

Creating application interfaces for legacy systems

Clinical-driven EHRs – the openEHR approach

Ricardo João Cruz Correia (rcorreia@med.up.pt)

Carla Ávila & Rong Chen

Medinfo 2010 – 13th World Congress on Medical and Health Informatics

Cape Town / South Africa

Health Informatics Group - <http://cintesis.med.up.pt>

Legacy systems and what is special about them

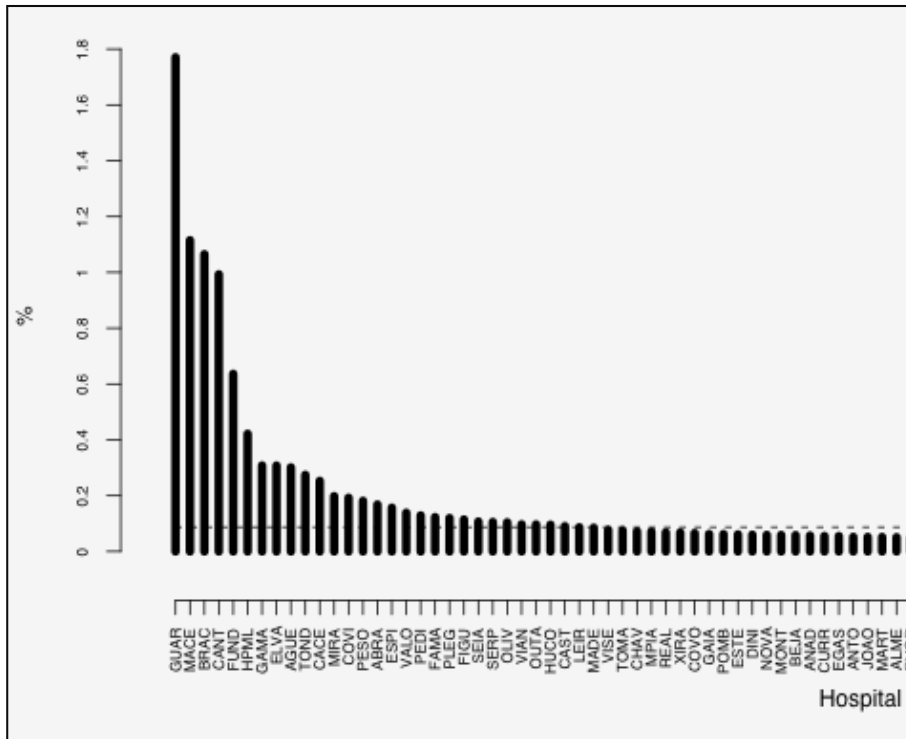
- Typically they are very **useful** (data)
- Institution **processes have adapted** to legacy system characteristics / problems
- Sometimes the **development team** has already **disappeared** leaving poor documentation

Problems with what data really **means**

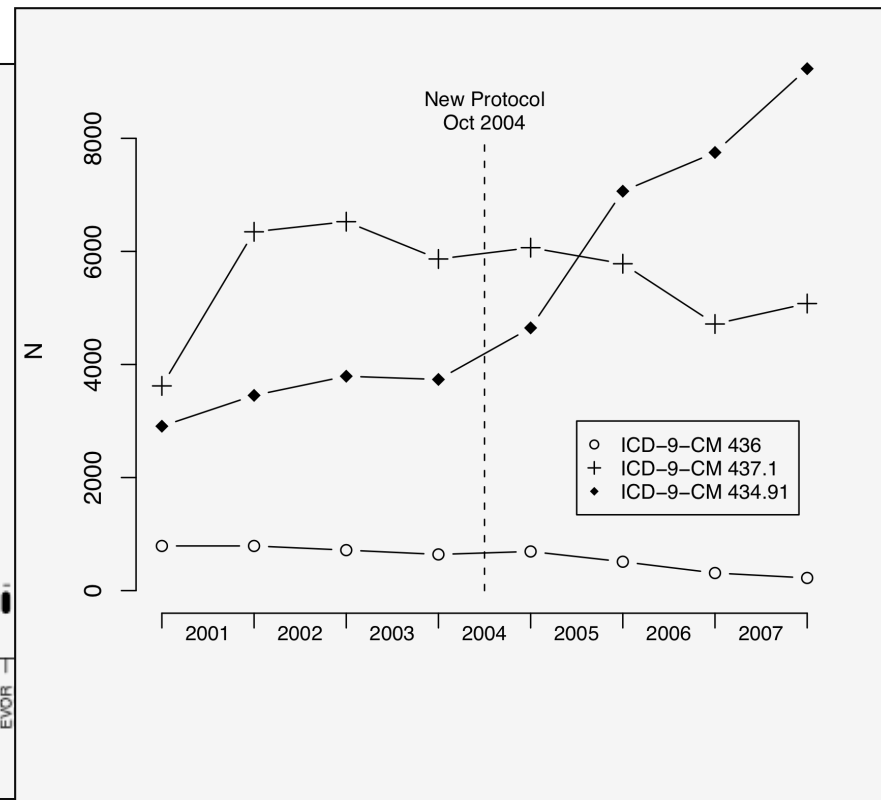
- Poor reproducibility between
 - Users (clinicians)
 - Different information **granularity**
 - Institutions
 - Different **processes**
 - Different **policies** (e.g. procedure coding for billing purposes)

