Aligning RxNorm with the SNOMED CT drug model and IDMP

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Disclaimer

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International drug standards

◆ Identification of medicinal products (IDMP)
  ● Set of ISO standards for
    ■ substances (ISO 11238)
    ■ pharmaceutical dose forms, units of presentation, routes of administration and packaging (ISO 11239)
    ■ units of measurement (ISO 11240)
    ■ regulated pharmaceutical product information (ISO 11616)
    ■ regulated medicinal product information (ISO 11615)
  ● Used by the European Medicines Agency (EMA)

SNOMED CT aims to be compliant with IDMP
International drug standards

  ● Health informatics - Requirements for medicinal product dictionary systems for health care
  ● “provides information to MPD-system developers, to help them design MPD-systems which are better able to meet the ISO IDMP standards and the needs of multiple use cases”

◆ EDQM Standard Terms
  ● European Directorate for the Quality of Medicines
  ● Standard terms for
    ■ Pharmaceutical dose form
    ■ Route or method of administration
    ■ Packaging items (Container, Closure, Administration device)
SNOMED CT drug model

Previous model
- Substance/product duality
- Most products are primitive concepts
- Limited set of attributes
  - Has_active_ingredient
  - Has_dose_form
  - No explicit BoSS information
  - No explicit strength information

Current model
- Substance/product duality
- All products are fully defined concepts
- Extensive set of attributes
  - Has_active_ingredient
  - Has_manufactured_dose_form
  - Has_BoSS
  - Has_presentation_strength_*
    - Numerator (value, unit)
    - Denominator (value, unit)
RxNorm vs. SNOMED CT

**RxNorm**
- Substance/product *implicit* duality
- Not based on description logics
- Attributes
  - Has_ingredient
  - Has_dose_form
  - No explicit BoSS information
  - Strength (attribute)
    - Normalized (not presentation*)
    - Combines value and unit, numerator and denominator
- Generic + branded drugs

**SNOMED CT**
- Substance/product *explicit* duality
- All products are fully defined concepts
- Extensive set of attributes
  - Has_active_ingredient
  - Has_manufactured_dose_form
  - Has_BoSS
  - Has_presentation_strength
    - Numerator (value, unit)
    - Denominator (value, unit)
- Generic drugs only

*Generic* and *branded* drugs refer to differences in classification and availability, with *generic* drugs being cheaper and available with a prescription, and *branded* drugs being more expensive with often over-the-counter availability.

*presentation* refers to the form of the medication, such as tablets, capsules, or solutions, which can be important for dosing and administration.

*normalized* refers to the presentation of data in a consistent and standardized manner, avoiding confusion and ensuring accurate tracking.

*Extensive set of attributes* indicates that SNOMED CT provides more detailed information, which can be crucial for clinical decision-making.

*Fully defined concepts* suggests that every concept in SNOMED CT is precisely defined, which can enhance the accuracy and reliability of data.
## RxNorm vs. SNOMED CT

### RxNorm
- **Clinical drug (SCD)**
  - Atorvastatin 10 mg oral tablet
- **Ingredient (IN) and Precise ingredient (PIN)**
  - Atorvastatin; Ergotamine tartrate
- **Multi-ingredient (MIN)**
  - amLODIPine / atorvastatin
- **Clinical dose form group (SCDG)**
  - Atorvastatin Oral Product

### SNOMED CT
- **Clinical drug**
  - Product containing atorvastatin 10 mg/1 each oral tablet
- **[Single] Medicinal product (or Substance)**
  - Product containing atorvastatin
  - Product containing ergotamine tartrate
- **[Multi] Medicinal product**
  - Product containing amlodipine and atorvastatin
- **Medicinal product form**
  - Product containing atorvastatin in oral dosage form
RxNorm vs. SNOMED CT

Ingredient
Azithromycin

C. Drug Comp.
Azithromycin 250 MG

C. Dose Form Group
Azithromycin Oral Product

Clinical Drug
Azithromycin 250 MG Oral Tablet

Medicinal Product
Product containing azithromycin

Med. Product Form
Product containing azithromycin in oral dosage form

Clinical Drug
Product containing azithromycin 250 mg/1 each oral tablet
Atorvastatin 10 mg oral tablet

