# Cross-Sector-Communication and Continuity of Care: Using Standards for an Integrative Health Environment

Rolf ENGELBRECHT[1], Claudia HILDEBRAND[2], Hans DEMSKI[2]
[1] ProRec Germany, Glaslweg 33 D 85737 Ismaning
[2] IBMI -Institute for Biological and Medical Imaging, MEDIS - Medical Information Systems,
Helmholtz Zentrum München, German Research Center for Environmental Health
Ingolstädter Landstr. 1, D 85764 Neuherberg, Germany

***Abstract* – European healthcare is changing The increased movement of the citizen asks for administrative changes, but also for patient records that can be accessed ubiquitously in real time and also across boarders. New technologies offer new approaches and possibilities. This paper outlines the changes of developments in the health sector brought upon by ICT. It demonstrates present initiatives towards European eHealth cross-border solutions regarding different levels of interoperability such as semantics, technical requirements, organisational and security related requirements. The project ByMedConnect is given as an example for implementing standardised solutions for overcoming limiting factors and ensuring an interoperable solution supporting continuity of care. Challenges on a future user-friendly European eHealth solution are discussed.**

***Index Terms* – eHealth, electronic healthcare record, EHR, interoperability, standard, cross-border healthcare, CCR, Continuity of Care Record, EHRcom, ISO EN 13606, ProRec, EuroRec,**

## I. INTRODUCTION

Electronic support of health care known as eHealth is able to improve the access to clinical data, knowledge and information and to enhance the quality of services and working conditions offered. eHealth supports mobility. It allows patients to access appropriate health resources based on equal opportunity and informed choice. Information and communication technologies (ICT) support networking between human beings, institutions and health information systems -also across borders. Smart and safe communication of data, information and knowledge will remain main development issues in the next decade as networks are crossing regional and national boundaries. There are several national initiatives in Europe which are not harmonised so far.

In 2008 the European Commission issued a recommendation on cross-border interoperability of the electronic healthcare record (EHR) [1]. It states that in order to achieve interoperability "Member States are invited to undertake actions at five levels, namely the overall political, the organisational, the technical, the semantic and the level of education and awareness raising".

At the same time a large scale project, called epSOS (European Patients Smart Open Services) [2] involving 12 Member States (and many Health Ministries) aiming to support the implementation of cross-border healthcare was initiated.

Many other National and European projects have helped advancing interoperability in different sectors of eHealth, e.g. TrustHealth [3] and SEISMED [4] in security, DIABCARD [5], NETCA@RDS [6] and ARTEMIS [7] developed technical and semantic solutions for communication, TOSCA [8] showed feasible solutions for tele-health, Bit4Health [9] demonstrated ways towards an eHealth architecture.

## II. HEALTH INFORMATION SYSTEMS

Health information systems are developed for different purposes using a variety of technologies. They might be supporting administration or even decision support. The scope of functions provided and the way they are implemented depend on the health care area. Primary care in mostly all countries is visit oriented with treatment time usually restricted to few minutes. This minimises the amount of data which are documented per visit.

In secondary and tertiary care larger systems were developed; these support logistics and patient management. They are episode oriented and at their core are ADT (Admission-Discharge-Transfer) and financial management. The systems serve as an administrative basis for departmental and service systems such as laboratory and radiology.

While presently healthcare systems and medical services evolve around the patient-doctor relationship, in the near future this correlation will be just one part of a more holistic approach. eHealth needs to be seen being a framework of compliance with privacy issues, healthcare centres, home-monitoring, and results being used for research. Social services are in many countries getting linked to health services.

Today health data communication is usually limited to one institution or to regional doctor networks. Most countries lack communication between the different health care institutions, e.g. hospitals and primary care. Some of the reasons are technical problems and missing standards and/or the insufficient application of existing standards.

Missing common terminology is another hindrance in communication, even more so when communication concerns institutions or physicians in different countries.

