Workshop of EFMI WG “Health Informatics for Interregional Cooperation” supported by the EFMI WG “Electronic Health Records”: Is There a Common Background to Support Better Healthcare in Central and South East Europe?

General EHR Status: Europe and World

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EHR
A repository of information regarding the health status of a subject of care, in computer processable form.
An EHR provides the ability to share patient health information between authorized users of the EHR and the primary role of the EHR in supporting continuing, efficient and quality integrated health care.

EHR system
The set of components that form the mechanism by which electronic health records are created, used, stored, and retrieved. It includes people, data, rules and procedures, processing and storage devices, and communication and support facilities.
**Definitions** (according to ISO TR 20514 Health informatics - Electronic health record – Definition, scope and context ) (2/2)

**EHR architecture**

A model of the generic features necessary in any electronic healthcare record in order that the record may be communicable, complete, a useful and effective ethico-legal record of care, and may retain integrity across systems, countries, and time.

In general, a **system’s architecture** defines its components, their functionalities and relationships.
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National EHR Strategy Examples

England: National Programme for IT (NPfIT)
Australia: HealthConnect, NEHTA
Canada: Infoway, EHRS Blueprint
USA: National Health Information Infrastructure (NHII), EHRVA
Germany: bIT4health, eGK, eGA
Taiwan: National Health Information Exchange Platform
France: DMP (Dossier Medical Personnel)
The Netherlands: AORTA
Wales: IHR/LLR within the “Informing Healthcare Program” (IHC)

... and probably 60+ other countries
International Programs and Budgets

Examples

• Health Infoway (Canada)
  • By 2007, the government of Canada had invested $1.6 billion CAD in Infoway. By March, 2008, Infoway had committed nearly than $1.5 billion CAD in co-investment within the jurisdictions. 50% pop. have EMR

• Health Connect (Australia)
  • NEHTA has received $160 AUD million in funding. All pts have EMR anytime

• Ctr. for Interoperable EHR (Korea)
  • 1.1 bill. USD by 2010 for universal EMR
Examples

• National Program for IT (UK)
  • The National Programme for IT (NPfIT) was initiated in 2003 and was originally budgeted to be £6.0 billion over 10 years, but the National Audit Office estimates the figure to be £12.4bn over 10 years and other officials have been recently quoted in papers as estimating the figure to be close to £20.0 billion. Objective: IT infrastructure for safe and efficient health information transfer.

• National Health Information Infrastructure (USA)
  • 86.5 mill. USD 2005, 125mill. USD 2006 for universal EMR. Within ARRA, more 40 billion US $ will be spent to provide a PHR to every American.
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EHR Approaches

**#1 Fully Federated**
- Patient data resides with source facility
- Data remains in the source systems
- EHR is a process which pulls patient data from carer systems
  - Real time: Google or Napster models
  - Batch extracts
  - DWHS not clear

**#2 Federated**
- Patient data resides with source facility
- Patient data consolidated in facility CDR
- EHR is a process which pulls from local CDRs for updates to central CDR as needed (e.g., dbMotion)
- DWHS works off CDR

**#3 Service Oriented**
- Patient data sent to EHR by message at end of care event
- Local systems message enabled
- EHR is a process which manages flow of messages
- CDR holds care events within patient ‘record’

**#4 Integrated EPR**
- Single integrated hospital system
- Embedded EHR capabilities

Source: Capgemini
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EHR Approaches after HIMSS

Wales
The Netherlands
Germany
Denmark
Canada
New Zealand

#1 Fully Federated
#2 Federated
#3 Service Oriented
#4 Integrated EPR
Evolution of Health Informatics, Taiwan

- **Ubiquitous e-Service**
  - U-Taiwan & NHII (2008~)
  - Tele care
  - Tele medicine
  - Electronic Medical Record

- **Mobile Services**
  - m-Taiwan (2005~)
  - Web Government Services
  - Web Health Administration Services

- **e-Service & e-industrialization**
  - e-Taiwan
  - HIS
  - HIN
  - NII
  - Health Insurance IC Card

- **Personal Healthcare Record**

- **International Trend**

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The XXII International Conference of the European Federation for Medical Informatics 8-9
MIE 2009, Sarajevo, Bosnia & Herzegovina
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Web Portal for Health Administration and Public Health Services in Taiwan after Kwak

Diagram:
- DOH
- CDC
- BNHI
- BHP
- PHBs
- Hospitals

Public Health Domain Single Entry Point
- Directory Service
- Authentication
- Authorization
- RBAC

National Health Info. Exchange Platform-Message Inbound/Outbound /Exchange Standard
- Reporting
- Data exchange
- Query
- Message for Public Health
- Download Service

External System Interface
- HL7 / XML

External System Interface
- HL7 / XML

HL7Mess. Auth. and Index System
epidemic situation
information
Exchange Platform

PHDB
ETL
PH Data mart
Common Data Bank
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EHR Infostructure: Conceptual Architecture

after Infoway
English EHR Architecture

• England’s EHR - the Spine - acts as a central Summary Record (CDA-based, ebXML) consists of the Spine Directory, Demographics Services, the Summary Care Record and adapters and is not an EHR. It contains only a small percentage of the information held in primary and secondary care systems.

