Graphical Modeling of HEDIS Quality Measures and Prototyping of Related Decision Support Rules to Accelerate Improvement

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Introduction

Many healthcare organizations have to report an increasing number of quality of care measures. The predominant method to model and solve such requirements is using SQL-based tools. However, existing database tools do not provide good support for solving time-related questions and SQL is not easily understood by clinicians. We used our previously developed analytical infrastructure called RetroGuide (RG) [1] to partially model two HEDIS 2007 quality improvement (QI) criteria developed by National Committee on Quality Assurance (NCQA). We also looked beyond the measure definition and retrospectively simulated decision support rules to capture pertinent clinical scenarios. We used data from the Enterprise Data Warehouse (EDW) at Intermountain Healthcare (IHC). IHC is a not-for-profit integrated delivery system of 21 hospitals with an affiliated health plan.

Methods

• HEDIS2007 OMW measure definition: The percentage of women 67 years of age and older who suffered a fracture and who had either a bone mineral density (BMD) test or prescription for a drug to treat or prevent osteoporosis in the six months after date of the fracture.

• HEDIS2007 CMC measure definition (modified): The percentage of patients 18-75 years of age who were discharged alive for acute myocardial infarction, coronary artery bypass graft or percutaneous transluminal coronary angioplasty who had each of the following: (1) LDL-C screening performed (CMC-I measure) and (2) LDL-C control <100 mg/dL (CMC-II measure)

• Two selected measures were modeled in RetroGuide analytical suite inspired by workflow technology

• RetroGuide analytical suite uses the following steps (Figure 4) [2-6]:

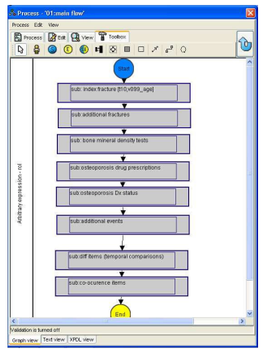
1. *data extraction phase:* assembly of chronologically ordered coded EHR event data for each cohort patient from various sources.
2. *scenario modeling phase:* creation of graphical executable model representing analytical steps. Scenario flowchart step-wise layer mimics a manual chart review process. Modeling constructs include use of nodes with links to external applications (code layer) and ability to use conditions on flowchart transition arrows (Figures 1,2 and 3).
3. *execution phase:* sequential execution of the scenario on each cohort patient, creation of output reports (Figure 4)
4. *reports review phase:* hierarchy of linked reports showing execution of the lymphoma scenario on the real EHR data (Figures 5 and 6)

Results

OMW: The RG output report showed that 7.96% of the patients had an osteoporosis drug prescription and 3.15% had a report about bone mineral density test within 6 months from the fracture. In terms of potential areas for improvement, we found that 21.96% of non-compliant women had an established prior diagnosis of osteoporosis (via ICD9 billing code or EHR problem list) and 11.2% had 2 or more encounters within 6 months after the fracture. We also studied women with fracture at age 65 to 66 (prior to the measure-qualifying-age of 67) and found that 12.0% had a prior diagnosis of osteoporosis; 20.0% had an additional fracture prior to age 65; and 4.67% had a record of therapy prescription only after 2 or more previous fractures.

CMC: We found that 43.24% of CMC patients had proper cholesterol screening performed and 31.53% were in good control. We investigated what percentage was close to the threshold level (100-130 mg/dL) and on a low dose of a lipid-lowering agent (2.66%). In 13.38% of the non-compliant patients we found evidence of 2+ laboratory-test-episodes or 3+ encounters within the desired time window. These results are limited by the presence of appropriate codes and completeness of the EHR available at IHC.

A)



B)

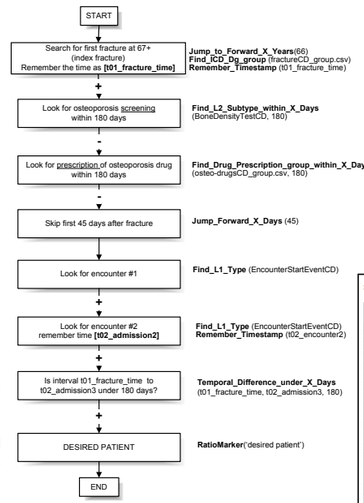


Fig 2: A) Main flowchart of the osteoporosis scenario (OMW) shown in the workflow editor (gray nodes include sub-flows).
B) Flowchart depicting individual steps and external applications involved in the sub-analysis investigating an alert logic for presence of 2+ encounters after index fracture event.