The DIABCARD project [5], which aimed at improving communication in diabetes care, was one of the first projects to demonstrate an interoperable solution. Its dataset was based on the standardised European Emergency Data Set

[10] and on a "Diabetes dataset" developed by European physicians and agreed by EASD (European Association for Studying Diabetes). Chip card technology was used for communicating data between physicians and other health professionals. A dedicated card connecting interface module ensured the independence of the solution from specific cards and card readers. DIABCARD was implemented in Austria, Greece, Italy, Spain, France and Germany. The follow-up project ByMedCard - Health across Borders adapted and implemented the DIABCARD concept for citizens travelling between Germany and Hungary.

Increased mobility of the citizens asks for administrative changes, but also for patient records that can be accessed ubiquitously in real time and also across boarders. Thorough and adequate administrative changes are required.

EpSOS [2] aims to develop a practical eHealth framework and an ICT infrastructure that will ensure secure access to patient health information, particularly with respect to basic patient summaries and ePrescriptions between different European healthcare systems. NETC@RDS [6] has been working towards the establishment of new improved health care administration services for mobile citizens across the EU.

## III. STANDARDISATION

Healthcare information is presently still very fragmented with proprietary medical information systems using individual interfaces, data protection solutions and even terminology. In contrast mobility requires interoperability which has to enable the exchange of clinical data between computer based applications, even for cross-border communication.

Modern technology supports mobility: the internet enables fast and –almost- ubiquitous access and is to be seen as a main platform for the future. Trusted portable devices like a mobile phone, a smart card or other devices such as USB sticks can complement it for reliable identification and authentication of users. Safe communication between sender and receiver relies on confidentiality, authenticity, data integrity and accountability.

The information needed to treat the patient as well as security functions will have to be available in the preferred language of the health professional. Under strict security conditions, authorised healthcare personnel will be able to read and write information locally or remote. This requires interoperability on different levels:

- Semantics ensuring common definition and understanding of the content;
- Technical enabling the use of different environments in order to integrate the different applications;
- Organisational requiring the understanding of legislation, regulation and other policies as well as governance models;
- Security making sure of a trustful environment.

A number of ISO and CEN standards have been published to advance these goals. They range from requirements on protocols, devices and architectures to service infrastructures. Unfortunately, they are often neither known nor used. The BioHealth project (Security and Identity Management Standards in eHealth including Biometrics) [12] has been analysing reasons for this and has at the same time tried successfully to provide ways to enable SMEs to get information on eHealth standards to help them decide – backed by an online Standards' Repository - whether a specific standard would be of help to them or not. The project was exemplified on security standards in eHealth.

A main step towards interoperability of healthcare related data and the development of eHealth platforms were decision 189, 190, 191 on the European Health Insurance Card (EHIC) [6], which is used to proof the citizen's entitlement to health treatment in any EU Member State. As an additional measure the European Commission issued Mandate 403 (M/403) [12] to the three European Standards Organizations (CEN, CENELEC, and ETSI) in order to provide a consistent set of standards to address the needs of European eHealth provision.

Amongst others digital identity is a major issue. This can be defined as a collection of digital information on one subject. It is needed to link different electronic data to one person, e.g. a person's health insurance number to his lab data in order to store these in the person's health record. Digital identity serves different purposes: identification, authentication, and assurance. It consists of a set of attributes, e.g. characteristic habits, preferences or traits plus an identifier which can be real or anonymous.

Management of digital identities (eID) is a very complex area. eIDs need to be allocated not only to human beings but to all principals and even to specific items. eID of replicable things and robots which are used for automated operation of patients have to be envisioned in the near future. Several projects and activities work towards to overcoming barriers in the digital identity sector and to finding ways on eID management.

