

# What are Functional Requirements of Future Shared Electronic Health Records?

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## Abstract

*Information processing in health care facilities is usually primarily directed towards the needs of the respective institution. However, patient related medical data are needed by several occupational groups and institutions of the health care system. The application of information processing technology towards patient-centred, shared care would better support high quality as well as efficient treatment in health care. “Shared Electronic Health Record” (SEHR) is one of the buzzwords of the last couple of years. But what do we mean with “Shared Electronic Patient Records”, what are the functional requirements? The analysis of the literature shows appreciations, visions, scenarios, examples. Existing installations of SEHR are basically implemented as proof of concepts for new technologies; functional requirement definitions as a basis for implementations have not been found in the literature. However, a detailed initial definition of requirements is essential for the success of software projects and should therefore also be done for SEHR. Literature analysis, brainstorming meetings and interviews with experts of occupational groups and institutions of the health care system resulted in an overview of required functions of a SEHR. Detailed requirement specifications could use this overview of functional requirements as a basis. By this systematic approach we hope to improve the quality of future SEHR. Before starting with technical implementations also risks of a SEHR (possible misuse of data, dependence on high technology levels, digital gap) and legal requirements should be reflected.*

## Keywords:

Hospital Information Systems, Computerized Medical Records Systems, Telemedicine, Hospital Shared Service

## 1. Introduction

Today’s information processing in health care facilities is usually primarily directed towards the information needs of the respective institution [1]. However, patient related medical data are needed as well outside the hospitals walls, i.e. by general practitioners, health insurance companies or pharmacies.

Over the past twenty years, researchers consistently report that the application of information processing technology towards patient-centred, shared care would better support high quality as well as efficient treatment in health care. By avoiding multiple medical

investigations and by optimized workflows, significant cost reductions are expected [2-6]. It has also been shown that health care organizations that use technology to partner with their patients and share information will achieve a significant advantage - leveraging consumer involvement helps containing costs, integrating data and improving quality and outcomes in the health care industry [7, 8]. This led to the idea of an cross-institutional shared electronic health record, which shares the relevant information between all the different players within the health care system [9, 10].

“Shared Electronic Health Record” (SEHR) is one of the buzzwords of the last couple of years. The analysis of the literature shows appreciations, visions, scenarios, examples. Existing installations of SEHR are basically implemented as proof of concepts for new technologies; functional requirement definitions as a basis for implementations have not been found in the literature. However, a detailed initial definition of requirements is essential for the success of software projects [9, 11, 12] and should therefore also be done for SEHR.

The aim of this article is an analysis of visions, expectations and risks of future inter-networked health care information systems. Based on this inquiry an overview of important functions and tasks of a future shared electronic health record for supporting cooperative care is worked out. What do we mean with “Shared Electronic Patient Records”, what are the functional requirements? The aim of this paper is to give a brief answer, which could be the basis for future detailed requirement specifications and technical implementations.

## **2. Methods**

The inquiry was conducted in three steps:

First, in an initial literature analysis (using pub med and Google scholar) and in brainstorming meetings within the project team (consisting of a medical computer scientist, a medical doctor, a software developer, a network expert and a bio-statistician) a set of players in the health care system was identified.

Then, the project team worked out requirement profiles from the player’s point of view using creativity methods and systematic literature studies.

Third, the requirement profiles were discussed with external experts in several systematically organized workshops to refine and validate the requirements. The graphic model follows the unified modelling language (UML) 2.0 standard.

## **3. Players in an inter-networked health information system.**

In the initial brainstorming phase the following players were identified (figure 1):

- Patients
- Medical professionals (general practitioners, established specialists, physicians in hospitals, rescue services)
- Pharmacies
- Researchers (epidemiologists, medical and public health scientists, statisticians)
- Health insurance companies
- Public authority (governmental institutions, controlling institutions of health care system, civil protection services)

