track and trace in healthcare clinical settings

Christian Lovis
Unit of Clinical Informatics
paleolithic, iron age, ... IT

Préhistoire

Il y a 106 000 ans  Il y a 66 000 ans  Il y a 26 000 ans
healthcare – the war of the worlds

- increase efficacy & efficiency
  - leads increase complexity

- increased knowledge
  - leads to specialization
  - leads to fragmentation
  - Medline: 1’500 references/day

- major decision taken in direct care
  - leads individualism and difficult process management
healthcare – at convergence of stakes

- economic pressure
- politic impact
- medias awareness
- patient and citizens empowerment
- legal and ethical issues
- knowledge & information r-evolution
• under-use, overuse, misuse of the health care system...
  • IOM Roundtable on Quality (JAMA 1998)

• \textit{“To Err is Human”}: building a safer Health System
  • 2.9-3.7\% inpatients have complications
  • 6.6-13.6\% lead to death, 50\% evitable
  • 8th mortality cause in the USA
  • drug errors > 7’000 death/y in the USA
  • (workers: 6’000)
linking virtual and real worlds

- consolidate information flows
- information integrity
- processes, things, actors
time is fastening and extending

- precision
  - high resolution data flows
- persistence
  - biogenomics
- traceability
  - medico-legal
persistence in time is critical

patient/citizen health record, medico-legal issues
R&D, epidemiology


Clear-cell adenocarcinoma of the vagina in a girl whose mother had taken diethylstilbestrol.

Williams RR, Schweizer RJ.

FPI: This case study illustrates the delayed association of administration of synthetic nonsteroidal estrogen to the onset of vaginal adenocarcinoma in their offspring. An 18-year-old-patient, whose mother had received diethylstilbestrol during the first 4 months of pregnancy, presented with irregular vaginal bleeding. Pelvic examination showed a normal vaginal wall. The area was nodular to granular and discolored by irregular hemorrhage. Endo-salpingo-oophorectomy, vaginectomy, resection of the anterior rectal segment, and vaginal reconstruction was also carried out. Microscopy of the vaginal wall (Stage 1). The patient progressed normally, and was followed up for 6 years.

PMID: 4709529 [PubMed - indexed for MEDLINE]
health system
very large industry
providers
consumers
transmission, communication
standards
multiple views
health politics
promotion
RFID today at the University Hospitals of Geneva

- identification of elements in flows
- clothes management
- sensitive products traceability

- application single sign-on
- authentication

**GOALS & OBJECTIVES**

- production flows
- accesses control
- physical accesses
- money

- accesses to buildings
- secured locations
- parking
- elevators, …

- personal money
- cash
- electronic distribution

**IMPROVE CARE PROCESS**

**IMPROVE EFFICIENCY**
• cash by RFID
  • coffee
  • printers
  • meals
  • ...

• accesses
  • secured areas
  • parking
  • ...

©2006 Hôpitaux Universitaires de Genève
• 5 groups (1 per campus)

• 8'551 users

• centralised management
  • users needs
  • clothes status

• in 2002: 1'103'142 treated
logistics
• equipments (monitoring, endoscopes, …)
• medical gas
• surgery instruments
the CPR at the heart of care

structured and unstructured documents

Documents from several sources, including structured forms, semi-structured reports, scanned images and other types of files are managed in a system that allows the sharing of structured data between the document in a content-based database and the content of the document in a structured data-oriented entity-attribute-based database.

More than 20 million data are stored and analyzed. There have been 140,000 documents published in 2004, organized in an EHR model type according to an M300.

laboratory and numerical results

All laboratory, including biochemical and viral sequences as well as other sources of numerical data are directly available and can be linked with other sources, such as reports or images.

In 2004, seven million lab results have been stored, almost 200,000 daily. These results can generate alerts through the notification system.

order entry

A generic order entry system for drugs, radiology, lab tests and lab results is being deployed.

Ninety million orders have been made in 2004, leveraging the work of physicians and other providers.

nursing care and observations

Nursing care, diagnoses, observations and care objectives are elements to understand the clinical situation and the care. The nursing record, based on standards such as HIMD and MCOs, is at the center of nursing activities.