## IV. SUPPORTING CONTINUITY OF CARE

The Continuity of Care Record (CCR) [13] developed by ASTM is a well structured basic data set of the most relevant facts about a patient's health status, covering one or more episodes or visits. These may be documented by a GP, a specialist physician, a hospital physician or a nurse during treatment in order to enable other health professionals caring for a patient to readily access a summary of relevant and actual information. It includes identifying data, information about the patient's health status (e.g. anamnesis, allergies, risks, problems, medications, operations) and basic data about insurance, care documentation and care plans. The CCR is represented in XML, a structured electronic format. The CCR is meant to address the information needs for continuity of care from one health professional to another. As it contains only selected, relevant portions of a patient's health record it provides a perfect data source for treatment across borders.

The physician originating the CCR transmits it to the co-treating practitioner. This approach already proofed applicable in the DIABCARD system where a smart card was used as communication tool. The XML structure contains also links which point to selected documents of the patient's EHR. The documents are located on a specific server and can be accessed by authorised physicians using the Health Care Professional Protocol (HCPP) [14] via internet.

The ASTM standard CCR has been introduced in the USA in more than 100 health care systems. Microsoft's Health Vault and Google's concept for healthcare support have implemented this standard. Another variant is CCD, the

CCR is translated into an electronic document conforming it to the HL7 CDA [15] concept. Solutions for patient centred administration of the CCR by use of mobile phones are available.

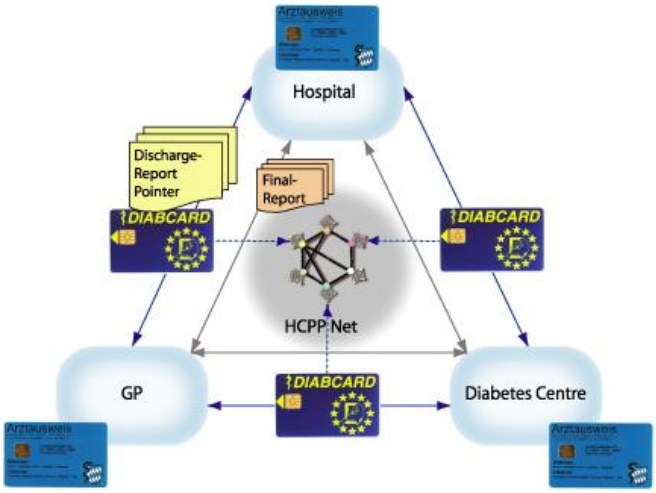


Fig 1: Secure communication network between physicians in hospital and primary care using professional cards (Arztausweis) and the DIABCARD smart card.

In the ByMedConnect [16] project the pragmatic and limited approach of the CCR is complemented by the more comprehensive standard ISO 13606 – Electronic Health Record Communication [17]. It consists of various parts and proposes an advanced architecture to deal with the heterogeneous systems existing in the medical domain. It defines a reference model for the EHR that specifies the common building blocks, and introduces Archetypes [18] as a formal model of real clinical concepts that lay the basis for interoperable semantically sound data exchange. Currently tools are developed that enable the clinicians themselves to define these universal models in an international collaborative approach [19]. Archetypes created can then be published in a repository for sharing and reusing them within inter-institutional and inter-sectoral communication. The use of archetypes is an important step towards semantic interoperable EHRs that are portable (via institutional / regional boundaries), precise (e.g. terminology binding), accessible (individual queries + decision support) and durable (life-long record).

Archetype based data exchange has the potential to fill the gap of lacking communication capabilities between heterogeneous systems. The standard for EHR communication has recently been published for international use at ISO, e.g. a Japanese version is ready for implementation. The standardisation activities are supported by the EUROREC Institute [20] and the OpenEHR Foundation [21].

## V. INTEGRATION OF LEGACY SYSTEMS

A multiplicity of different routine applications is used in hospitals, by family doctors and in medical specialist practices. These software solutions are often specialized for the surroundings and to the tasks they support. Users are versed in them and have a lot of experience in handling the included procedures.

A replacement of the programs in use is not feasible. But major disadvantage is in most cases that data of patients, which would be helpful for further attendances, is stored at different places in different forms.