• The English envisioned EHR contains a new network infrastructure as well as national applications that will utilize the EHR (e.g., electronic transfer of prescriptions, electronic outpatient scheduling).

• The EHR portion (the Care Record Service) includes three components:
  – Personal Demographics Service (PDS),
  – Summary Care Record (patient's clinical information, such as allergies and adverse reactions to medicine),
  – Secondary Uses Service (SUS), which uses data from patient records to provide anonymised and pseudonymised business reports and statistics for research, planning and public health delivery.
English EHR Architecture

- The NHS turns between detailed information models on the one hand and extended terminology to include information models.
- The result is the Logical Record Architecture (LRA) for Health and Social Care in England.
  - A generic model designed to work with the SNOMED CT terminology
  - Domain models, derived directly from the Generic Model and terminology, designed to meet specified uses
  - A catalogue of the requirements/uses for data, whether for direct care of patients or secondary uses, including analysis
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The record structure

- Actors and participants
- Attestation and governance
- Observations and findings
- Actions and events
DMP: a French national eHealth record

DMP (Dossier Médical Personnel) will be:

- A private medical file digitalised aimed at favouring coordination, quality and continuity of care;
- A file shared by Healthcare professionals (HCP) but under the holder's control (i.e. The patient manages its access, the holder can hide documents...)
- Not a substitute for professional files of HCP in ambulatory care or in Hospital
- Accessed through:
  - Web Portal for holder's
  - Only through professional application for Healthcare professionals to maximize ergonomy and avoid time-consuming change of application
- Consisting of data (structured or not) signed by the author (at first only by the HCP)
DMP: A health record needing adequate protection

As a health record, the DMP needs to be:

- **Available**
  - Opens 7/24
  - Availability 99,9% (total amount of interruption of 8 hours a year)

- **Protective of data integrity and confidentiality**
  - Protected communications (SSL)
  - Restrictive access to a DMP (eSafe, HCP rights defined by law)
  - Separation of trusted services (authentication) and data housing
    
    - Good level authentication

* Caisse des Dépôts et Consignations is a state-owned financial institution that performs public-interest missions on behalf of France’s central, regional and local governments.
DMP: A record used by numerous actors
Five Years from Now...Transformation!

- Personal Health Records
- Physician-to-Patient communications
- Peer-to-Peer interaction
- Quality measures & Pay-for-Performance
- Population health management
- Biosurveillance

Two Years from Now...

- Interoperable EHRs: practices, hospitals, labs, imaging & pharmacies
- Interactive patient information exchange

Now...

- EHR upswing
- Lack of connectivity: hospitals, labs & pharmacies
- Reliance on paper-based information
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Interoperability Target – Roadmap

Communications Service Model

after EHRVA: EHRVA Interoperability Roadmap. HIMSS EHRVA, Version 2.0
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Dutch Design of the Architecture, Basic Infrastructure, for Healthcare after NICTIZ, 2002
Turkey National EHR Approach

• Development of an Adaptor for automatically transforming National Health Information System (NHIS) of Turkey “Transmission Schema” instances to HL7 CDA R2 conformant EHRs
• Development of a Terminology Server based architecture enabling automatic mapping of the local coded terms that appear in the NHIS Transmission Schema instances to international counterparts
• Development of an Adaptor for automatically transforming CDA conformant NHIS Transmission Schema instances to CEN EN 13606 conformant EHRs
The Architecture of the Transformation Environment for National Health Information System (NHIS) of Turkey  

after Assuman, 2008
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Healthcare System Vision for Croatia after Blazova, 2007

Diagram showing various healthcare and governmental institutions connected to a central hub labeled IHCIS (Integrated Healthcare Cloud Information System). The diagram includes labels for Ministry of Health, Physician Chamber, School of Public Health “Andrija Štampar”, Government Agencies, Insurance Company, Public Health Institutions, Hospital, Laboratory, Pharmacy, Ministry of Health, Gynecologist Pediatrician Specialist, GP, HRR, EPR, EHCR, HC Agent, and GP.
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German EHR Architecture

- Registries
- Common Services
- EHR System
- Health Data Warehouse

Longitudinal Record Services

Communication Bus
- Common Services

Resource Locator Service

- Connector
  - Application 1
  - Application 2
- Connector
- Connector
  - EHR Viewer
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Summary and Conclusion

- Many national and international projects and initiatives deal with design and implementation of semantically interoperable EHR systems.

- Different approaches such as HL7 v3, HL7 CDA, HL7 EHR, HL7 CCD, EN/ISO 13606 EHRcom, CEN HISA, openEHR, CCR, etc., provide a convergent pathway to component based, flexible, scaleable, business process controlled and service oriented, knowledge based, lawful, user friendly, and trustworthy EHR architectures as well as unified processes for implementing them.

- The Generic Component Model establishes a framework for developing and evaluating EHR systems and migration strategies for existing approaches.

- Interoperability requires quality assurance, testing and certification procedures.