GDL EDITOR

SAMPLES (v0.9)

FUNDED BY: Cambio Healthcare Systems (http://www.cambio.se)

BODY MASS INDEX CALCULATION

This example will describe how to create a simple guide line to calculate the body mass index using the formula:

$$\text{BMI} = \frac{\text{mass(kg)}}{(\text{height(m)})^2}$$

> *The description of the guide should include all the necessary information to make sure it is used in the correct context.*

To add a new rule, we click on the *Add rule* button. We include the name of the rule and hit *Accept*.

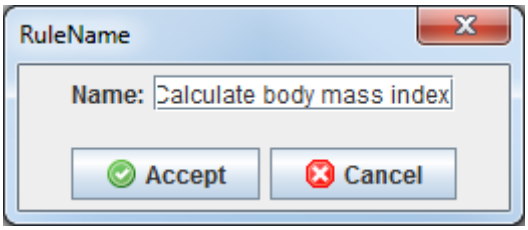

Figure 1: Creating a new rule

After this step is performed, we will begin the rule editing. We should make sure that the elements needed have the correct units. We want to add two conditions: weight is measured in kilograms and height in centimeters. Double clicking twice on the *Compare (Attribute)* condition, we will add two empty conditions to the rule.

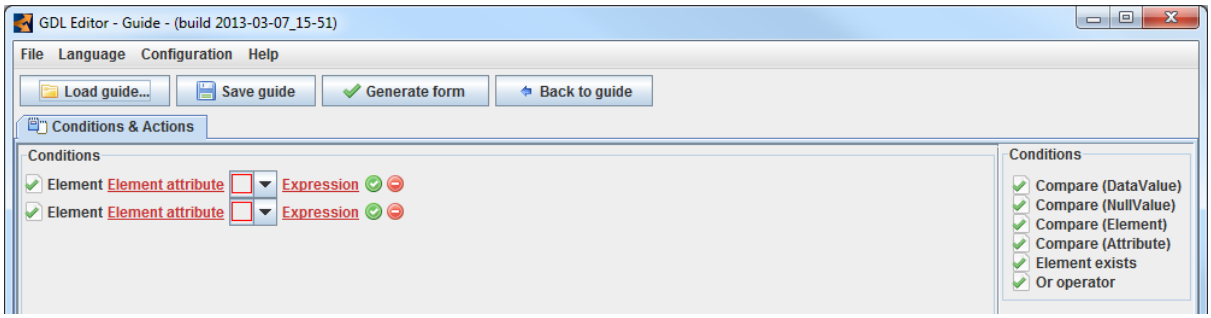

Figure 2: Adding conditions to specify units

Now we can specify the units for both elements we are going to obtain from the EHR (weight and height). Clicking on the *Element attribute* link, we can select the attribute we are going to use. Since we don't have yet any archetypes defined on the guide, we will have to click on the *Add archetype* button to add an archetype reference (in this case Body Weight archetype, see Figure 4). Double click on the archetype or just select it and click on the *Accept* button. Once the archetype reference is added, we can select an element from it. Archetype references are stored in the definition section of the guideline and can be reused to select several elements from them (see Figure 5).