The measures of predicted and effective nursing activity leads to better planning and care efficiency. Daily, almost 15,000 nursing interventions are recorded.

non radiological images and signals

Non-radiological images, such as pathology, biomarkers and demographic events are becoming increasingly important in the patient record.

The link between these images and other patient data such as hematology and hemogram is of some importance to make the work of clinicians.

radiology

Radiology is an important and crucial component of the patient record.

More than 20,000 images are added daily from a commercial PACS and extremely widely integrated with advanced tools for image interpretation.
Mapping out the patient’s journey: experiences of developing pathways of care

Amanda Layton, Fiona Moss, Graham Morgan

TOTAL ABDOMINAL HYSTERECTOMY PROTOCOL

POST-OP DAY 2  Date: _____________  NAME: ___________________  HOSPITAL NUMBER: ___________________

<table>
<thead>
<tr>
<th>MILESTONES:</th>
<th>REASONS IF NOT MET at 4.00pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Apyrexial</td>
<td>Y / N</td>
</tr>
<tr>
<td>- HB &gt; 10.5 g/dl and no clinical symptoms of anaemia</td>
<td>Y / N</td>
</tr>
<tr>
<td>- Passing urine normally</td>
<td>Y / N</td>
</tr>
<tr>
<td>- Bowels open</td>
<td>Y / N</td>
</tr>
<tr>
<td>- Evidence of wound healing</td>
<td>Y / N</td>
</tr>
<tr>
<td>- Pain free with or without analgesia</td>
<td>Y / N</td>
</tr>
<tr>
<td>- Independently mobile</td>
<td>Y / N</td>
</tr>
</tbody>
</table>

ASSESSMENT

- Vital signs; fluid balance; pain; bowels

INVESTIGATIONS

- FBC  Y / N  Result: _________
  - Remove vanflon (if blood transfusion not required),
  - Removed  Y / N
- Is patient pyrexial? (2-3° rise above baseline recorded presurgery)
  - If YES
    - Review blood count, wound and chest
    - Consider blood cultures (ideally 3 separate samples NOT taken through the IV line)  Y / N
• consolidate information flows
• information integrity
• processes, things, actors
consolidate views
chemotherapy

- complex production processes
  - patient
  - specialists
  - pharmacists

- complex administration

- scattered in time and space

- critical, time dependant

- major consequences in case of errors

- needs traceability and security
Prescription decision support

<table>
<thead>
<tr>
<th>Patient</th>
<th>Prénom</th>
<th>Date de naissance</th>
<th>No Tit</th>
<th>Unité</th>
<th>4-EL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td>Médicin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poids (kg)</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taille (cm)</td>
<td>168</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface corporelle (m²)</td>
<td>1.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Créatinine</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clartance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHOP
Protocole de 4 à 8 cycle(s) de 21 jour(s) chacun.

Moduler      | Cyclophosphamide 750 mg/m² à 250 ml sur 30 minutes | 346 mg | 346 mg | 100 % | 1   |
Moudler      | Doxorubicine 50 mg/m² i. push | 69.71 mg | 69.71 mg | 100 % | 1   |
Moduler      | Vinorelbine 1,4 mg/m² i. push | 2912 mg | 2912 mg | 100 % | 1   |
Pharmacie    | Prednisone 40 mg/m² po | | | | |

Administration: J1 heure:minute No Cycle
personalized care plan
Onco4: FORMATION Nouvelle, New 30.07.1963
METHOTREXATE 5430 mg INTRA VEINEUX
Poche Glucose 5 % ad 554 ml

