# User Requirements Meet Large-Scale EHR Suites: Norwegian Preparations for Epic

Gunnar ELLINGSEN[a,1] and Morten HERTZUM[b]
ª *UIT – The Arctic University of Norway, Tromsø, Norway*
ᵇ *University of Copenhagen, Copenhagen, Denmark*

**Abstract**. Electronic health records (EHRs) are becoming the norm in healthcare. Typically, these EHRs are large-scale suite systems. The up-front presence of ready-for-use EHR suites changes the role of user requirements and the conditions for deciding which requirements to include in the final contract. In this paper, we investigate how user requirements are negotiated in the ongoing preparations for the implementation of Epic throughout the region of Central Norway. User requirements shape vendor selection but they are also shaped by the vendors' existing EHRs and by the requirements of the selected vendor's other customers.

**Keywords**. Electronic health record, Epic, implementation, user requirements

## 1. Introduction

Electronic health records (EHRs) are becoming the norm in modern healthcare. Typically, these EHRs are large-scale suite systems with many modules and extensive configuration facilities [1]. Examples include Cerner, Epic, and InterSystems. In the initial procurement phase healthcare organizations choose among vendors that already have EHR suites ready for deployment. Subsequently, healthcare organizations negotiate configurations, extensions, and revisions with selected vendors. The initial presence of ready-for-use EHR suites changes the role of user requirements and the conditions for deciding which requirements to include in the final contract [2]. We investigate how user requirements are negotiated in the ongoing preparations for the implementation of Epic throughout the region of Central Norway. The new EHR in Central Norway is not restricted to its hospitals but will also cover its municipal healthcare services, that is, general practitioners (GPs), home care, and nursing homes. Due to the heterogeneity of these healthcare providers, the user requirements are many and diverse. It is essential to convey these requirements to the vendors. After a single vendor has been selected it is especially important that this vendor comes to understand the requirements. At the same time the requirements – and the implementation preparations in general – will be strongly shaped by the EHR suite already available from the vendor. The outcome of this process is still open [3].

We ask: *How are user requirements negotiated and shaped in the meeting with large-scale EHR suites?* Empirically, we ask this research question in relation to the Epic implementation in Norway, but the process is not specific to the Norwegian case.

---

[1] Corresponding Author: Gunnar Ellingsen, E-mail: gunnar.ellingsen@uit.no

## 2. Method

The study takes an interpretive research approach [4,5]. The data consist of interviews and publicly available documents. We conducted six interviews with top management in the Health Platform program, which is responsible for the Epic implementation in Central Norway. The director of the program was interviewed twice. The interviews were audio-recorded and transcribed for analysis. Media coverage and informal discussions with project members provided supplementary input. The data were collected in the autumn of 2018, about half a year before the contract with Epic was signed.

## 3. Case

The Health Platform is a regional program owned by the Central Norway Regional Health Authority and Trondheim municipality. It aims to acquire and implement an EHR for the whole region, including all the hospitals, GPs, nursing homes, and home-care services. By including the municipalities, the health authorities want to make the Health Platform a pilot for the long-term national goal of establishing a nationwide EHR functionality, "one citizen - one record" [6].

The Central Norway region includes 44,000 healthcare professionals and an approximate population of 720,000 citizens. There are 3 hospitals whereof the largest is the university hospital, St Olav's Hospital, located in Trondheim. St Olav's Hospital is already at a high level of digitization. In contrast, the level of digitization varies substantially across the GPs, nursing homes, and home-care services, where particularly the GPs already have well-working systems at their disposal. The Health Platform has identified 80 current information systems that will be replaced by the new EHR. In addition, 160 integrations between the EHR and other systems must be developed. Trondheim municipality will be in the first wave of implementation, while the rest of the 84 municipalities in Central Norway have the option to opt in after that.

### 3.1 The bid for tender

The invitation to tender was announced in August 2016 with an upper limit for the contract of NOK 2.7 billion (EUR 270 million), including licenses, the vendor's services, and 10 years of maintenance [7]. The time schedule for the main activities was as follows: vendor prequalification in 2016, dialog phase with selected vendors in 2017/2018, contract with a specific vendor signed in 2019, and implementation and go-live in 2021.

From early on, extensive user participation was identified as crucial to the success of the program. When the acquisition process started, 400 clinicians from municipalities and hospitals across the Central Norway region became involved. These clinicians participated in 101 workshops in which they described what they valued about their current information systems, what challenges they currently experienced, and what was missing. The outcome of these workshops became the basis for the requirements specification, which amounted to 4000 user requirements.