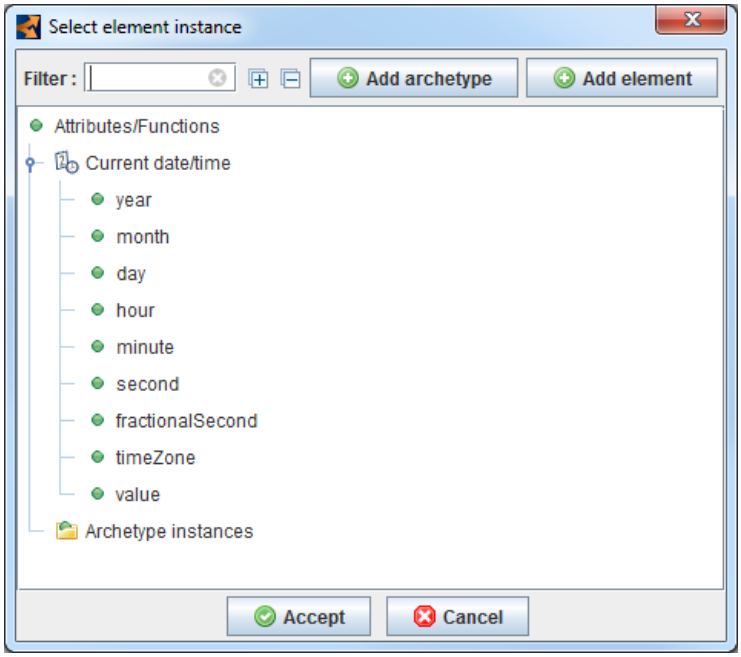

Figure 3: Select element instance

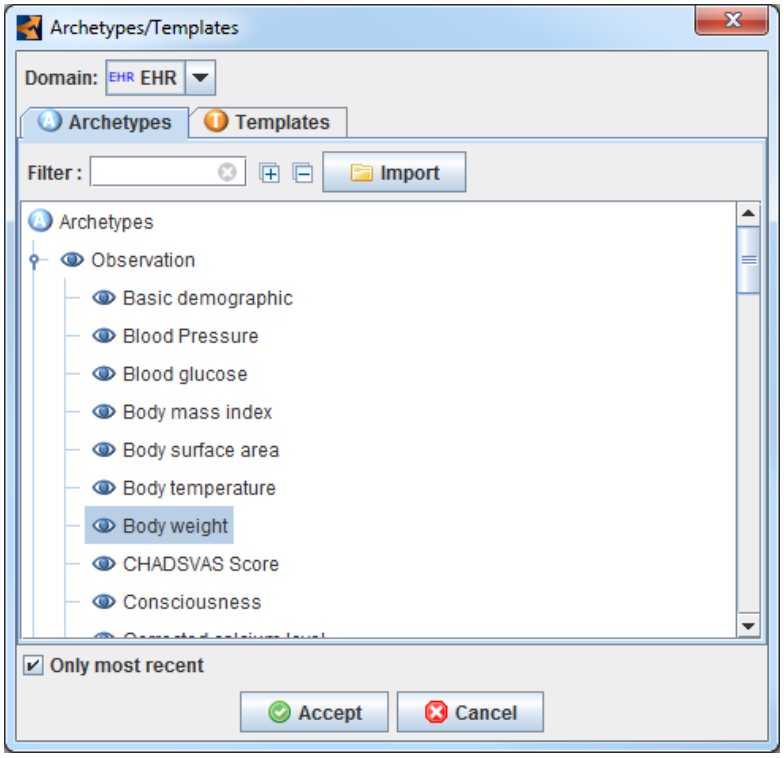

Figure 4: Adding body weigh archetype reference

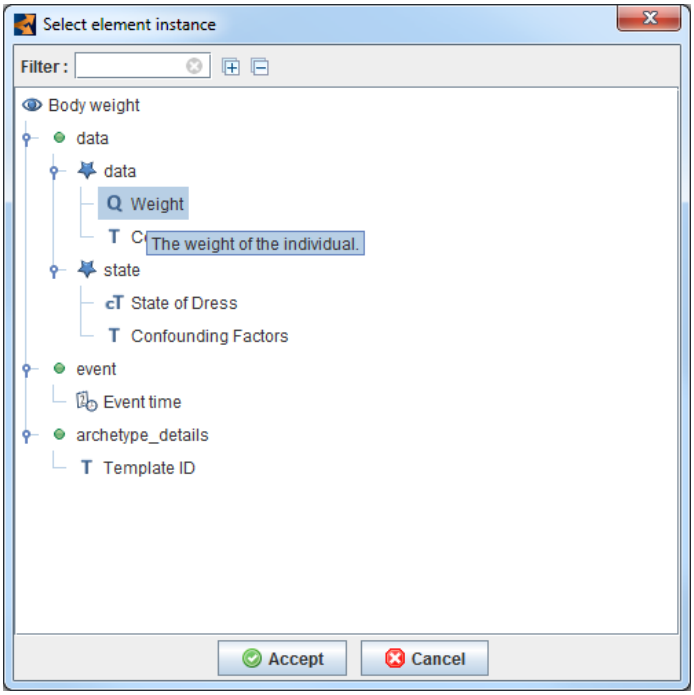

Figure 5: Selecting an element from the archetype

After selecting the element, we will be presented with a new dialog for selecting the attribute of the element (see Figure 6). We choose the units attribute and click *Accept*.

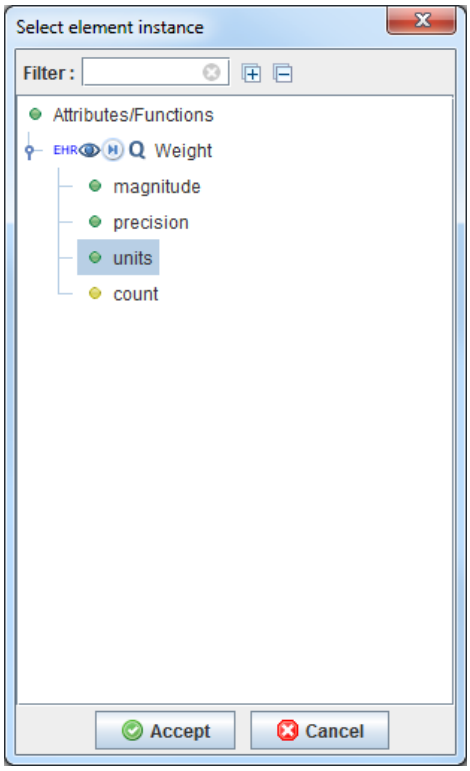

Figure 6: Select attribute

Now we can select the operator and the units (*kg*) we want to specify.