To gain interoperability between health care institutes, it is necessary to transmit data in a standardized format. EN 13606 provides structures for this task, but doesn't define how information can be extracted out of already existing

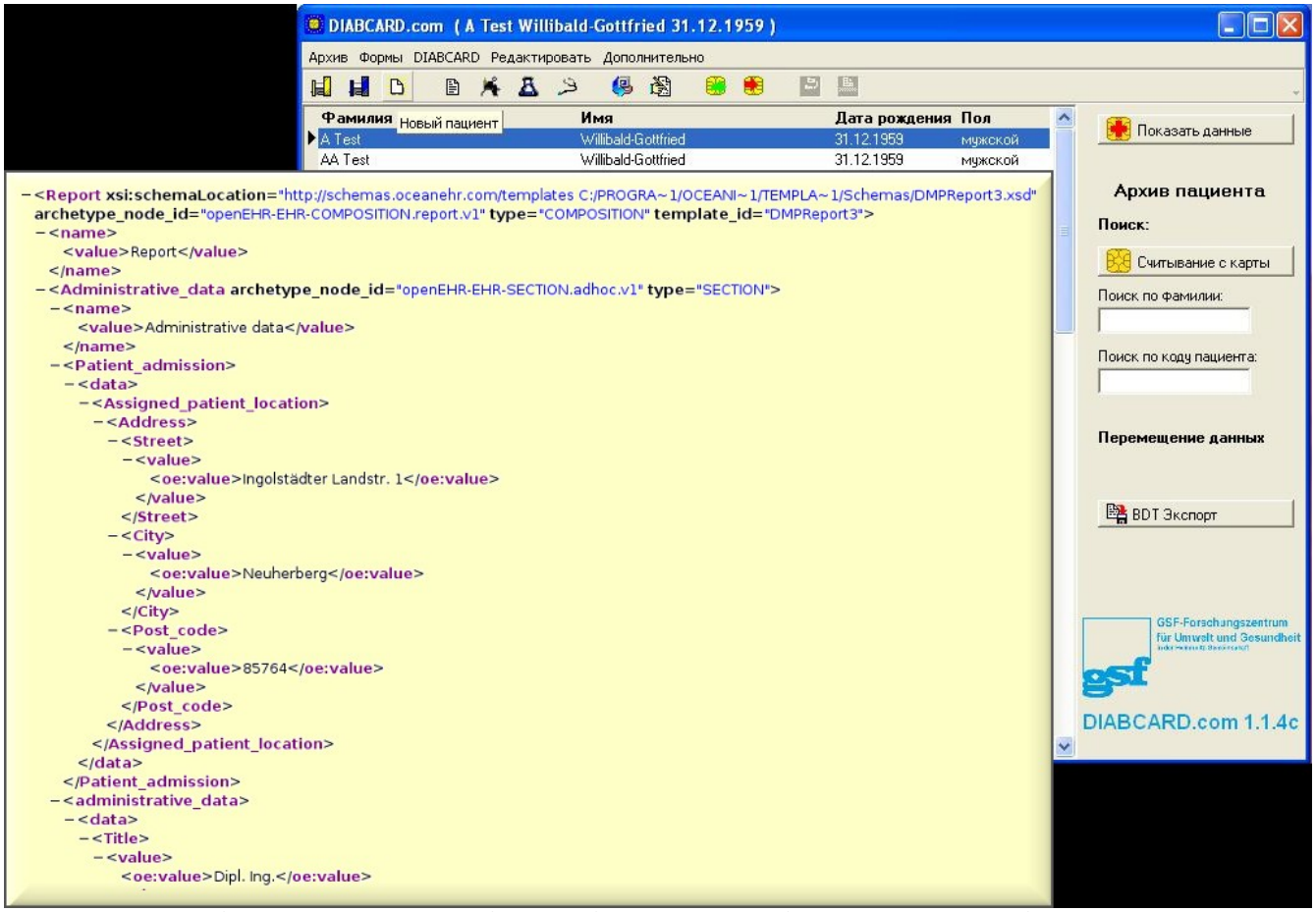


Fig 2: Export of data in ISO 13606 compatible format out of the Russian version of the disease management software DIABCARDcom

systems. ByMedConnect meets this challenge by the development of a transformation module.

