Integration points to facilitate drug extension integration

Matt Cordell and Dion McMurtrie | CSIRO

Introduction

The SNOMED International drug model (and national extension model) has been developed to provide both core content and interoperability opportunities for other medicines terminologies. Interoperability can be facilitated either through direct integration for “SNOMED based” terminologies or mapping for other types of drug code systems. The success of interoperability is dependent on how well two code systems correlate. Aside from universal adoption of a single drug model *and* editorial rules, any integration effort will be met with challenges that are either delt with through compromise or mitigation.

While integration at the uppermost "Medicinal Product” (ingredient) level is relatively simple; existing national drug terminologies encounter similar challenges integrating at or below the “Clinical Drug” level of the SNOMED CT International Edition content. Even integration at Medicinal Product Form is problematic due to route specific forms used in the international content but not necessarily drug extensions.

Largely, these challenges relate to variation in levels of modelling abstraction, product regulatory details, and editorial rules across the various jurisdictions and international content. Including:

- “Unit of presentation”
- Manufactured vs dispensed forms
- Forms that imply route
- Significance of ingredient salt forms
- Basis of Strength Substance differences
- Jurisdictional strength variation
- Inconsistent discrete / continuous distinction
- Strength representation differences
- Unit of measure variation
- Only / at least semantics

Goals of integration

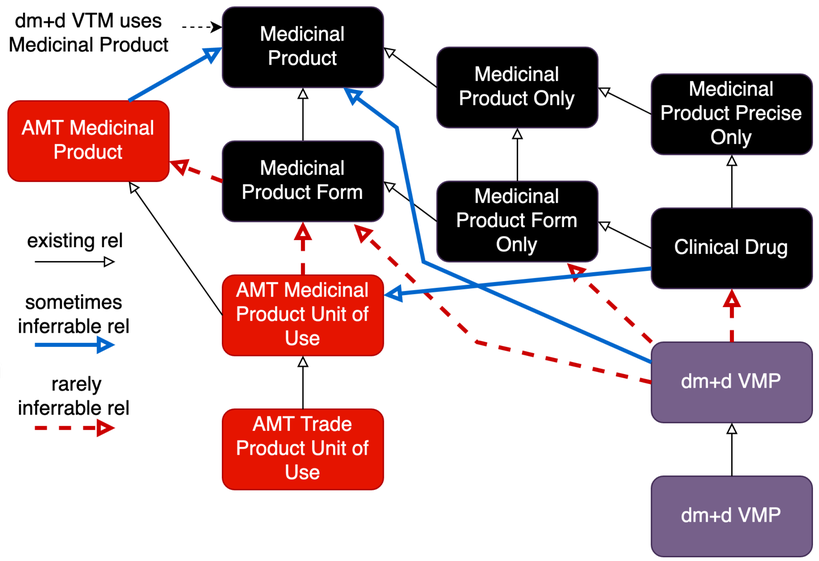
The goals of integrating to international drug content are typically one or more of:

- Interoperable cross boarder health data exchange
- Inferred knowledge from SNOMED International and easier integration to knowledge providers (e.g. decision support)
- Ease implementation costs for clinical system vendors

Fortunately many interoperability and knowledge system use cases can be fulfilled at the Medicinal Product (ingredient) level. While a ubiquitous model for drug terminologies aid implementations, modern terminology servers make this a much less significant implementation issue.

Model correlation

The dm+d, AMT and international models correlate as shown semantically. However due to the challenges described subsumption is inconsistent, with reliable integration limited to the Medicinal Product level.



Integration points to facilitate drug extension integration

Matt Cordell and Dion McMurtrie | CSIRO

Unit of Presentation

The precise meaning and purpose of “unit of presentation” is unclear and has caused confusion across implementations of the national extension model. In particular, for continuant medicines (e.g. ‘solutions’) a container may or may not be a “unit of presentation”. The application of “Unit of Presentation” is inconsistent – both across and within national drug models, and partially determined by local business requirements rather than logical definitions. This indicates that this notion has business meaning, but is not part of the definition of the product.

Strength Representation

There are different approaches to representing strength, both within the logical models and terms, and **within and between** drug models.

