Realist representation of the medical practice: an ontological and epistemological analysis

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Summary

- Advantages and limitations of realist ontologies for medical knowledge representation
- Evaluation of the relationship between formal ontologies and clinical reasoning
- Methodology used to identify information contained in medical records
- Partial findings and discussion
Introduction

Electronic health records (EHR): essential in healthcare applications

Common data has to be shared among health professionals

Interoperability among systems: communication between systems without human intervention

Ontologies are an alternative to interoperability through the creation of an unambiguous vocabulary

Realist ontologies require a referent in the real world; not able to represent statements like: “suspected fever” and “no fever”

Our Goal:
-evaluate real medical records
-analyse entities in a record and how they can be represented
Advantages and limitations of realist ontologies

Ontologies have been used in architecture, geography, medicine and biology

**Biomedical ontologies:**
- Gene Ontology (GO)
- Foundational Model of Anatomy (FMA)
- Cell-Type Ontology (CEL)
- Protein Ontology (PRO)
- Chemical Entities of Biological Interest (CHEBI)
- Disease Ontology
- Ontology for General Medical Science
Realistic ontologies:
Realism while philosophical discipline can reveal different flavours

One of the main tenets of realism is the existence of universals and particulars

We take “ontological realism” as a methodology for ontology development – said “realist ontologies” (Smith, 2003)

The unrestricted creation of classes to represent every possible entity leads to inconsistencies

The realist methodology uses a upper-level ontology (BFO) to organize universals in a top-down approach

BFO is comprised of SNAP (continuant) and SFAN (occurrents) branches
Limitations of realist ontologies for representing medical practice

Criticisms of realist proposal

Conceptual approaches: closer to medical everyday language
(a diagnosis is presumptive, based on incomplete data)

Realist approaches: creation of ontologies of concepts is based on language and subject to ambiguities

Class vs Universals:
“AIDS is spreading quickly through Asia”
“AIDS is caused by the HIV”

Ontology vs Epistemology

Four kinds of terms in biomedical terminologies

[Bodenreider et al, 2004]
Methodology

Separating ontological from non-ontological information

Steps:

- Record creation based on real clinical cases
- Transcription of records for information identification
- Analysis and classification of the record’s information items, according to distinctions made in realism ontologies
QP: Chest pain and abdominal pain.

HMA: Six months ago, the patient felt severe precordial pain in addition to nausea and dyspnea. She attempted medical care in the Hospital X, where received isordil + AAS 300mg. Enzimes: CKT 262 CKMB 30. She was not aware of previous pathologies. It was prescribed: Captopril, HCTZ e AAS.

Last month, the patient felt severe pain again and sought for medical care in a different place. Then, it was prescribed: Losartan, AAS, Sinvastatina e Nebilet.

She sought for medical care in other occasions because of the precordial pain. In addition to the medicine mentioned, she uses Metoprolol - 100 mg 12/12 h.

She reports diffuse and intermittent abdominal pain, which becomes worse in case of stress. It is not related with bowel movement alterations. She also reports rare burning epigastric pain that improves with water drinking.

Example of medical record under analysis
1- Aspects that represent entities IN REALITY

<table>
<thead>
<tr>
<th>continuant</th>
<th>occurrent</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Chest pain</td>
<td>-Were prescribed</td>
</tr>
<tr>
<td>-Abdominal pain, precordial pain</td>
<td>-Makes use</td>
</tr>
<tr>
<td>-Nause, Dyspnea</td>
<td>-Bowel movements</td>
</tr>
<tr>
<td>-Enzyme</td>
<td>-Moment of first occurrence of pain (six months ago)</td>
</tr>
<tr>
<td>-Captopril, Losartan</td>
<td>-Moment of re-incidence of pain (one month ago)</td>
</tr>
</tbody>
</table>

2- Aspects that represent useful constructs for medical practice NOT empirically verifiable

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-Severe (precardial) heavy pressure (pain)</td>
<td>-Diffuse and intermittent (abdominal pain)</td>
</tr>
<tr>
<td></td>
<td>-Rare burning (epigastric pain)</td>
</tr>
</tbody>
</table>
3- Aspects that represent observations ABOUT reality (not reality itself)

- CKT 262
- CKMB 30
- Left ventricle ejection fraction: 68%

4- Aspects that represent observations ABOUT the physician understanding of the clinical situation (not about reality)

<table>
<thead>
<tr>
<th>Previous consultations and prescriptions</th>
<th>- Previous diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not related to bowel movement alterations</td>
<td>- (Diffuse and intermittent abdominal pain) that worsens with stress</td>
</tr>
<tr>
<td></td>
<td>- (Rare burning epigastric pain) that improves with water drinking</td>
</tr>
</tbody>
</table>
Partial findings

1. Entities IN REALITY
2. Useful constructs for medical practice
   NOT empirically verifiable
3. Observations ABOUT reality
   (not reality itself)
4. Observations ABOUT the physician
   understanding of the clinical situation
   (not about reality)

This research is on-going