The module is placed at the existing software environment of the health care institute. Thereby it is connected to interfaces of the routine applications. On demand, it extracts, the necessary data out of the legacy systems into XML, or into an XML convertible form (CSV, JSON). A correspondent XML schema (XSD) describes the data exported. Approaches to use this schema for binding information on parts of tharchetypes have been published before [7, 8]. Scripts can be generated out of the mapping automatically, this allows the module to do the correct transformation without any further interaction by the user.

## VI. CONCLUSION

In future healthcare will be different. The benefits of eHealth are apparent. For many years the Member States and the European Commission have been supporting projects enhancing the quality of care by ICT. The present technological developments -building on the results and achievements of those early initiatives- are pointing towards patient-centred health care supported by anytime-anywhere access to health information and enabling instantaneous connections to clinical support. Presently eHealth is at a crucial point; many initiatives towards European eHealth solutions have been initiated and are ongoing as has been shown in the p

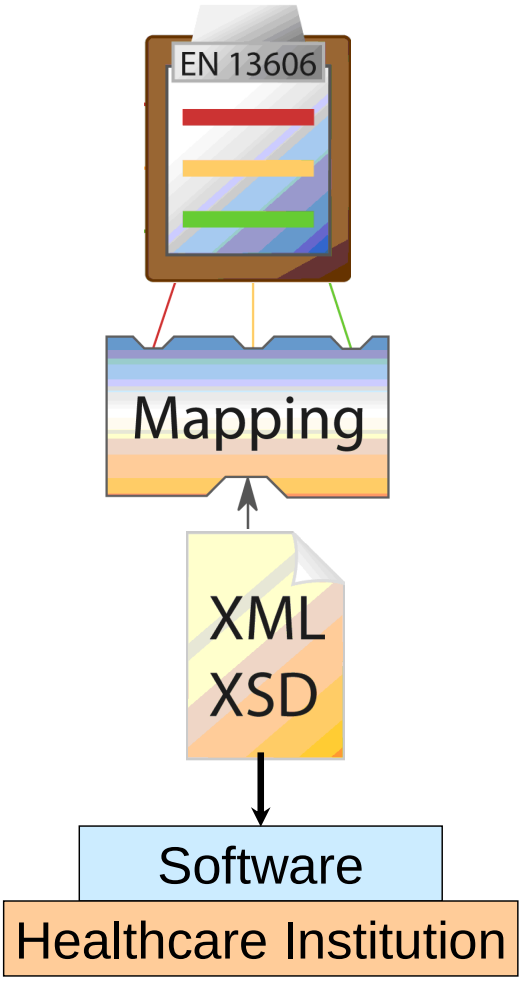


Figure 2. Integration of legacy systems

receding chapters. These solutions still need to be proved applicable, feasible, usable, acceptable and useful.

The success of eHealth will depend on the acceptance by all users. This means that a comprehensive European eHealth strategy needs to be developed. eHealth offers large business opportunities and it has the potential to drive innovation. This necessitates the development of new products and high investment costs. A clear political commitment towards the financing is required.

eHealth requires accessibility of new technologies and e-literacy. The European population is aging. This means, on the one hand, large opportunities towards the support of the elderly, but, on the other hand, challenges like creating awareness and technology education in the elderly have to be met. In a European cross-border scenario legal barriers such as the contradiction of national legal requirements, and of national laws impacting identity have to be overcome without neglecting social barriers such as the culture of distrust or the fear of loss of anonymity. eHealth relies on the trust in the system by all stakeholders. This keeps data protection, privacy, security and also ethical issues high on the agenda.