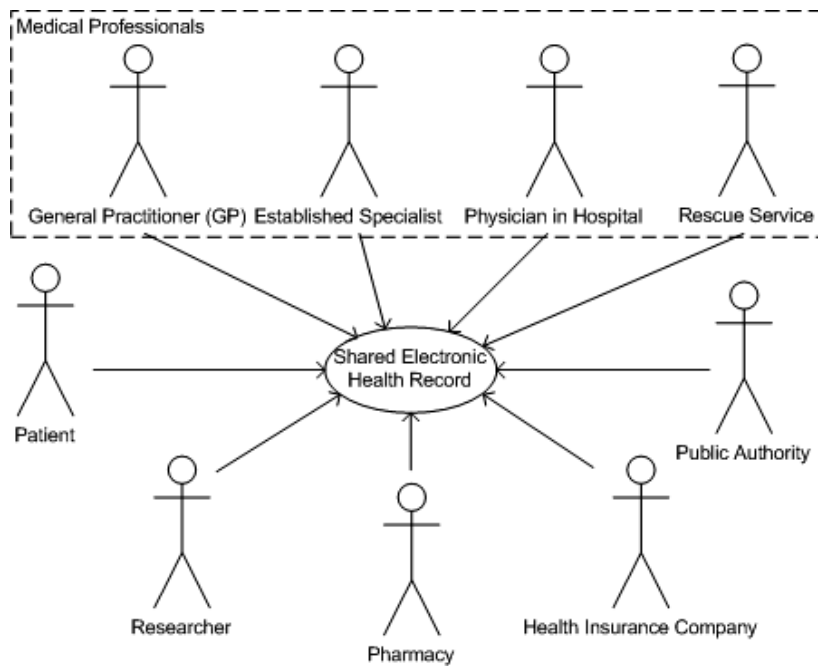


Figure 1 - Player in a networked health care system.

Six groups of important player, benefiting from a shared electronic health record (SEHR), were identified. At the moment every one of them uses own data sources and stores his data only in his own application. For more information please refer to the text.

### 3. Visions and expectations of future inter-networked health information systems

In the following section the overview about required functions of a SEHR as result of step two and three of the analysis is shown.

#### *From the patients' view*

**Access to personal health record:** Patients would like to have access to their medical data, independent of the localization of medical treatment or investigations. A patient-understandable preparation of data should improve readability by patients. Therefore in addition patients need assistance for interpretation of medical terms.

**Support change of localization of treatment or doctor:** Patients would like to visit the physician or specialist of their choice. They would like to avoid (partly invasive) re-investigations. Medical findings should be communicated to all physicians who are involved in the therapy process.

**Transparent data forwarding:** Patients would like to forward parts of their health record to a certain specialist of a medical field to obtain a second opinion. Secure mailbox functions would be helpful to improve the patient-physician communication.

**Making personal annotations:** Patients would appreciate to make own annotations to their health records. They further would like to administrate their medical diaries (like pain diary, blood pressure diary, glucose level diary, etc) or patient testaments (like organ donation pass, treatment restrictions due religious or ethnic reasons).

**Costs and services overview:** Patients would like to be informed about costs and services.

**Electronic drug ordering:** Patients would like to go to a pharmacy of their choice or to order drugs electronically via web. The pharmacy should have access on electronic prescriptions (issued by physicians).

**Security functions:** For patients a high level of security functions is essential for the acceptance of a shared electronic health record. Access to personal health records requires

the four-eye-principle per default (patient and involved party together). Exceptions are the access by the patient or by the data producer. In addition the patient can issue and revoke access rights for defined parts of the health record and to defined parties or persons. In order to prevent misuse due eventual social pressure the patient should also be able to permanently hide or de-activate defined parts of the health record for all parties except data producer or persons including him. No information should be displayed about the existence of hidden parts of the health record. A re-activation should require a media crack (by postal mail). In case of emergency situations permissions can be overridden. This allows full access to all data in the health record. To track access to health records logging in a level of particularity which is accepted by law has to be done. The patient would like to have access to aggregated views of the logs. In case of an emergency override a notification will be sent to the patient. In all cases, SEHR have to comply with national and international legal requirements.

**Direct benefit of clinical trials:** Patients would like to be informed about newly discovered risks based on results obtained by the evaluation of (pseudonymized) patient related data in current scientific research studies.

**Management of health care related resources:** Patients would like to get information about available resources for therapy. In order to make coordinated appointments with specialists, outpatient departments or clinics for planned investigations or treatments the patient (as well as these institutions) would need calendar functions.

**Backup functions:** Patients would appreciate to make a copy of his personal record for backup.

#### *From the view of medical professionals*

**Access to patient's health records:** Doctors would like to get treatment-relevant information aggregated from the patient's medical history, independent from the institution where the data were produced. The data presentation (view) should depend on the area of expertise. Search and filter options should be provided as well as chronological and problem oriented sorting functions. Depending on a treatment relation a medical institution should be able to (semi-automatically via special interfaces) append relevant data to the patient's health record.