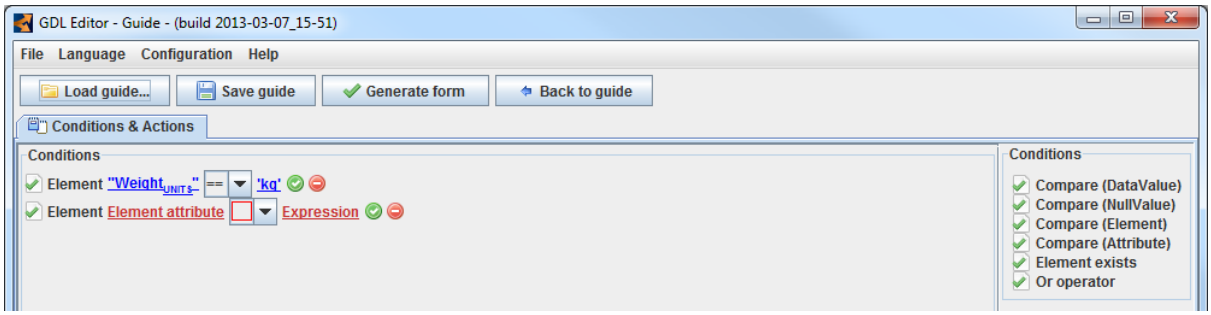

Figure 7: Specifying kg units for body weight

We can do the same procedure for the archetype Height/Length, using the *cm* units. Next we will need to add an action that will update the magnitude attribute of the element Body Mass Index archetype. We double click on the Action *Set (Attribute),* located at the lower panel. We follow the same steps as seem before for selecting units, but instead select magnitude attribute. By now, the rule should look like Figure 8.