Strength, split into
- Numerator (unit, value)
- Denominator (unit, value)
Atorvastatin 10 mg oral tablet

- **Ingredient**: BoSS info (implicit)
- **Dose form**: Active ingredient (implicit)
- **Strength**: No explicit BoSS info
  - Numerator (unit, value) together
  - No denominator
### ATORVASTATIN CALCIUM
atorvastatin calcium tablet, film coated

<table>
<thead>
<tr>
<th>PRODUCT INFORMATION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Type</td>
<td>HUMAN PRESCRIPTION DRUG</td>
</tr>
<tr>
<td>Item Code (Source)</td>
<td>NDC:42291-143(NDC:62175-890)</td>
</tr>
<tr>
<td>Route of Administration</td>
<td>ORAL</td>
</tr>
</tbody>
</table>

### ACTIVE INGREDIENT/ACTIVE MOIETY

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>Basis of Strength</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atorvastatin Calcium (UNII: 48A5M73Z4Q) (Atorvastatin - UNII:A0JWA85V8F)</td>
<td>Atorvastatin</td>
<td>10 mg</td>
</tr>
</tbody>
</table>

**Dose form**: ORAL

**Active ingredient**: Atorvastatin Calcium

**Active moiety**: Atorvastatin

**BoSS**
Atorvastatin 10 mg oral tablet

Dose form

BoSS=Active moiety

Active ingredient

Active moiety

Strength, split into
- Numerator (unit, value)
- Denominator (unit, value)
WHO'S THE BOSS?
Extracting BoSS and presentation strength information

◆ From SPLs whenever available (XML) [~2/3]
  ● `<manufacturedProduct>` tag
    ■ `<quantity>` → presentation strength
      (numerator + denominator; value + unit)
    ■ `<ingredientSubstance>` → active ingredient
    ■ `<activeMoiety>` → active moiety
    ■ `classCode` attribute `<ingredient>` → BoSS
      - ACTIB → BoSS = active ingredient
      - ACTIM → BoSS = active moiety
      - ACTIR → BoSS = other (specified) reference substance

◆ From similar SPLs or other reference information sources otherwise [~1/3]
BoSS inconsistencies in SPLs

- A given RxCUI (SCD) is linked to multiple NDCs
- These NDCs are associated with multiple SPLs
- BoSS or presentation strength information is sometimes inconsistent across labels
  - Different, but functionally equivalent
    - Units are different, but values reflect equivalent strengths
    - ACTIB vs. ACTIM when AI = AM
    - ACTIR points to a reference that is the AI or AM (as opposed to another reference substance)
  - Different and not equivalent
    - Require manual review
    - Not all SPLs are high-quality
Some information had never been recorded explicitly in RxNorm
- BoSS (+ active ingredient and active moiety)
- Presentation strength [except through PSNs]

Extracted from Structured Product Labels whenever possible

Future work
- Harmonization of dose forms with EDQM’s

This information will be made available in RxNorm after completion of the project
Summary

◆ Opportunity for alignment with
  ● New SNOMED CT drug model
  ● International standards for medicinal products

◆ Contribution to SNOMED CT
  ● RxNorm drug content will be converted to and loaded in SNOMED CT

◆ Opportunity for quality assurance
  ● Comparison with DM+D (UK) and AMT (Australia) once also converted to and loaded in SNOMED CT

◆ Will also facilitate the publication of RxNorm as a set of FHIR medication resources
Medication (DomainResource)

- code: CodeableConcept [0..1] SNOMED CT Medication
- status: code [0..1] MedicationStatus!
- isBrand: boolean [0..1]
- isOverTheCounter: boolean [0..1]
- manufacturer: Reference [0..1] Organization form: CodeableConcept [0..1] SNOMED CT Form
- image: Attachment [0..*]

ingredient:

- itemCodeableConcept:
  - coding:
    - system: "http://snomed.info/sct",
    - code: "386983007",
    - display: "Alprazolam [substance]"

- amount:
  - numerator:
    - value: 0.25,
    - system: "http://unitsofmeasure.org",
    - code: "mg"
  - denominator:
    - value: 1,
    - system: "http://snomed.info/sct",
    - code: "Tablet dose form (qualifier value)"
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  - Lee Peters
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