Compreension of collected data

Proportion of flu diagnosis in all Portuguese hospitals(2000-7)



ICD-9-CM use in Ischemic Stroke



Portuguese reality

- Legacy ADT System named SONHO present in 95% of all public Hospitals (n=90)
 - Based on Oracle 7
- Created in 1988, last version of 1996
- Act as standard *de facto*
- Involved in 54% of all IS integrations (n=629)

Portuguese reality

- Governmental project to create a National **Electronic Health Record (RSEpt)**
 - *Forced by EU initiatives (e.g. EpSOS)*

- Although old, the legacy system **SONHO** will for sure be an important **pillar** of the national **EHR**

openEHR and Legacy Systems

- Most organisations have many **existing systems**, many of which **do not communicate** or for which only expensive one-off integrations are made.

- The openEHR platform provides a **disciplined way to integrate** such data,
 - using openEHR **Templates to model the legacy data structures**, while using normal openEHR archetypes to define the data points.

http://www.openehr.org/shared-resources/getting_started/provider_orgs.html

Why openEHR

- OpenEHR has a solid Reference Model and expressive archetype model
 - This is very useful to represent legacy data
- Many available archetypes in international repository
 - Good starting point
- Possibility to transform to ISO 13606 easily and HL7 CDA (done by Ocean already)

Project aim

- To create an openEHR based interface to SONHO
 - probably using web-services
 - making the interface downloadable for all interested
 - Just the interface, not the patient data :-)

Methods

1. Define patient summary
2. Select archetypes and define template
3. Select data from SONHO
4. Create a web-service

Methods

1. Define patient summary
 - Papers (n=29)
 - Doctors (n=13)
2. Select archetypes and define template
3. Select data from SONHO
4. Create a web-service

Methods

1. Define patient summary
2. Select archetypes and define template
 - Search for archetypes (Clinical Knowledge Manager)
 - Template designer from Ocean Informatics
3. Select data from SONHO
4. Create a web-service

Methods

1. Define patient summary
2. Select archetypes and define template
3. Select data from SONHO
 - Study the GUI (administrative/clinical)
 - Map the data items to the template
4. Create a web-service

Methods

1. Define patient summary
2. Select archetypes and define template
3. Select data from SONHO
4. Create a web-service
 - ... technical ...