INT	Acetaminophen 100 mg/mL oral solution	Acetaminophen 24 mg/mL oral solution
AU	Paracetamol 100 mg/mL oral liquid [1]	Paracetamol 24 mg/mL oral liquid [2]
UK	Paracetamol 100mg/ml oral solution sugar free	Paracetamol 120mg/5ml oral solution paediatric
US	acetaminophen 100 MG/ML Oral Solution	acetaminophen 24 MG/ML

1. Is available in 5 and 20mL bottles.
2. Is available in 20, 50mL, 100, 200, 500 mL bottles.

Continuous, Discrete & Packaged

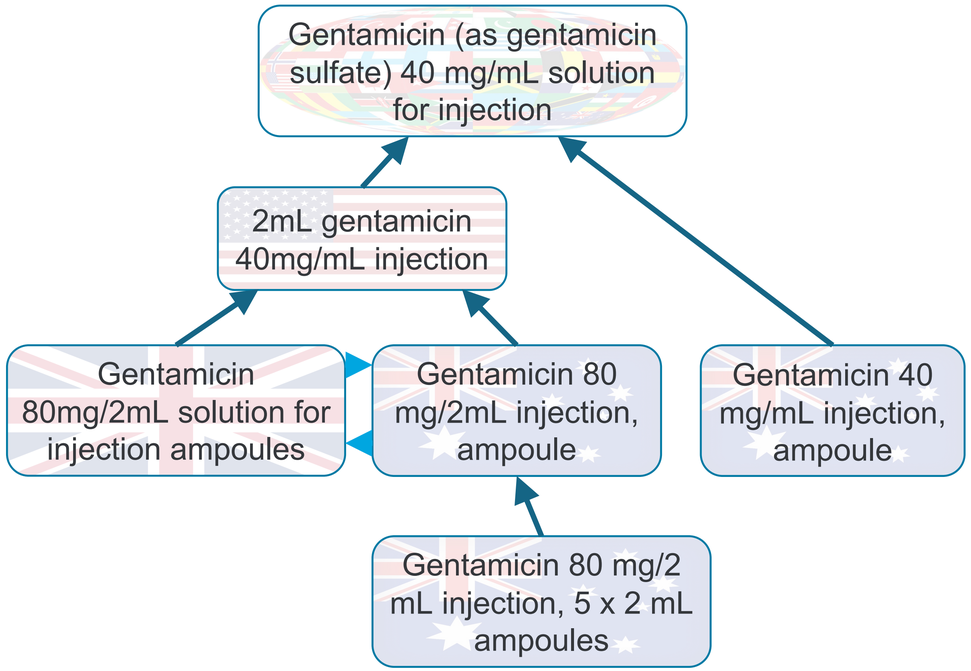


Fig 2: Hierarchical relationship between “similar” concepts from 4 drug models. Only the UK and AU have what could be considered equivalent concepts

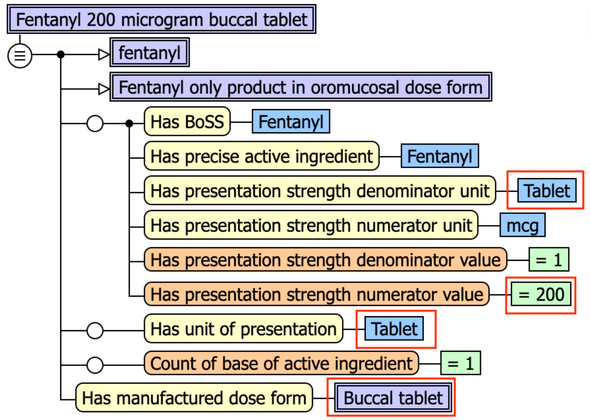
Similar to the ”unit of presentation” variation, there is variation in what is considered discrete, and what is continuous, at the Clinical Drug / MPUU / VMP level. This creates inconsistency as to when a concept at this level is a “unit” and represents a container of a medicine, as opposed to when it represents the medicine in the container and other concepts represent the packaging.