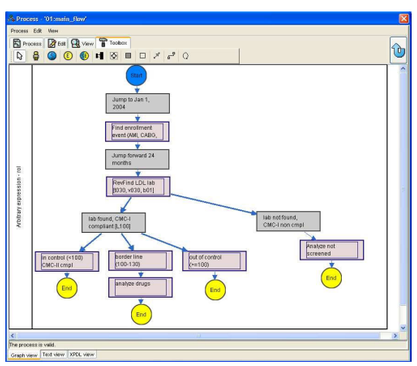
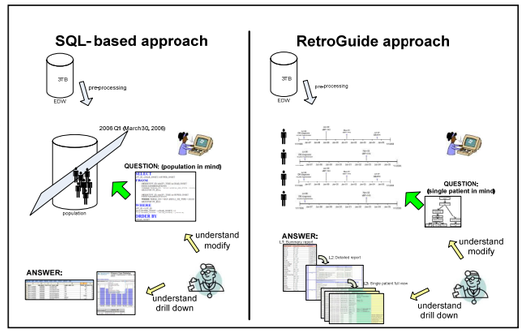


Fig 3: Main flowchart of the cholesterol screening scenario (CMC) shown in JaWE open-source workflow editor. Pink nodes contain subflows, gray nodes represent individual steps with references to one or more modular external applications (see Figure 1)

Discussion

RG's key advantages are: (1) Graphical approach to modeling analytical questions. Such graphical middle layer facilitates better clinician-analyst collaboration (executable flowcharts will be included in the poster version); (2) Ability to model a set of criteria where parameters or results from previous restricting criterion can be easily used in subsequent criteria; (3) Ability to easily extent the HEDIS model with additional relevant analytical questions; and (4) Ability to prototype several versions of decision support on retrospective data and observe potential impact prior to deployment (with support for patient level execution trace and EHR drill down capabilities). (5) RetroGuide is based on cross-industry workflow technology with a potential to use different editors or engines for implementing similar analytical framework at different institutions and ability to share scenarios definition via standard process definition languages (e.g., XPDL).

Fig 4 (on the right): RG analytical approach compared to SQL-based approach. RG scenario is constructed having single patient in mind and runs against data of individual patients (single patient execution strategy). RG results are hierarchical (3 levels of mandatory reports). Optional reports can be generated if appropriate RG external applications are used.



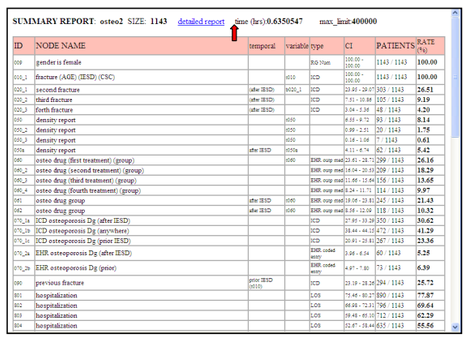


Fig.5: RG generated level 1 *Summary report* shows population overview of results (for the OMW scenario). Only results of the first 25 items are shown. The arrow shows the link to the level 2 report (see Figure 6).

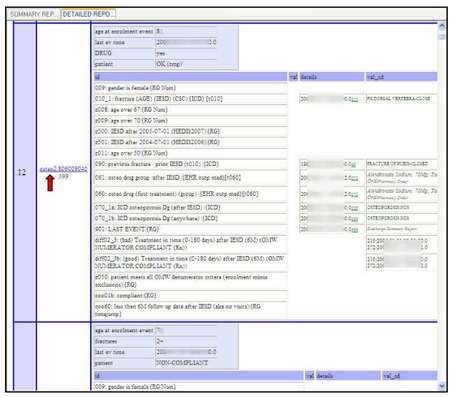


Fig. 6: RG generated, level 2 *Execution trace* report (OMW scenario) . In this report, each scenario step is audited (separately for each patient). The arrow shows the link to level 3 view of an EHR of an individual patient.

1. DataGet applications
- Find_Diagnosis
- Find_Lab
- Find_Medication
- Find_Exam
- Find_Coded_Value_under_Exam
- Find_Coded_EHR_Event

2. Analytical applications
- Jump_Forward_X_Months
- Jump_to_First_EHR_Event
- Jump_to_Last_EHR_Event
- Jump_to_Timestamp
- Get_Pt_Age_at_Current_Position
- Patient is Male
- Remember_Timestamp
- Remember_Numeric_Value
- Evaluate_Two_Timestamps_Difference
- Track_Patient_Count
- Generate_Custom_Pt_List
- Capture_Statistical_Data_Item

Figure 2: List of selected RG external applications which can be used inside flowchart nodes. External applications supports in and out parameters (parameters not shown) and represent modular analytical steps. Their use resembles instructions which are similar to steps involved in a manual chart review.

RetroGuide *clinician-friendly flowchart alternative to SQL !*

References

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