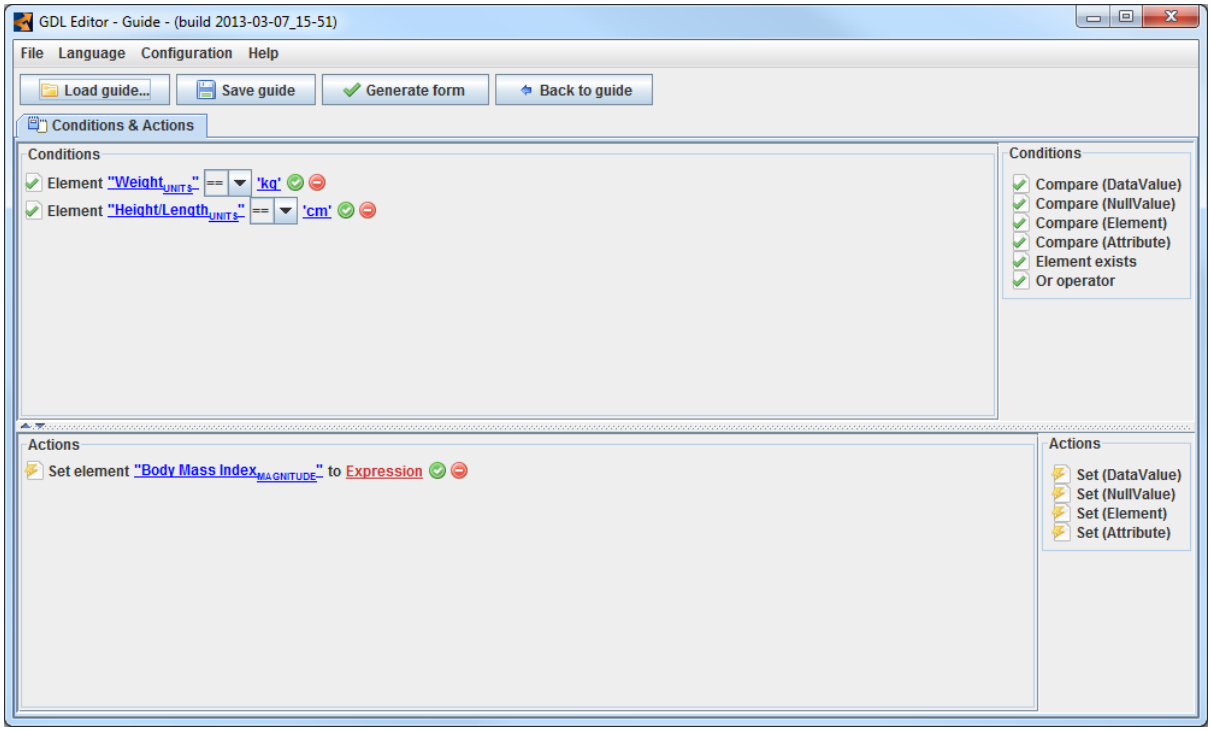

Figure 8: BMI magnitude selected

Last part requires defining the expression for calculating the BMI. We click on the *Expression* link to open the expression editor and enter the equation *(weight/ ((height / 100) ^ 2))*. Click on *Accept* button to add the expression to the action.

> *Expressions on current version must follow the pattern '(expression operator expression)'*

