

## Chapter 26

# Design Principles in Health Information Technology: An Alternative to UML Use Case Methodology

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### **ABSTRACT**

*Electronic health record (EHR) systems are said to be the cornerstone of a modernized health service. They improve health care, allow for integrated information, and help prevent lost and duplicated records as well as occurrence of administrative errors. Studies have consistently shown, however, that introducing EHR systems is a complex task, with difficulties stemming from technical designs that fit poorly with the details of clinical work practices. Given the evolving role of EHRs and the importance of information design, the need exists for further exploration of EHRs with the purpose of advancing innovations in health IT with the potential for significant positive effects on clinical practice. This paper focuses on a subfield of EHR studies that is working to establish a foundation for applying information design principles to implementation of health information technology in primary care settings. Without loss of generality, the paper examines a specific attempt that includes documenting patterns of clinician information use and developing “use cases” and tools for evaluating EHR implementation. The paper proposes an alternative approach based on a new flow-based specification methodology. It is shown that the method can be applied uniformly at the conceptual requirements level and simultaneously at the user interface level. The new method seems to be a viable technique for expressing situations arising in clinical work practices.*

DOI: 10.4018/978-1-4666-8756-1.ch026

## CONCEPTUAL FOUNDATION FOR ELECTRONIC HEALTH RECORD SYSTEMS

An electronic health record (EHR) system involves methodological collection and organization of health information in electronic format that is theoretically capable of being shared across different health care settings (Gunter, 2005). EHRs include several types of health information, including medical history, medications and allergies, laboratory test results, radiology images, age and weight, and billing data, generated and maintained within a healthcare institution to give patients, physicians, and care providers access to medical records.

EHRs are said to be the cornerstone of a modernized health service (Greenhalgh et al., 2009). They improve health care, allow for integrated information, and help prevent administrative errors and lost and duplicated records (Department of Health, 2008; Institute of Medicine, 2009). An EHR system can improve efficiency in workflow, effectiveness of healthcare services, and synthesis of patient data with medical evidence to support the decision-making process (Kupersmith et al., 2007; Stead & Lin, 2009).

In such systems, “the key challenge was seen as getting the design right, implementing the technology, and ensuring that clinicians used it” (Greenhalgh et al., 2009). Some researchers have reservations about such a holistic approach to organizing electronic health information (Avison et al., 2007; Kreps & Richardson, 2007), however, and failures in this context have been reported recently (Røed, 2011).

Nevertheless, despite apparently negative conclusions, research in this area is still quite extensive for several reasons, including the fact that

*There is considerable scope for more flexible and technologically sophisticated forms ... (e.g., mobile devices) to overcome current limitations. But for this to happen, technology [re]design must*

*occur in intimate proximity to the work process and actively involve users and potential users ... (Greenhalgh et al., 2009, referencing Hartswood et al., 2003; Oudshoorn & Pinch, 2005).*

Also, according to Armijo et al. (2009),

*Given the evolving role of EHRs in clinical practice and the importance of information design and display to meaningful use, further exploration of EHR usability ... [is] an opportunity for innovation in health IT with the potential for significant impact on clinical practice.*

## Problem and Proposed Solution

Studies have consistently shown that introducing EHR systems is a complex task in which difficulties arise because “technical designers typically missed these subtleties and produced artefacts that fitted poorly with the situated nature of knowledge and the micro-detail of clinical work practices” (Greenhalgh et al., 2009). Currently, efforts have been insufficient to evaluate EHR systems in terms of identifying best practices in information design. Recognition of usability as a critical issue is inconsistent, and objective evidence is insufficient for design considerations. Hence, the need exists for standards for the design of user interfaces to guarantee efficiency and quality (Armijo et al., 2009a). Greenhalgh et al. (2009) identified a number of “tensions” in relation to users, organizational context, clinical work, the process of change, implementation success, and complexity and scale.

Many approaches and solutions have been proposed related to the establishment and development of EHR systems. An extensive (600-page) review in this area can be found in Car et al. (2008). The present paper focuses on a narrow subfield of EHR systems concerned with establishing a foundation for the application of information design principles to the use of health information technology in primary care settings. Without loss

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