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IT support for clinical pathways—Lessons learned

R. Lenz[a,*], R. Blaser[b], M. Beyer[b], O. Heger[b], C. Biber[c], M. Bäumlein[c], M. Schnabel[c]

[a] Department of Computer Sciences, University of Erlangen and Nuremberg, Germany
[b] Institute of Medical Informatics, Philipps-University Marburg, Germany
[c] Department of Trauma, Reconstructive and Hand Surgery, University Hospital, Giessen and Marburg, Location Marburg, Germany

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ABSTRACT

Clinical pathways are an effective instrument to decrease undesired practice variability and improve clinician performance. IT-applications embedded into clinical routine work can help to increase pathway compliance. Successfully implementing such applications requires both a responsive IT infrastructure and a participatory and iterative design process aimed at achieving user acceptance and usability. Experiences from the implementation and iterative improvement of an online surgical pathway at Marburg University Medical Centre have shown that pathway conformance actually could be improved by the use of IT. An analysis of the iterative design process has shown that future pathway projects can benefit from the lessons learned during this project. Based on these lessons recommendations for developing well adapted interaction mechanisms are presented, aimed at improving process alignment. Our goal is to build up a library of tested reusable components to reduce the number of iterations for pathway implementation.

1. Introduction

There is an increasing consensus among healthcare experts that information technology (IT) can significantly contribute to improve healthcare quality and reduce costs, by timely providing patient information and relevant medical knowledge at the point of care [1,2]. Evidence based medicine (EBM) is aimed at integrating the best available evidence with clinical expertise and patient values [3]. Following the principles of EBM physicians are required to formulate questions based on patients' problems, search the literature for answers, sort the wheat from the chaff with regard to study validity, then apply the information to patients [4]. Yet, searching and evaluating current evidence is nearly impossible to practice in everyday clinical care [5,6]. Medical guidelines are aimed at supporting clinicians in interpreting existing evidence by providing recommendations for decision making based on literature reviews and existing evidence. Guidelines are aimed at enabling the physician to make informed decisions, rather than establishing a "cookbook medicine" as many fear [5,7]. The goal is that physicians know what they are doing when they individually estimate patients' chances and risks. Yet, there is a gap between the information contained in published clinical practice guidelines and the knowledge and information that are necessary to implement them [8,9]. Methods for closing this gap by using information technology have been in the focus of medical informatics research for decades (e.g. [9–11]).

Clinical pathways can be used to implement guidelines in a specific setting and reduce undesired practice variability [12]. In contrast to guidelines, pathways consider available resources like staff, level of education, available equipment, and hospital topology, and they typically also include a time component. While guidelines need to be consented among medical experts, clinical pathways require a consensus among different groups of hospital personnelinvolved in the patient

* *Corresponding author*. Tel.: +49 9131 85 27899; fax: +49 9131 85 28854.
E-mail address: Richard.Lenz@informatik.uni-erlangen.de (R. Lenz).
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treatment process. Thus, clinical pathways are planned process patterns aimed at improving both process quality and resource usage. Note, that a clinical pathway may deviate from a corresponding guideline (e.g. the specific hospital might not have the resources to follow a recommended procedure), and an individual treatment plan may again deviate from an existing pathway (e.g. due to some contraindication) [13].

Clinical pathways do not necessarily need any IT support but IT-applications can increase pathway compliance, as studies have shown the potential benefit of computerized decision support based on alerts and reminders [14–16]. To effectively improve clinical processes by IT-applications, however, their embedding in routine work practice is of paramount importance. Therefore, an IT-application that supports a clinical pathway should be integrated with routine documentation and with the hospitals electronic health record system in order to avoid redundant data entries. This, however, is only one factor contributing to successful process alignment. It is a well known fact that many IT projects fail and that multiple factors need to be considered to increase the probability for success [17,18]. Clinical systems and decision support systems depend on even more success factors than other systems [19]. A core reason is that an IT intervention in a healthcare setting will necessarily change a complex socio-technical system with often unpredictable results [20]. Consequently, IT projects in healthcare settings should be seen from a broad socio-technical perspective and should be accompanied with careful change management [21–24].

As the overall goal is process improvement, IT projects should be driven by demand rather than technology. Demand-driven system evolution requires a responsive IT infrastructure optimized for adaptation to changing requirements. At Marburg University Medical Centre we tried to approximate this goal by an extensible holistic Hospital Information System (HIS) [25–27]. Responsiveness is achieved through an integrated Rapid Application Development (RAD) tool [27,28] and agile programming techniques [29] with close end user involvement [26]. An iterative and participatory software engineering process has been developed to support continuous system improvement and process alignment [21,26].

In Ref. [30] we described our approach of utilising this infrastructure to implement a guideline-based clinical pathway for patients with proximal femoral fracture at the Department of Trauma, Reconstructive and Hand Surgery. The basic idea was to support major parts of the pathway by integrating patient-specific advice according to pathway recommendations into routine documentation. In this paper, we will have a closer look at the lessons learned during the iterative development of the pathway application and draw conclusions for future pathway projects.

2. Background and objectives

The clinical pathway for patients with proximal femoral fracture was systematically developed based on the results from a prospective study of the care process in 2001/2002 and it was initially introduced without additional IT support in 2003/2004 [30]. As a result, process management could be improved significantly. However, evaluation of the pathway documentation also showed that important information, like the side of a fracture or medication details, was still often missing. In order to further increase pathway compliance and improve documentation quality, an adapted IT-application was developed in 2004 which was aimed at bringing pathway-conformant recommendations to the point of care by reusing online routine documentation. As described in Ref. [30] the application is closely integrated into the hospitals electronic patient record system. It is based on workflow-enabled electronic forms, in which coded data from a central database are reused to place reminders and alerts or to automatically parameterise order sets. The pathway application can be viewed as a set of electronic checklists for pathway documentation. In order to decrease documentation overhead and to improve user acceptance the pathway application makes use of the principle "charting by exception" as proposed by Short [31]. The idea is to minimize documentation time by only recording deviations from the pathway (variance documentation).

In Ref. [30] we already described that pathway conformance could be improved by iteratively developing an IT-application for pathway documentation. A number of iterations was required to correct "intuitive" but counterproductive first attempts. The objective of this paper is to summarise our experiences made during the iterative software development for clinical pathway documentation and to draw conclusions for future pathway projects. The goal is to derive a set of generally applicable rules or recommendations for developing online support for clinical pathways, which may help to reduce the number of iterations and improve process alignment from the beginning.

3. Methods

According to our adapted software engineering process in Ref. [26] end users were intensively involved in the development of the IT-application. In addition, application development was embedded in an overall change management process in order to improve integration with the clinical workflow [21]. Thereby, user participation was seen as a dialogue where both users and software engineers learned from each other. User participation covered academic detailing for effective training of clinicians during clinical routine, qualitative user surveys and usability analyses, and continuous pathway controlling.

Systematic pathway controlling included continuous monitoring of the usage rate of the clinical pathway for patients with proximal femoral fracture, deliberate pathway deviation (variance documentation), and indicators for process quality (e.g. preoperative length of stay, time to first thromboembolism prophylaxis) and documentation quality (e.g. completeness and specificity of medication information).

In order to detect and analyse problems resulting from the IT intervention, controlling was expanded for a "methodical controlling". User feedback was evaluated and pathway documentation was compared with the actual treatment process to find out whether there were discrepancies

- between the documentation intended by the user and the actually documented data (e.g. do users unwillingly take over preselected default values?), or