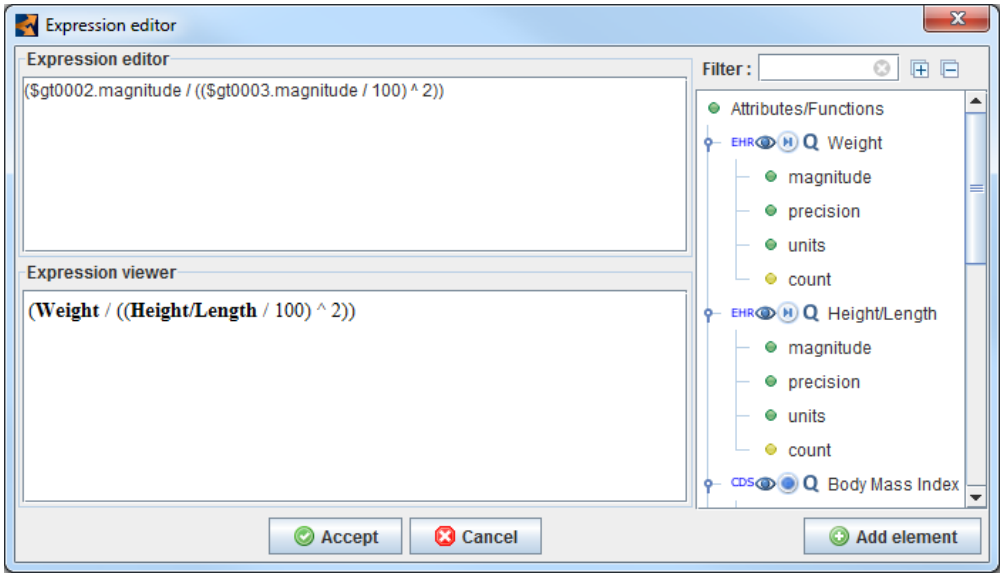

Figure 9: Expression for BMI calculation

We can now repeat the same task to set units and precision of the element calculated.

Figure 10: BMI calculation actions

Now the guide is ready for testing. We use the *Generate form* action to see if the rule is behaving properly.

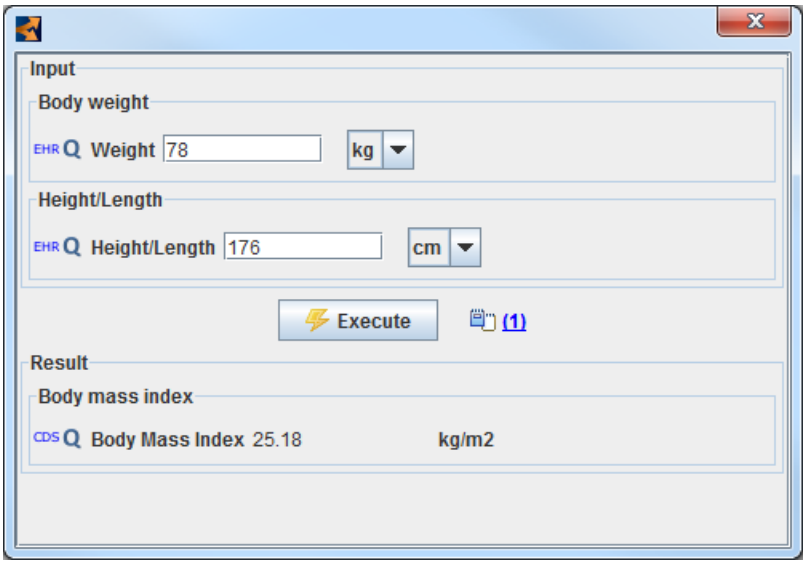

Figure 11: Form generator calculating BMI

The final GDL file will look like can be found at the Appendix A.

CHA2DS2-VASC CALCULATION AND COMPLIANCE

CHA2DS2-VASc is a clinical prediction score for estimating risk of stroke in patients with non –rheumatic atrial fibrillation (AF). We will see a small example on how to create a guideline in GDL to perform this calculation automatically, and another guideline to check compliance.

(b) Risk factor-based approach expressed as a point based scoring system, with the acronym CHA_2DS_2-VASc
(Note: maximum score is 9 since age may contribute 0, 1, or 2 points)

Risk factor	Score
Congestive heart failure/LV dysfunction	1
Hypertension	1
Age ≥75	2
Diabetes mellitus	1
Stroke/TIA/thrombo-embolism	2
Vascular disease[a]	1
Age 65–74	1
Sex category (i.e. female sex)	1
Maximum score	**9**

Figure 12: CHA2DS2-VASC table

Before starting with the GDL editing, we must create an intermediate archetype that will store the different parts needed for the final calculation, and score summary. We create an archetype containing seven ordinals and one count (score). The full archetype defined can be found on Appendix B.