**Emergency access:** In case of emergency situations physicians or rescue services would like to override permissions to gain full access to all data in the health record of a patient.

**Support of external consultation:** Physicians would appreciate a mailbox implementation to allow secure person-to-person communication (i.e. for consultation of a specialist).

**Monitoring and alert functions:** Future wearable devices or drugs which are able to electronically communicate measurements should be supported in order to get acquired parameters directly into the electronic health record. Alert functions should be added to automatically call a physician when parameters get out of acceptable ranges. In this case it should be possible to localize a patient.

**Clinical pathways and expert functions:** Doctors would like to treat according to international treatment standards and evidence based medicine. Therefore they need guidelines or pathways for defined symptoms to support them in their decisions.

**Management of health care related resources:** Doctors would like to get information about available medical resources and make electronic appointments for their patients.

**Quality reports:** Quality reports (complications, costs) about their treated patients should be generated automatically.

#### *From the view of health insurance companies*

**Communication of invoicing:** Health insurance companies would like to receive insurance data or invoicing of medical professionals or pharmacies electronically.

**Statistics and quality reports:** Statistics about accumulation of specific diagnoses or treatments in special areas would be useful to prevent misuse and to make comparisons.

**Feedback:** Health insurance companies would like to put a scope of medical services and prescriptions into the patient's record.

#### *From the view of pharmacies*

**Electronic prescriptions:** The pharmacy would like to have read access on special parts of the electronic prescriptions issued by physicians. Alerts in case of contra indications or side effects would be helpful.

#### *From the view of researchers*

**Anonymized analyses:** To gain new knowledge and to discover unknown patho-physiological functions researches would benefit from an unrestricted access on pseudonymized data (data mining, cross-patient search).

**Alerting functions:** Pre-defined automatic analyses of specified items of the health record can lead to warnings if parameters get out of accepted ranges to discover epidemics or pandemics in an early stage.

#### *From the view of the public authority*

**Anonymized conclusions:** Governmental institutions need statistical overviews about diagnoses or treatments in order to control the health system and to prevent dangerous sanitary situations (civil protection).

## **4. Discussion and Conclusion**

Shared electronic health records (SEHR) should improve the cooperation between patients and/or occupational groups of the health care system, and thus improvements of quality and efficiency as well as cost reductions are expected.

The literature shows several ways for the technical implementation of such a system. Existing installations of SEHR are basically prototypes, implemented as proof of concepts for new technologies. However, a detailed requirement definition is essential for the success of software projects [9, 13, 14] and should therefore also be conducted for a SEHR.

To analyse the functional needs of a SEHR group interviews and workshops together with experts were organized. With this approach an impression of the functionality and complexity of a SEHR was quickly discovered. However, the found players in the health care system as well as the list of functional requirements of a health care record might not be complete and represent the personal opinion of the involved experts and members of the project team. Furthermore no statement about the importance of functions can yet be issued. As a next step judgement techniques like the "Delphi method" or the "Nominal Group Technique" might provide more objective results, but will take more time and resources [11]. Taking this into account the results could serve as the basis for an additional Delphi survey to validate the gained results.

Before starting with technical implementations legal issues (which are partly still unclear) and risks of a SEHR should be reflected and stay in mind:

- Cooperation between patients and different occupational groups of the health care system assumes transparency in treatment processes. But transparent data could be misused and therefore the privacy of patients or also physicians could be harmed. Job positions or insurance rates could be made dependent of the medical risk of a person.

Embracing organizational and technical arrangements have to avoid misuse of data and therefore have to be an essential part of SEHR.

- Comprehensive information about patients at the time of admission could lead to select or refuse patients by medical institutions.
- The dependence of the high-level technology increases by the use of SEHR. The risk of a breakdown of such a system has to be minimized and appropriate concepts for redundancy and self managed systems are essential. Errors in treatment due to a technical breakdown of SEHR must be avoided.
- Indeed a high level of technology could split the society, known as digital gap. Patients or physicians who have access to possibilities for digital data processing might also have more possibilities for medical treatments than persons without these possibilities due financial or other reasons.

This paper provided an overview of initial, important functional requirements of a SEHR. Detailed requirement specifications could use this overview of functional requirements as a basis. By this systematic approach we hope to improve the quality of future SEHR.

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