## ACKNOWLEDGEMENT

The authors are in debt to the European Commission and the freestate Bavaria for funding several successful research projects especially DIABCARD and ByMedCard. The project ByMedConnect is currently funded by the Bavarian Minister for environment and health.

## REFERENCES

[1] Commission Recommendation of 2 July 2008 on cross-border interoperability of electronic health record systems (notified under document number C(2008) 3282)

[2] epSOS- European Patients Smart Open Services; http://www.epsos.eu (last accessed 24-09-09)

[3] Blobel, Bernd (2000) The European TrustHealth Project experiences with implementing a security infrastructure. International Journal of Medical Informatics 60 (2), S. 193-201.

[4] SEISMED - Secure Environment for Information Systems in Medicine; http://ehto.org/aim/volume2/seismed.html (last accessed 24-09-09)

[5] DIABCARD

[6] NETCA@RDS -A step towards the electronic European Health Insurance Card; http://netcards-project.com (last accessed 24-09-09)

[7] ARTEMIS- Building interoperability into medical information systems; http://istresults.cordis.europa.eu/index.cfm/section/news/Tpl/article/BrowsingType/Features/ID/79928 (last accessed 24-09-09)

[8] TOSCA- Tele-Ophthalmological Services - Citizen-centred Applications; http://www.ist-world.org/ProjectDetails.aspx?ProjectId=525f09f393a64657a6c645111f3fc278 (last accessed 24-09-09)

[9] Blobel, Bernd (2005) Die Implementierung von bIT4health im Spiegel der europäischen Initiativen sowie der fortgeschrittenen Programme anderer Länder. In: Steyer, Günter und Tolxdorff, Thomas, (eds.) bit for bit - Halbzeit auf dem Weg zur Telematikinfrastruktur: TELEMED 2005 - Telematik im Gesundheitswesen.

Akad. Verl.-Ges., Berlin, S. 88-95. ISBN 3-89838-064-5

[10] European Emergency Data Set – NETLINK Requirements for Interoperability; http://www.sesam-vitale.fr/netlink/netlink_requirements_for_interoperabilityv21.pdf (last accessed 24-09-09)

[11] BioHealth - Security and Identity Management Standards in eHealth including Biometrics; http://www.bio-health.eu (last accessed 24-09-09)

[12] M/403 EN; http://ec.europa.eu/enterprise/standards_policy/action_plan/doc/mandate_m403en.pdf (last accessed 24-09-09)

[13] Continuity of Care Record (CCR) Standard - Resource Site; http://www.ccrstandard.com (last accessed 24-09-09)

[14] ByMedCard - Health-Care-Professionals-Protocol (HCPP); http://www.stmugv.bayern.de/krankenhaus/telemedizin/projekte_detail.htm?ID=AAxpv0ps7BE2AiIRuFTDJA%3D%3D (last accessed 24-09-09)

[15] HL7book – CDA Resource Page; http://hl7book.net/index.php?title=CDA (last accessed 24-09-09)

[16] ISO13606-Part 1:2008, http://www.iso.org/iso/catalogue_detail.htm?csnumber=40784 (last accessed 24-09-09)

[17] ByMedConnect - Improving communication by linking domains thus fostering integrated healthcare in Bavaria; http://www.bymedconnect.de (last accessed 14-06-2010)

[18] ISO 13606-Part 2:2008, http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=50119 (last accessed 24-09-09)

[19] openEHR Clinical Knowledge Manager; http://www.openehr.org/knowledge (last accessed 24-09-09)

[20] EuroRec Institute; http://www.eurorec.org (last accessed 14-06-2010)

[21] openEHR Foundation; http://www.openehr.org (last accessed 14-06-2010)

Address for Correspondence
Rolf Engelbrecht
ProRec Germany,
Glaslweg 33
D 85737 Ismaning