Once we have the archetype we can begin with the GDL editing. We create a new guide and fill up the description part. The first time the guide is executed we want to set default values to the content of the score summary archetype, so we create a rule (e.g. 'Set default'), where we initialize all possible diagnosis to 'Absent'. To do this we first check if all the elements have no value (using the 'Element exists' condition).

The elements that need initializing are those referencing a diagnosis, since the age and gender should always be known, so we will only add five conditions checking for the existence of a value in the elements *Diabetes*, *Vascular diseases*, *Congestive Heart* Failure, *Previous* stroke and *Hypertension* (inside CHA2DS2-VASc archetype). The action part will consist on five actions setting this same elements to 'Absent' value, using the 'Set (DataValue)' action. The resulting rule should look like the one seem on Figure 13.

Now the first time the guide is executed, we have a clean instance of the archetype with the values diagnosis set to absent. Next step requires setting these diagnosis, if found on the patient's EHR.

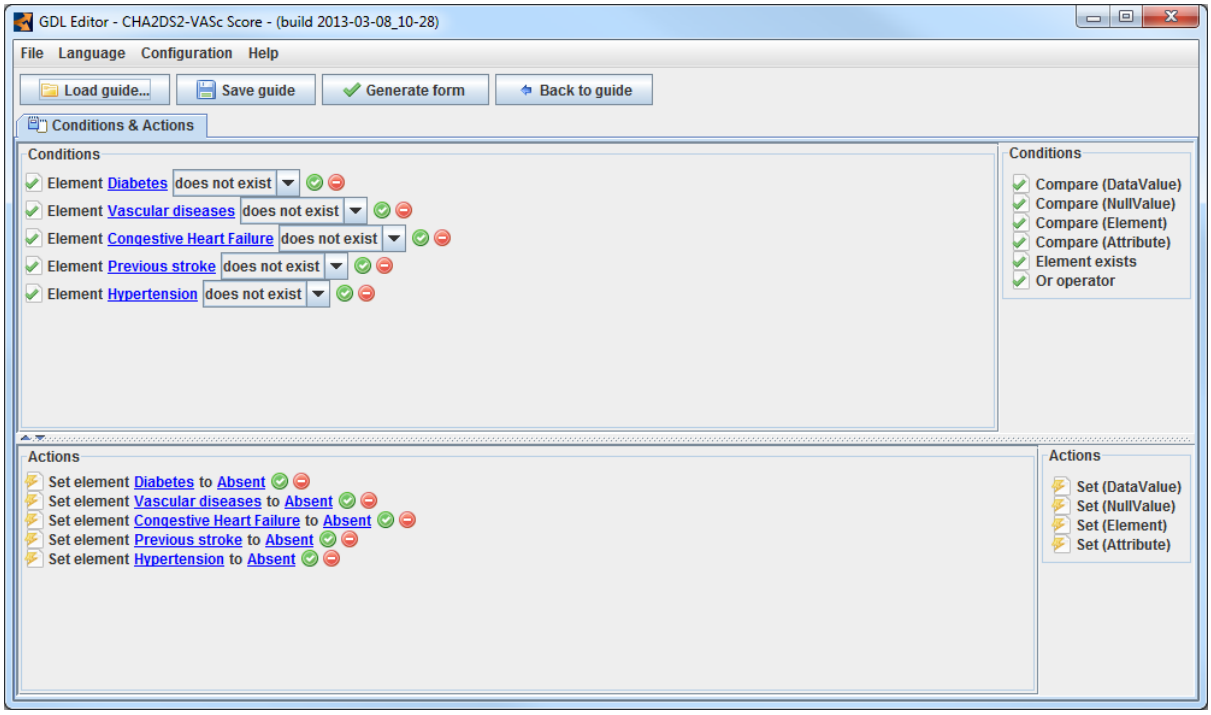

Figure 13 : Set default on CHA2DS2-VASc archetype

We can start with any of the diagnosis; in this case we will use hypertension. We create a new rule called 'Set hypertension diagnosis', in here we will check if the patient has the diagnosis 'Hypertension', if so, we will set the value of the element *Hypertension* in the CHA2DS2-VASc archetype instance to *Present*. To find diagnosis we use the archetype *openEHR-EHR-EVALUATION.problem-diagnosis.v1*. To allow se

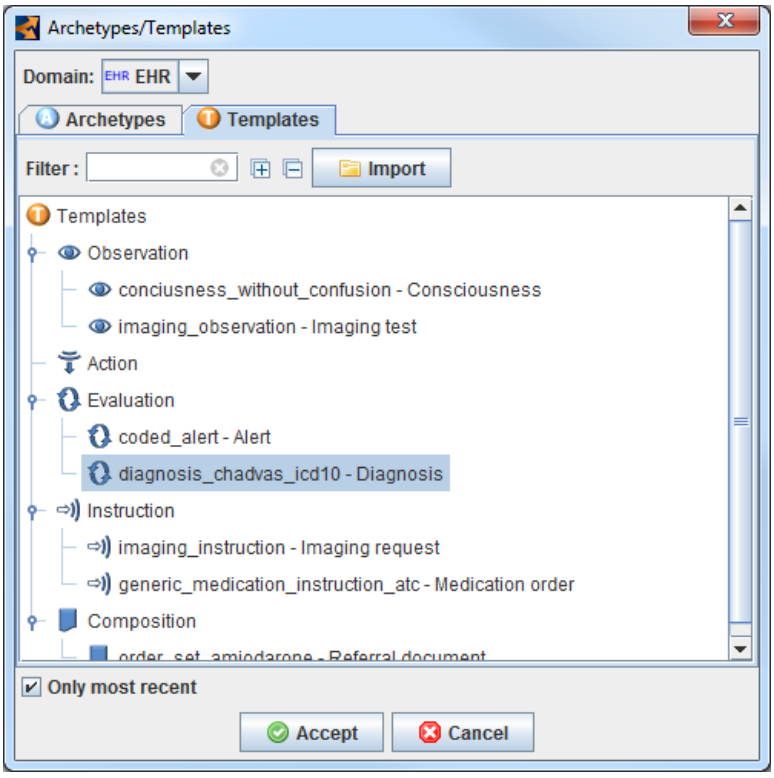

Figure 14: Insert template instance for diagnosis (ICD10)