A total of 11 EHR vendors applied for prequalification in 2016. In February 2017, the Health Platform sent out the final information for the procurement of the future HER

to the five prequalified EHR vendors: Cerner, CSC Scandihealth (later renamed to DXC Technology), Epic, InterSystems, and Tieto. The tender was based on the user requirements and a dialogue with the vendors about how they planned to meet these requirements. The bids submitted by the vendors were evaluated by project members and by people from the line organization. In May 2017 four EHR vendors submitted revised bids, and in January 2018 the number of vendors was reduced to two, namely Cerner and Epic. However, Cerner decided to withdraw, because they could not see a business case for making a bid that met all requirements in the functionality for the municipalities. The contract between the Health Platform and Epic was signed in March 2019.

## 3.2 Negotiating the development of functionality

In spite of the substantial functionality and configurability of Epic, some new software development was needed, particularly to extend Epic with additional functionality for the municipalities. The Health Platform requested that Epic developed a pregnancy record, a medication module for home care, and support for patient-related administrative procedures such as which benefits the patient shall receive. Although Epic initially responded positively to these requests, things became more complicated closer to the deadline for signing the contract. The Health Platform had to work hard to convey Norwegian routines to Epic, particularly in relation to the administrative procedures.

A lot of functionality is dependent on integrations between Epic and other systems. In the municipalities, the systems that need to be integrated with Epic include Transmed at the security centers, employee administrative systems, economy systems, and the roster module in the administrative resource management system. The need for integration invoked questions about the location of certain data and functions. For example, the GPs' current EHR stores their economy data. As a result, all claims against, for example, the Norwegian Labor and Welfare Administration are handled in their EHR. In addition, the GPs have billing systems where patients pay for their GP visit. The vendors of the billing systems handle debt collection from patients who have not paid what they owe according to the data in the GPs' EHR. Epic was not familiar with such a setup, but with one in which the billing system handled all economy data. It requires considerable work to develop the integration between Epic and the billing systems.

To ensure the continued evolution of the EHR after its implementation, the Health Platform management envisions to increase its collaboration with other European Epic customers. This is in line with the Epic strategy for development. As a means to establish common requirements, Epic encourages its customers to collaborate on requirements for new functionality. For example, there is currently a collaboration between Epic customers in Switzerland and Denmark about the development of functionality for medication management. These collaborations mean that new Norwegian user requirements will have to be brought into alignment with those of other customers as well as to be negotiated with Epic. A new version of the entire Epic system is rolled out to all customers four times a year; the philosophy is that all new developments are available to all customers.

## 3.3 Configuring the system

Overall, the Health Platform management was satisfied with the configuration facilities in the system. The Health Platform was, for example, pleasantly surprised when they

learned that Partogram (graphical maternal and fetal data) functionality could be configured and, thus, did not have to be developed from scratch by Epic. However, Epic promoted configuration proactively, and sometimes at the expense of development. An illustrative example is the Health Platform's request for offline EHR functionality in the ambulances. When ambulance personnel lose online contact with the EHR, they should still be able to read and update the EHR in an offline mode, and these updates should then be synchronized with the online version later. Epic argued that the development of offline functionality would delay the project. As an alternative, they suggested that they could configure the existing user interface of the ambulance module in a way that would partially cover the requested functionality. After conferring with the relevant clinical disciplines, the Health Platform decided to let go of offline functionality and settle for the solution that Epic offered.

Configuring the Epic system in the start-up phase involves lots of decisions about how the system should function. While Epic can be configured differently for different settings (e.g., GPs, home-care services, hospitals, and nursing homes), a great deal of standardization of work processes is necessary to achieve the goal of an all-compassing EHR that can support inter-organizational information exchange and workflows. Standardization can also be a means of getting rid of unwanted variation in treatment and care. For a given patient condition and a given step in, say, an outpatient work process, the system could for example enforce the prescription of certain drugs or tests, and in a specific order. The Health Platform has established an extensive formal decision structure to decide on such standardizations, but some decisions will also require top-level approval because the standardization has far-reaching organizational consequences. For example, the Health Platform is considering to enforce a fully electronic medication management process (ordering, dispatching, distribution, dispensing, and administration), which currently is only supported by paper-based routines.