CHIMIOTHERAPIE
keep human interfaces for humans
bedside final check and validation

fast  secure  simple
### furosemide-Furosemide Lasix® inject

<table>
<thead>
<tr>
<th>Dose par prise</th>
<th>Fréquence</th>
<th>A passer sur</th>
<th>Voie</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mg</td>
<td>1x/j</td>
<td>IV lent</td>
<td>intraveineux</td>
</tr>
<tr>
<td>10 mg</td>
<td>2x/j</td>
<td>IV direct</td>
<td>intramusculaire</td>
</tr>
<tr>
<td>40 mg</td>
<td>3x/j</td>
<td>sur 24h</td>
<td>per os</td>
</tr>
<tr>
<td>80 mg</td>
<td>1x/h</td>
<td>sur 12h</td>
<td></td>
</tr>
<tr>
<td>120 mg</td>
<td>1x/8h</td>
<td>sans précision</td>
<td></td>
</tr>
<tr>
<td>autre</td>
<td>matin-midi-soir</td>
<td>autre</td>
<td>autre</td>
</tr>
</tbody>
</table>

#### Début
- débute DE SUITE
- débutes selon horaire habituel
- en urgence
- autre début

#### Fin
- jusqu'à nouvel ordre
- ce jour
- pour demain
- autre durée

#### Condition
- d'office
- en Réserve
- autre

⚠️ ne pas dépasser une vitesse d'injection de 4mg/min (2.5 mg/min en cas d'HF sévère)

**Commentaires, instructions :**

---

**Informations**

| Ordre Saisi | le 23.02.2004 à 14:15 | par Dr. Christian Lois |

©2006 Hôpitaux Universitaires de Genève
Physiothérapie

But(s) du traitement
En accord avec le médecin, la physiothérapeute peut choisir ou modifier les moyens et méthodes pour atteindre au mieux le but de traitement

- Amélioration de la fonction articulaire
- Amélioration de la fonction cardiaque
- Amélioration de la fonction circulatoire
- Amélioration de la fonction neuro-musculaire
- Amélioration de la fonction respiratoire
- Analgésie / anti-inflammatoire
- contention articulaire
- Entraînement d'exercices/instruction
- Prophylaxie / coordination
- Évacuation à la marche

Autre

Motif de la demande :

Fréquence
- Fréquence 24/7
- Indispensable le week-end
- Samedi et Dimanche

Location de matériel :

Précautions
- Pompe sous-cutanée
- Machine transmissible
- Pacemaker / implants

Attention

Debut
- Débuter dès suite
- Débuter selon horaire habituel
- En urgence
- Autre début

Fin
- En cas de nouveau ordre
- En cas de raccourci

Condition
- d'office
- en Réserve
- Autre durée

Commentaires, instructions :

Informations
Ordre Saisi le 23.02.2004 à 14:20 par Dr Christian Louis
Un ordre pour ce médicament est déjà présent sur la feuille d'ordre

**furosémide** Lasix cp 40 mg 1x/j (par jour : 40 mg) PO

Vous pouvez peut-être modifier un ordre existant.

Pour prescrire tout de même cette ordre :

**ERYTHROMYCINE** interagit avec **FUROSEMIDE**

Il est déconseillé d'associer les médicaments non antarythmiques donnant des torsades de pointes (astémozole, érythromycine M, ibutilide, piméridine, spéfloxacine, sulpride, terfenadine et vincaine M) d'une part, et les médicaments hypokaliémiants d'autre part. En effet l’hypokaliémie, au même titre qu’une bradycardie et un espace QT long préexistent, est un facteur favorisant la survenue de torsades de pointes.

* corticoides par voie générale et, dans certains cas, par voie locale (intra-articulaire, cutanée, lavement rectal), tetracosactide, durètiques hypokaliémiants ou associés, laxatifs irritants, omphéotéline B.

the problem of standards

- encoding
  - GS1 - EAN-UCC

- carrier
  - barcodes, rfid, frequencies

- semantic
  - HL7-3, LOINC, EN13606

- integration
  - IHE
• **linking to the world**
  - identifying actors, unique patient IDs, care providers
  - packaging, manufacturers
  - customers

• **describing the inner world**
  - > 10’000 locations in the HUGs

• **keeping trace of actions**

• …
at the patient level, every pill is unique

- bedside controlling
- real-time
- human check
- unique reader, many encodings

- supporting processes

- ethically acceptable
- economically supportable
- technically possible
simplified models do not simplify the world

is not just tagging things in separate worlds

confusion of goals and perfection of means seems to characterize our age

A. Einstein
the human factor