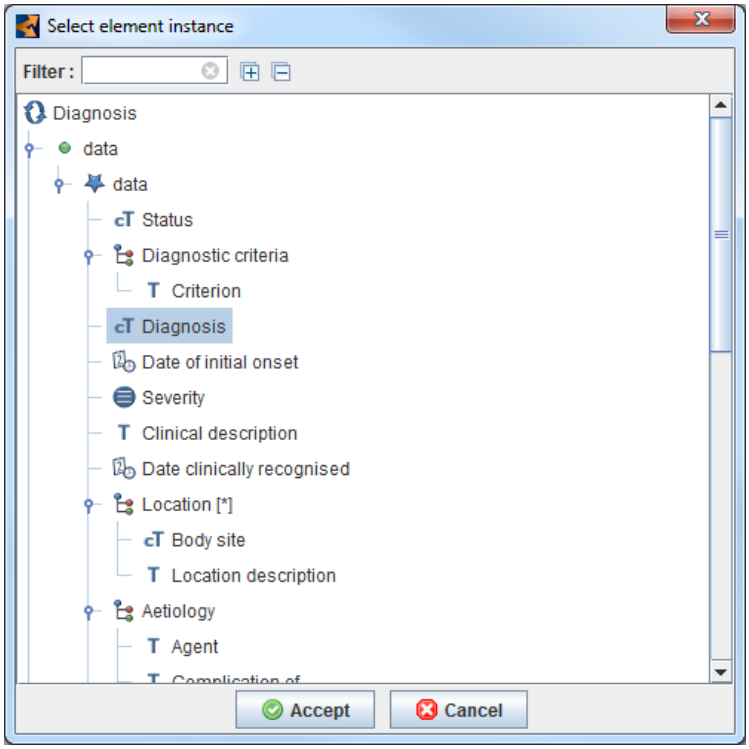

Figure 15: Diagnosis selection (using template)

but we want to specify that we are only interested on the instances containing hypertension problems. To filter all other problems we use predicate. In the current version of the editor we only support predicate definition inside the *Definitions* tab.

APPENDIX A - GDL

BMI GDL

```
(GUIDE) <
  gdl_version = <"0.1">
  id = <"guide">
  concept = <"gt0000">
  language = (LANGUAGE) <
    original_language = <[ISO_639-1::en]>
  >
  description = (RESOURCE_DESCRIPTION) <
    details = <
      ["en"] = (RESOURCE_DESCRIPTION_ITEM) <
      >
    >
    lifecycle_state = <"Author draft">
  >
  definition = (GUIDE_DEFINITION) <
    archetype_bindings = <
      [1] = (ARCHETYPE_BINDING) <
        archetype_id = <"openEHR-EHR-OBSERVATION.body_weight.v1">
        domain = <"EHR">
        elements = <
          ["gt0002"] = (ELEMENT_BINDING) <
            path = <"/data[at0002]/events[at0003]/data[at0001]/items[at0004]">
```

```
          >
        >
        function = <"LAST">
      >

      [2] = (ARCHETYPE_BINDING) <
        archetype_id = <"openEHR-EHR-OBSERVATION.height.v1">
        domain = <"EHR">
        elements = <
          ["gt0003"] = (ELEMENT_BINDING) <
            path = <"/data[at0001]/events[at0002]/data[at0003]/items[at0004]">
          >
        >
        function = <"LAST">
      >

      [3] = (ARCHETYPE_BINDING) <
        archetype_id = <"openEHR-EHR-OBSERVATION.body_mass_index.v1">
        domain = <"CDS">
        elements = <
          ["gt0004"] = (ELEMENT_BINDING) <
            path = <"/data[at0001]/events[at0002]/data[at0003]/items[at0004]">
          >
        >
      >
    >
    rules = <
      ["gt0001"] = (RULE) <
        when = <"$gt0002.units=='kg'", "$gt0003.units=='cm'">
        then = <"$gt0004.units='kg/m2'",
                "$gt0004.precision=2",
                "$gt0004.magnitude=($gt0002.magnitude/(($gt0003.magnitude/100)^2))">
        priority = <1>
      >
    >
  >
  ontology = (GUIDE_ONTOLOGY) <
    term_definitions = <
      ["en"] = (TERM_DEFINITION) <
        terms = <
          ["gt0000"] = (TERM) <
          >
          ["gt0001"] = (TERM) <
            text = <"Calculate body mass index">
          >
          ["gt0002"] = (TERM) <
            text = <"Weight">
            description = <"The weight of the individual.">
          >
          ["gt0003"] = (TERM) <
            text = <"Height/Length">
            description = <"The length of the body from crown of head to sole of foot.">
          >
          ["gt0004"] = (TERM) <
            text = <"Body Mass Index">
            description = <"Index describing ratio of weight to height.">
          >
        >
      >
    >
  >
>
```

CHA2DS2-VASC CALCULATION GDL

CHA2DS2-VASC COMPLIANCE GDL

APPENDIX B – ARCHETYPES

CHA2DS2-VASC ARCHETYPE