The formal decision structure will be pertinent to a successful implementation. During the preparations for going live in 2021, it is estimated that Epic will raise something like 8000-12000 questions about the details of how the system should be configured. The customer must respond within a 10-day deadline, otherwise Epic will choose the default configuration for the area in question.

After Epic has been implemented, key users (and not the vendor) will be responsible for the continued configuration of the system. In Epic terminology, these clinicians are called "physician builders". They will become responsible for configuring the layout of the system, its information flows, and its support of workflows. During the configuration of the initial Epic setup the physician builders will work together with Epic personnel. In a subsequent regional organization, the physician builders will continue to work on optimizing and streamlining work processes. To prepare for this task, the physician builders will attend a training course of up to six weeks and will subsequently work full-time as physician builders in Central Norway. This policy is intended to ensure flexibility for the users and to reduce dependence on the vendor.

## 4. Concluding discussion

In the initial procurement phase of EHR suites, the customer has the option of choosing between different vendors based on a detailed requirement specification. The vendors present what functionality they offer, and the development of new functionality is

negotiated. In this phase, the vendors must be able to respond satisfactorily to the customer's demands. However, after the vendor selection the preparations for implementing the system are strongly shaped by the product already available from the vendor, including its configuration possibilities. During these preparations the customer's (and future users') involvement consists to a large extent of responding to opportunities provided by the vendor, such as to queries about configuration choices. In this process the requirements specification may face considerable competition and initial requirements may be revised on the basis of descriptions and demonstrations of the vendor's suite system [8]. We are not claiming that requirements specification is no longer important but that its main role is in vendor selection.

After go-live the vendor will most likely be less available, both for system development and for configuration. New functionality that requires development must be aligned with other Epic customers along the lines of the current collaboration between Switzerland and Denmark. By encouraging such collaborations, the vendor shifts it onto its customers to reach agreement about how the system should evolve [9]. This way alliances and shared – or conflicting – interests among the customers will shape the user requirements that the Health Platform can present to Epic. Requirements specific to single customers will likely receive low priority from Epic or be considered topics for configuration (by the individual customer) rather than development (by Epic).

Regarding future configuration, it is expected that the physician builders do this. However, given that many decisions about configuration will have to be made before go-live, it is an open question to what extent it will be practically possible for the physician builders to make larger configurations later. After all, some of these decisions must be made in a complex decision structure, sometimes requiring top-level organizational approval. For larger configurations to happen, a continued organizational commitment to the same extent as in the implementation phase will probably be necessary. Without such a continued commitment, the extensive configuration possibilities will remain a dull instrument for meeting emergent user requirements.

## References

[1] A.J. Holmgren, J. Adler-Milstein, J. McCullough, Are all certified EHRs created equal? Assessing the relationship between EHR vendor and hospital meaningful use performance, *Journal of the American Medical Informatics Association* **25** (2018), 654-660.

[2] G.S. Fletcher, T.H. Payne, Selection and implementation of an electronic health record, *PM&R* **9** (2017), S4-S12.

[3] M. Hertzum, G. Ellingsen, The implementation of an electronic health record: Comparing preparations for Epic in Norway with experiences from the UK and Denmark, *International Journal of Medical Informatics* **129** (2019), 312-317.

[4] H. Klein, M. Myers, A set of principles for conducting and evaluating interpretive field studies in information systems, *MIS Quarterly* **23** (1999), 67-94.

[5] G. Walsham, Interpretive case studies in IS research. Nature and method, *European Journal of Information Systems* **4** (1995), 74-81.

[6] Direktoratet for e-helse, Utviklingstrekk 2018 - Beskrivelser av Drivere og Trender Relevant for e-helse. Versjon 1.0, Oslo, Norway (2018).

[7] Helse Midt-Norge-1, Vedtok tildeling av kontrakt om Helseplattformen, https://helse-midt.no/nyheter/2019/vedtok-tildeling-av-kontrakt-om-helseplattformen 2019 (accessed Aug. 8, 2019).

[8] A. Finkelstein, G. Spanoudakis, M. Ryan, Software package requirements and procurement. In *Proceedings of the 8th International Workshop on Software Specification and Design,* Schloss Velen, Germany, London: IEEE Computer Society Press (1996), 1–7.

[9] N. Pollock, R. Williams, L. D'Adderio, Global software and its provenance: Generification work in the production of organizational software packages, *Social Studies of Science* **37** (2007), 254-280.