The Reproducibility of CLIF, a Method for Clinical Quality Indicator Formalisation

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Quality Indicators

Used
- internally and
- externally
  ➢ need to be well-formalised to lead to comparable results
  ➢ CLIF
  ➢ needs to be reproducible
Case Study

- We performed a case study to investigate CLIF’s reproducibility
- Developed reference standard together with experts for sample indicator

- 8 participants (Medical Informatics Master Students) formalized sample indicator with the help of a web-based tool
**Employed Indicator**

**Numerator:** Number of patients who had 10 or more lymph nodes examined after resection of a primary colon carcinoma.

**Denominator:** Number of patients who had lymph nodes examined after resection of a primary colon carcinoma.

- **Exclusion criteria:** Previous radiotherapy and recurrent colon carcinomas

**Evidence-based** (correct staging leads to better outcome), requires data from several sources
CLIF’s 8 Steps

(constuct two queries)

1) Encode relevant concepts in terms of a terminology
2) Define the information model
3) Formalise temporal constraints
4) Formalise numeric constraints
5) Formalise Boolean constraints
6) Group constraints by Boolean connectors
7) Formalise in- and exclusion criteria
8) Construct the denominator by removing constraints that only aim at the numerator
Step 1: Encode relevant concepts in terms of a (standard) terminology

Numerator: Number of patients who had 10 or more lymph nodes examined after resection of a primary colon carcinoma.

Exclusion criteria: Previous radiotherapy and recurrent colon carcinomas
### Users' Results Step 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent colon carcinoma</td>
<td>20%</td>
</tr>
<tr>
<td>Primary colon carcinoma</td>
<td>30%</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>15%</td>
</tr>
<tr>
<td>Colectomy</td>
<td>25%</td>
</tr>
<tr>
<td>Examination of lymph nodes</td>
<td>10%</td>
</tr>
</tbody>
</table>

**Fleiss' kappa:** 0.754 (substantial agreement)
Step 2: Define the Information Model

**Numerator**: Number of patients who had 10 or more lymph nodes examined after resection of a primary colon carcinoma.

Problem-oriented information model: relate all procedures to diagnoses.

- Users had major difficulties with relating concepts in the information model.
Step 3: Formalise Temporal Constraints

**Numerator**: Number of patients who had 10 or more lymph nodes examined **after** resection of a primary colon carcinoma.

**Exclusion criteria**: Previous radiotherapy and recurrent colon carcinomas

**Reporting year**: 2010

- Users had difficulties due to ambiguities:
  - Which procedure during the *reporting year*? Lymph node examination or resection? Or both?
  - Before which event should the radiotherapy have taken place?
Step 4: Formalise Numeric Constraints

**Numerator**: Number of patients who had **10 or more** lymph nodes examined after resection of a primary colon carcinoma.

- All users met the reference standard
Step 5 & 6: Boolean Constraints & Connectors (not applicable)
Exclusion criteria: Previous radiotherapy and recurrent colon carcinomas

- Only consecutive errors: constraints / concepts have not been defined previously (step 1 and 3) and thus could not be excluded.
Step 8: Difference between Numerator and Denominator

**Numerator**: Number of patients who had 10 or more lymph nodes examined after resection of a primary colon carcinoma.

**Denominator**: Number of patients who had lymph nodes examined after resection of a primary colon carcinoma.

- All users met the reference standard
Overview of Users’ Results

Adherence to Reference Standard

0 20 40 60 80 100

<table>
<thead>
<tr>
<th>concepts</th>
<th>inf. model</th>
<th>temporal</th>
<th>numeric</th>
<th>exclusion</th>
<th>num/denom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

participant 1
participant 2
participant 3
participant 4
participant 5
participant 6
participant 7
participant 8
Recommendations, Conclusions and Future Work

- We recommend indicator-releasing organisations to publish indicators together with sets of concepts and to formulate indicators as precisely as possible - especially temporal relations. Otherwise: compare with caution!

- Those responsible to calculate indicators must be trained in the employed information model.

- CLIF helps to make ambiguities in indicators explicit and can support reproducible results.

- Future work: Investigate the generalizability of CLIF and the use of standard information models.