Case-based learning: A formal approach to generate health case studies from Electronic Healthcare Records

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The problem

• There is an increasing social pressure to have medical students reach the end of their curriculum with a level of competence needed to face clinical practice already in the early phase of their career.

• Active methods of teaching/learning can guarantee results of high standards of expertise, because they are addressed to the development of knowledge and also to its use in real or realistic settings.
CBL: Case-Based Learning

• The CBL is a teaching method that belongs to the more general class of the inquiry or discovery learning.

• The CBL has been defined as an approach to teaching and learning which aims to prepare students for clinical practice, through the use of real or realistic clinical cases.

• These cases link theory to practice through the application of theoretical knowledge to the cases themselves and encourage the use of methods of inquiry based learning.
Health Case Study (HCS) features for CBL

• a) be authentic (based on real patient stories);
• b) involve common scenarios
• c) tell a story
• d) be aligned with defined learning outcomes
• e) have educational value
• f) stimulate interest
• g) create empathy with the characters
• h) include quotations in the patient voice to add drama and realism
• i) promote decision making
• l) have general applicability
Why CBLs?

• Learning activities in CBL are essentially ways to "play" a simulation of management of a case, and it is very different from the traditional "case reports", in which clinical features and the decision-making process are illustrated to the “passive” learner.

• In a CBL case the learning is interactive: the learner has to do his/her choice at every point of decision.
The Italian longitudinal electronic healthcare record (L-EHR)

L-EHR is a lifelong EHR of patient health information generated by patient’s encounters with caregivers in any care delivery setting. L-EHR can represent the clinical history of a citizen during his entire life.

It integrates standard clinical documents produced by different specialties and by different organizations (e.g., laboratory and hospital information systems, GP’s record), documents are marked by clinical contact (during which it was written) and health issue (the origin of the clinical contact).

L-EHR could be a good source of real patient stories to extract cases for educational purposes.
Health Issue

Each episode of care starts from a health issue (eg. symptom) and then it is described by the evolution of the health issue together with the clinical events that are carried out during the care in order to solve the initial health issue.

Health Issue is the reason for the request for health care
Clinical history

The clinical history of a patient can be described as a network of health issues that provides the complete semantics of the various problems encountered by the patient and their evolution in time. The edges of this graph have different meaning, for example:

a) **in depth** (the problem is analyzed in depth and defined more);

b) **complication** (the problem degenerates into a different issue);

c) **consequence** (some diseases, especially chronic, could produce complications).
Our system: an example of simple HCS
HCS generation process

1. Extraction and anonymisation
2. Preparation of the HCS
3. Storage in HCS repository
Extraction and anonymisation

I. selection of the initial health issue from which all the care pathway must be derived

II. export of selected case

III. Anonymization according to Italian laws
Preparation of the HCS

Connection of the elements of the care pathway

| scientific references | clinical guidelines | documents, websites and other resources (comments, notes, etc) |

AIM: to improve the reading of HCS
## The HCS repository

**AIM:** to have for each significant problem of health *a wide selection* of HCSs from which, by the *designing, a learning object process may start*

<table>
<thead>
<tr>
<th>The <strong>educational</strong> metadata of a single HCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>competence (level 1 of Tuning)</td>
</tr>
<tr>
<td>work activity (level 2 of Tuning)</td>
</tr>
<tr>
<td>theoretical knowledge / factual or use specific skills brought into action</td>
</tr>
</tbody>
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HCS formalization

The HCS is a complex artefact composed by:
✓ network of health issues, formally a connected graph (container of the health issue target)

✓ the clinical events linked to the network of the health issues
✓ the clinical documents linked to clinical events linked to the network of the health issues
Formalization of HCS extraction

The extraction of the HCS is based on the choice of the initial health issue and then on the extraction of all the directly and indirectly connected health issues together with the related clinical events and clinical documents.

In the paper the formalization is shown.
Conclusions

A prototype of the proposed system has been developed in the framework of the project Smart Health 2.0 funded by the Italian government research and innovation programme “Smart Cities and Communities and Social Innovation".

Functionalities

- Enhancement of clinical data by means of links to external information sources
- Tools to support abstraction and meditation process
- Tools for communication and collaboration
- Tool for HCS generation and management