

If you can not measure it, you can not improve it. Lord Kelvin

Problems, Goal and Requirement

Problems

- Indicators that are released in natural language are *ambiguous*
- Increasing number* of indicators makes their manual calculation unfeasible

Goal

Ideally, indicators would be *calculated automatically* based on patient data that is captured during the care process.

Requirement

To derive comparable values, a *formalisation method* is needed to transform indicators from natural language into an *unambiguous, machine-processable, formal representation*.

Example Quality Indicator

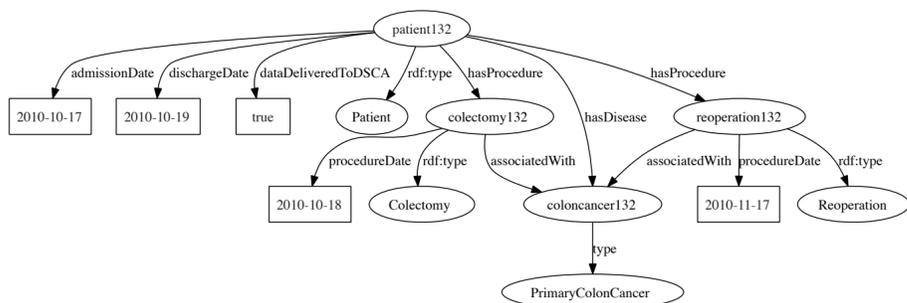
Number of examined lymph-nodes after resection

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

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

Exclusion Criteria: Patients with previous radiotherapy; recurrent colon carcinoma.

Example Patient

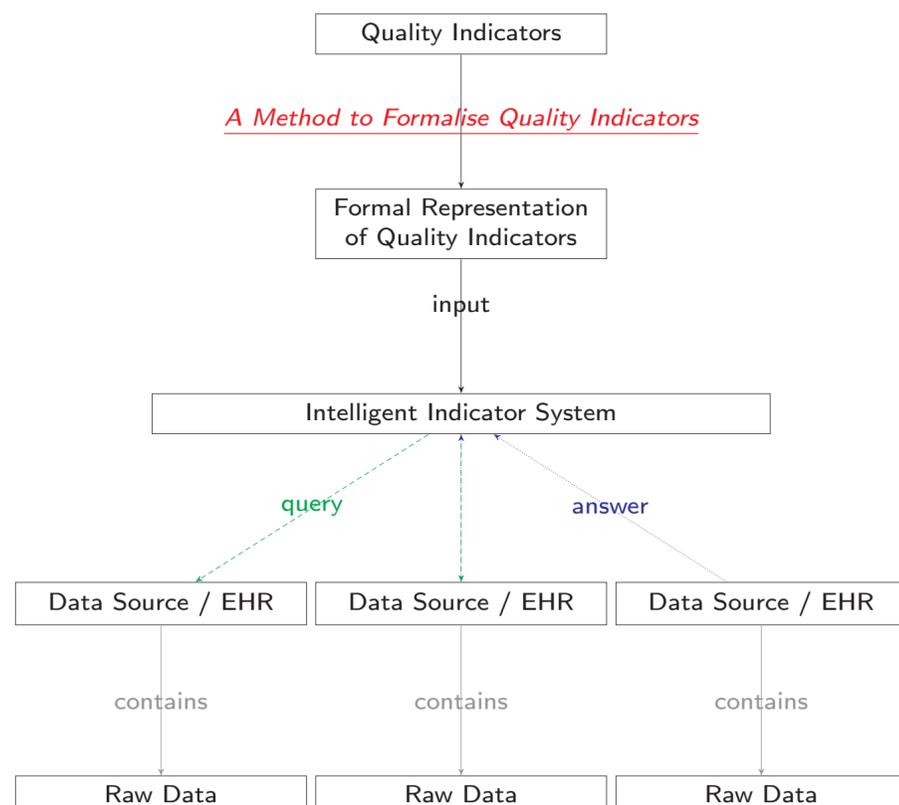


Definition Quality Indicator

A quality indicator is "a measurable element of practice performance for which there is evidence or consensus that it can be used to assess the quality, and hence change in the quality, of care provided."

(Lawrence 1997)

The Big Picture: Formalise indicators to calculate them automatically



Method to formalise Quality Indicators into SPARQL Queries

Step 1)

Encode relevant concepts (diagnoses and procedures) from the indicator by concepts from a terminology

`?colectomy a sct:SCT_23968004 .`

Step 2)

Define the information model

`?patient schema:hasDisease ?coloncancer .`

Step 3)

Formalise temporal constraints (FILTER - SPARQL FILTERs restrict solutions to those for which the filter expressions evaluate to true)

`FILTER (?lymphnodeexaminationdate > ?colectomydate)`

Step 4)

Formalise numeric constraints (FILTER)

`FILTER (?numberexaminedlymphnodes ≥ 10)`

Step 5)

Formalise boolean constraints (FILTER)

`FILTER (?deliveredToDSCA = true)`

Step 6)

Group constraints by boolean connectors

`(coloncancer AND colectomycode) OR (rectumcancer AND resectionrectum)`

Step 7)

Mark exclusion criteria

`FILTER (?lymphnodeexaminationdate > ?radiotherapydate) }`

Step 8)

Mark constraints that only aim at the numerator

`FILTER (?numberexaminedlymphnodes ≥ 10)`

Resulting SPARQL query (Numerator)

`SELECT ?patient WHERE`

`# Step 1)`

`?patient a sct:SCT_116154003 .`

`?coloncancer a sct:SCT_93761005 .`

`?colectomy a sct:SCT_23968004 .`

`?lymphnodeexamination a sct:SCT_284427004 .`

`# Step 2)`

`?colectomy sct:SCT_47429007 ?coloncancer .`

`?patient schema:hasDisease ?coloncancer .`

`?patient schema:hasProcedure ?colectomy .`

`?colectomy schema:procedureDate ?colectomydate .`

`?patient schema:hasProcedure ?lymphnodeexamination .`

`?lymphnodeexamination schema:procedureDate ?lymphnodeexaminationdate .`

`?lymphnodeexamination schema:hasNumber ?numberexaminedlymphnodes .`

`# Step 3)`

`FILTER (?lymphnodeexaminationdate > "2010-01-01T00:00:00+02:00")`

`FILTER (?lymphnodeexaminationdate < "2011-01-01T00:00:00+02:00")`

`FILTER (?lymphnodeexaminationdate > ?colectomydate)`

`# Step 4); needs to be removed to construct the denominator (# Step 8))`

`FILTER (?numberexaminedlymphnodes ≥ 10)`

`# Step 7)`

`FILTER NOT EXISTS`

`?radiotherapy a sct:SCT_108290001 .`

`?patient schema:hasProcedure ?radiotherapy .`

`?radiotherapy schema:procedureDate ?radiotherapydate .`

`FILTER (?lymphnodeexaminationdate > ?radiotherapydate)`

OWL Schema for Patient Data

