the review. Many articles were rejected during the initial title and abstract review because they were studies not related to EMR/EHR implementations or case studies that were not specific to health care. From the 57 articles selected, 30 were used to develop the evaluation criteria on which the case studies would be critiqued and 27 were used on which to perform the analysis. After a full review of the papers a further 12 were excluded as duplicates, 4 were excluded as they were not about implementations and 2 were excluded, as the full article could not be accessed. Therefore, 19 studies were included to build the evaluation criteria and 20 studies were included in the review. A total of 39 articles were used.

3.2. Case Study Evaluation Criteria

According to Dresch et al., [6], the case study is a method that when properly carried out provides an in-depth understanding of certain phenomenon; however, before conducting a case study, the research question needs to be well considered. Each study was reviewed for a research question. Each case study was also evaluated to see what type of case study it was. The data sources used and the elements that a case study typically requires to have been met were extracted from each of the articles. Case study designs, as described by Yin [7], were used to evaluate the journal articles. Yin [7] identified several types of case study designs, including: explanatory, exploratory, multiple case studies and single case studies. The author also analyzed each case study design in terms of the value of the study findings, and the clarity of the presentation findings. The case study content was evaluated to ensure that the case was well defined, had a research question identified, and ensured sufficient data resources were being used. It was important for the methods used to select the cases, gather the data and analyze it were well described.

4. Discussion

4.1. Synthesis of Findings

Twenty case studies were analyzed. Eight studies contained multiple-cases. Twelve studies had single case study as the research study unit. From the eight multi-case studies, seven of these were exploratory and one was explanatory. The seven multi case studies contained a great deal of information and were found to be well written and informative, drawing comparisons that added value to the knowledge being created. From a systems implementation perspective, these eight case studies were of great value providing information about real-life success and failure factors as well as details about the implementation process.

For the data sources used within the case studies, it was found that case studies that used a combination of documentation analysis, interviews and observational study methods. Combinations of methods were of value in assisting with pattern matching and explanation building. Seven of the 20 case studies used all three data sources that led to informative case studies. These articles tended to add to the knowledge source on the topic and in some cases new processes and models were developed from the information analyzed within the case study. Those case studies that were descriptive in nature had an element of bias to them and the information was not presented with clarity on what the phenomena was. As well, there was little analysis in these studies. For a descriptive type case study to be used effectively either an in-depth analysis is required for a single case study or multiple case studies should be used.

Each case study was evaluated against the elements required to carry out a case study. It was found that from the criteria used, the majority of case studies met most of the elements. The quality of the case studies on the topic of EMR/EHR implementations is high and is conducted very well. All 20 papers met the criteria of having a conceptual framework; a hypothesis or theory and they all had a research

question. Nineteen of the 20 case studies provided explanations about the data sources used and the methods utilized from a study design and data analysis perspective.

Recommendations for successful implementations from the case studies included: the use of stakeholders throughout the process, ensuring executive support is provided, ensuring that the system was being designed and built as per the requirements, and for sufficient time to be spent on training clinicians. User involvement in the implementation lifecycle is paramount to the success of a project and sufficient time should be allocated to allow for adequate training.

In writing good, comprehensive, useful case studies using a best practice approach that adds to the body of knowledge should always include details about the case study. These details include the background of the organization, project history, project approaches, methodologies used, processes and any tools being used. A description of the setting in which the case study takes place should also be provided in terms of services the setting offers, geographic locations, population served, size of the facility, and number of patients that are seen. Details of any project approaches that are used across the case study setting should be collected including the scope and schedule. Approaches taken historically can be compared with approaches that have been used more recently. Approaches taken across different service models can also be compared and would be useful information to have. Project phases need to be analyzed in detail in the case study. All of the activities conducted in these phases as well as project deliverables can be used to compare implementations across case studies.

Pattern matching is a useful outcome of the case study method. Patterns can be analyzed in the context of the organization and human factors, implementation and outcomes to identify if there is a correlation between organizational influences, different implementation approaches, methodologies, processes and tools being used that affect outcomes positively or negatively. Success factors and barriers as identified by case study participants can be contrasted to understand the differences in perspectives between those implementing and those receiving the solution. When performing data analysis the following principles can generally be applied: analysis should rely on all relevant available evidence, analysis should address the most significant aspects of the case study and any prior, expert knowledge to further the analysis can be used by the researcher Abraham & Junglas; Bar-Lev & Harrison; Baxter & Jack; Calvo-Amodio et al., Cresswell et al., Cucciniello et al., Feldman et al., Follen et al., Gagon et al., Joukes et al [8, 9, 4, 10, 11, 12, 5, 13, 14, 15].

5. Conclusion

Research in the area of implementing EMR/EHR systems is important. Funding is limited in health care settings. Much money is wasted on healthcare IT projects that are initiated and not completed or those that fail. Identifying and developing an implementation approach using case study research methods would benefit health care organizations, by being able to leverage repeatable implementation processes that would not only be cost effective, but also time efficient. This may lead to completing projects as opposed to abandoning them part of the way through or spending on projects that are set up to fail. Developing an approach that supports projects seamlessly being transitioned over to the operations environment faster and more

efficiently with strong processes and tools to continue with system expansions would allow health organizations to deliver more under the constraints they continue to operate within. This area of health informatics requires further research.

Case study research methods can be used to understand the factors that influence healthcare IT implementation approaches, methodologies, processes and tools being used in industry and can be used to assess the outcome of these implementations. Case study research used along with other qualitative research data collection methods can provide a universal understanding of EMR/EHR implementations in a real context. The research available in the use of case studies in systems implementations specifically for EMR and EHR's shows that case studies can provide some useful and valuable insights, if done well. Case studies are well suited to the how and why questions that can be explanatory in nature. This makes case studies a perfect research method that can be used when investigating the high failure of IT projects in healthcare. Simons [16] states that it is important to tell a story of evolution, development and experience in a case study, this can lead to the development of new processes, approaches and models to be used in the successful implementation of EMR/EHR's projects. There is a bias in the literature towards case studies that speak to successful implementations. Case studies provide analyses of the challenges faced, what worked well and lessons learnt. There are few case studies available that speak to failed and abandoned projects. It would be useful for these research papers to be further reviewed as the knowledge obtained would be instrumental in creating implementation strategies that could reduce the number of system projects failing in healthcare. The proper use of case study material can be seen as the approach that is needed to develop evidence-based approaches towards resolving issues impacting EMR/EHR implementations and could help in turning failing projects into successful implementations where countries may be able to achieve appropriate targets and come to realize the benefits that are well discussed in the EMR/EHR area. Health organizations have a responsibility to the public to allow for failed implementations to be analyzed, perhaps anonymity when writing case studies can be used so as not to name the project or organization. Government could also make health organizations more accountable and request that they report all projects initiated for EMR/EHR's and their outcomes. Alternatively, independent consultants could be used to perform the evaluation to avoid further bias in the reports. Analysis of failed implementations is as important as successful implementations in order for the real obstacles to be identified and resolved. This paper provides an analysis of case studies and provide useful insights into EMR/EHR implementations. Case studies can be used to better understand the underlying reasons for failed and successful implementations. The use of case studies can strongly support the development of EMR/EHR best practice implementation approaches. There is great opportunity here for further research in the area of EMR/EHR implementations using case study research methods and approaches.

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