Creating application interfaces for legacy systems

Patient summary concept (Articles +Questionnaire)	Concept in SONHO	Concept in openEHR	OpenEHR Archetype name
Diagnosis	Diagnosis	Diagnosis	EVALUATION.problem-diagnosis.v1
Medication	Medication prescription	Medication order Medication description involving a formulation	INSTRUCTION.medication.v1 ITEM_TREE.medication-formulation.v1
Problems	Problems	Problems	EVALUATION.problem.v1
Treatment	Therapeutic	Procedure undertaken Procedure	ACTION.procedure.v1 ITEM_TREE.procedure.v1
Patient name	Patient	Personal name	CLUSTER.person_name.v1
Alerts / Reminders	Medical Alert	Alert	EVALUATION.alert.v1
Identification	Hospital patient identification	Individual's personal demographics	CLUSTER.individual_personal.v1
Patient Number	number		
Date-of-birth	Date of birth	Individual's personal demographics	CLUSTER.individual_personal.v1
Complications	-	Problems	EVALUATION.problem.v1
Gender	Gender	Individual's personal demographics	CLUSTER.individual_personal.v1
Allergies	Medical Alerts	Adverse reaction	EVALUATION.adverse.v1
Vital Signs	Vital signs Monitoring	Vital Signs Pulse Respirations Blood Pressure Indirect oximetry Heart rate and rhythm Body temperature	SECTION.vital_signs.v1 OBSERVATION.heart_rate-pulse.v1 OBSERVATION.respiration.v1 OBSERVATION.blood_pressure.v1 OBSERVATION.indirect_oximetry.v1 OBSERVATION.heart_rate.v1 OBSERVATION.body_weight.v1
Exams	Lab./Exams	Imaging investigation	ACTION.imaging.v1 ITEM_TREE.imaging.v1
Current Medication	-	Medication order Medication description involving a formulation	INSTRUCTION.medication.v1 ITEM_TREE.medication-formulation.v1
Address	Address	Address	CLUSTER.address.v1
Weight	Weight	Body weight	OBSERVATION.body_weight.v1
Tests	Lab./Exams	Laboratory test	OBSERVATION.lab_test.v1
Immunization	-	Non-drug therapy	INSTRUCTION.non_drug_therapy.v1
Family history	Family Background	Risk of condition based on family history	EVALUATION.risk-family_history.v1
Complaints	-	Symptom Pain symptom Story	CLUSTER.symptom.v1 CLUSTER.symptom-pain.v1 OBSERVATION.story.v1
Healthcare History	Clinical History	Story	OBSERVATION.story.v1
Surgical	Operation Room	Operation Record	OBSERVATION.operation_record.v1

Patient Data in SONHO

HSJ	ALTA DO HOSPITAL	IGIF
- Nº PROCESSO: 901		
Nome: CARLA Idade: 26 Anos		
- EPISÓDIO Nº 902		
Serviço: ORTOPEdia**ORTOPEDIA ADULT Data: 21/12/2009 Hora: 08:58		
Sala: Sala H - Ortop Edificio Hospit Piso 7 Cama: 040		
- SAÍDA DO SERVIÇO		
Resultado: 1 MELHORADO Data Saída: 22/12/2009 Hora: 12:47		
- ALTA		
Médico: 46211 EURICO FERNANDO MONT Resultado Inter.: 1 MELHORADO		

Discharge

Patient number:
Name: Age: __ years

Encounter number:
Department: Date: Time:
Room: Bed:

Discharge from department
Result: Date: Time:

Discharge
Doctor: Intern. Result:

Patient Data in SONHO

Patient
Respo. Nurse

New drug

Prescribed

Prescrições Médicas

Nº Titente: TESTE PARA INTERNAMENTO 87 anos **RECM**

Ent. Resp. ANULACOES PARADEIRO DESCONHECIDO NºBenef. [REDACTED] **! alertas** **R** Receita Renovável

Prescrição de Medicamentos por :

Nome Comercial	Forma Farmacêutica	Dosagem	Embalagem	Qt.	P.V.P.	%comp(R.G.)	Preço Ut.	Preço SNS
IBUPROFENO GENERIS 20 MG/ML	Suspensão oral	20 mg/ml	Frasco - 1 unidade	1	1,52	69%	0,00	1,52
<input type="checkbox"/> Trifene, 20 mg/ml, Suspensão oral, Frasco - 1 unidade(s) - 200 ml					+0,44		+0,68	-0,24

ibuprofeno Generis **Os mais baratos**

Posologia **Outras prescrições** **Diabetes**

Nome Comercial	Qt.	prescrever em receita renovável?	Posologia	autoriza dispensa genérico	Nome DC/medic. AIII	Tt. Medicção Prolongada?
Ácido acetilsalicílico, Aspirina, 500 mg, Comprimido, Blister - 2	1	<input type="checkbox"/>	1 cp 6/6h em caso de febre ou dor	<input type="checkbox"/>		<input type="checkbox"/>

Data Prescrição: 2010/09/04 Local Prescrição: HOSP. DE SAO JOAO DO PORTO O médico, MEDICO TESTE [99948]

Prescrições anteriores Ver medicação prolongada Receitas anteriores

Legenda: tabela1 - Tratamentos de curta ou média duração tabela2 - Tratamentos prolongados **Não Autorizado** Genérico + tabela1 Genérico + tabela2 prod diabetes

Creating application interfaces for legacy systems

The screenshot shows a medical appointment system interface. At the top, it displays the doctor's name 'Agenda Médica - Dr(a) Maria Margarida Tavares' and the Oracle logo. Below this is a toolbar with various icons for functions like 'sair', 'gravar', 'diario', 'receita', 'relat.', 'calend.', 'pedido', 'modif.', 'alta', 'o.t.', 'lto.', 'alertas', 'diag.', 'antec.', 'impr.', 'desm.', and 'ajuda'. The main area is divided into several sections:

- Agenda 03 Setembro 2010:** Includes radio buttons for 'Médico' and 'Especialidade'. The 'Especialidade' is set to 'C.PEDIATRIA GERAL'. It also shows patient information: 'Nº Episódio: 10490259', 'Idade: 3 meses', 'SNS - Nº 197390107', and 'Prov:CONSULTA EXTERNA - C.PEDIATRIA GERAL'. The appointment time is 'Hora Efectivação 09:15', 'Hora Início 09:49', and 'Hora Fim 09:49'.
- Consultas Agendadas:** A table listing scheduled consultations. The first row is highlighted in red and yellow.
- Diagnósticos:** A section for entering diagnoses. The 'Diagnóstico Principal' is '5901 PIELONEFRITE AGUDA'.

Hora	Nº Processo	Nome do Doente	M	A	C	E	I	T
09:00	1001	NAIR	R	E	P			
09:00	4023	RUBEN	R	E	P			
09:30			E	P				
09:30			E	P				
10:00	1003	PEDRO	R	E	S			
10:00	1006	PALMA	R	E	S			
10:30	8027	JOAO	R	E	S			
10:30	8035	ANA S	R	E	S			
11:00	1002	AFON	R	E	S			
11:00	1002	RODR	R	E	S			
11:30			E	S				
11:30			E	S				
12:00			E	S				
12:00			E	S				
12:30			E	S				

Main diagnosis

Templates

[Patient Summary v10.oet]

- Template Properties
- Report
 - context
 - other_context
 - Report ID
 - Status
 - items
 - Individual's personal demographics
 - content
 - Body weight
 - Adverse reaction
 - Operation Record
 - Non-drug therapy
 - Risk of condition based on family history
 - Alert
 - Vital signs
 - Laboratory test
 - Imaging investigation
 - Diagnosis
 - Medication order
 - Procedure undertaken
 - Story or history

[Patient Summary v10.oet]

- Operation Record
- Non-drug therapy
- Risk of condition based on family history
- Alert
- Vital signs
- Laboratory test
- Imaging investigation
- Diagnosis
 - data
 - (Diagnosis)
 - Status
 - Date of initial onset
 - Age at initial onset
 - Severity
 - Clinical description
 - Date clinically recognised
 - Age when clinically recognised
 - Location
 - Aetiology
 - Occurrences or exacerbations
 - Related problems
 - Date of resolution
 - Age at resolution
 - Diagnostic criteria
 - protocol *Hidden*
- Medication order
- Procedure undertaken
- Story or history

Available in SONHO

Difficulties of mapping legacy information models to archetypes

- definition of many concepts has a certain level of subjectivity
 - SONHO users write complaints in personal history, or in the reason for admission
 - SONHO doesn't have concepts like complaints, problems, immunizations and **current** medication
 - Fields like medical alerts are used to insert allergies and chronic diagnoses
 - SONHO has currently many free-text fields

My questions

- How to extract what the existing data really means ?
 - Database documentation
 - IS user manual
 - Extrapolate from data
 - User forms
 - Ask users

- What to do with information in generic text-fields?

- What to do with conflicting information?

Final message

- Legacy systems still play a central role in most organizations and so have to be included in integration plans.
- Although difficult, the use of openEHR based communication interfaces may prove to be useful in creating future proof IS integration.
- Semantic mapping should be based on the analysis of how the users perceive what information is requested by the software user interfaces.