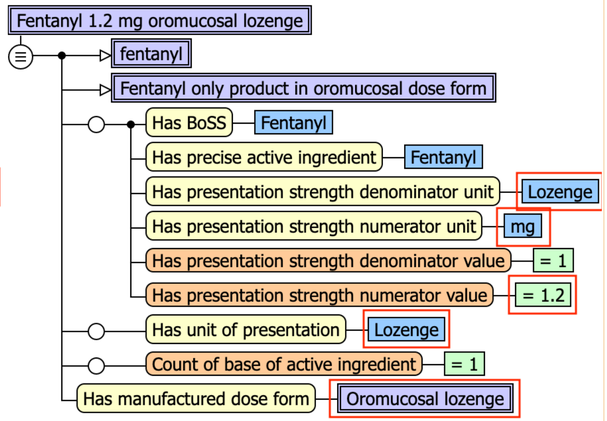
This flows on to affect strength representation between 8 parallel presentation vs continuous strength properties.

Matt Cordell and Dion McMurtrie | CSIRO

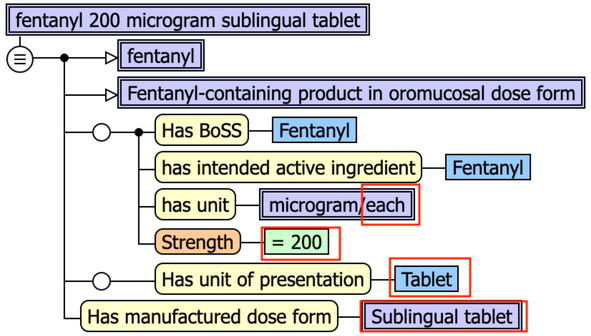
Dose Form and unit of measure

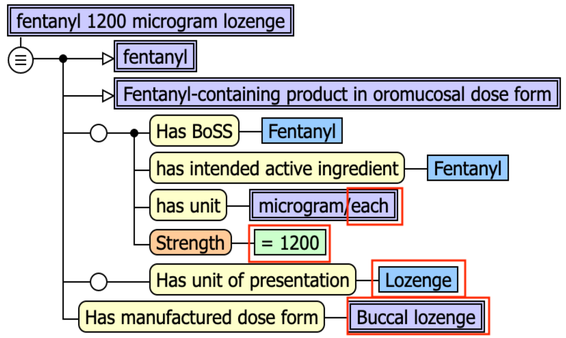
International Fentanyl example





AMT Fentanyl example





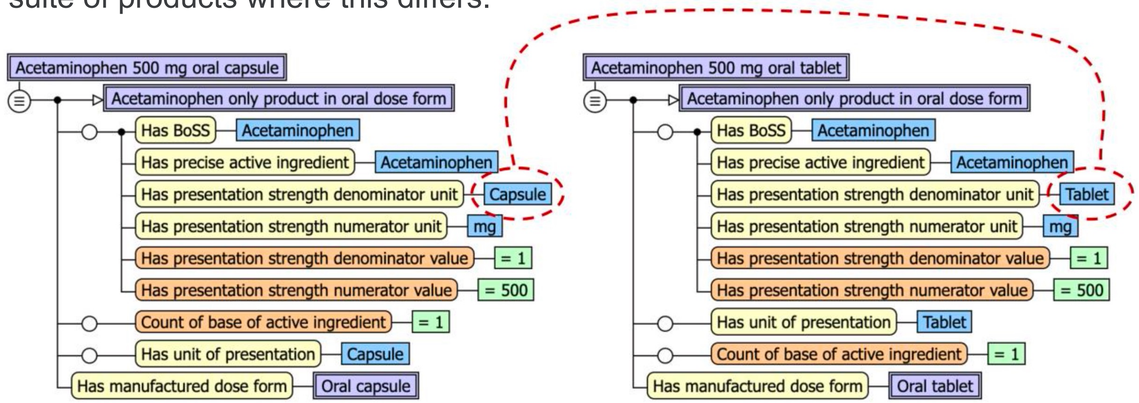
These examples show the inconsistency of unit used for the ingredient which will affect classification, and is also challenging for ECL expressions looking for products with greater or less than a quantity of an ingredient.

Note also the redundant replication of the “lozenge” as unit of presentation and denominator unit, both of which must be matched to be subsumed.

AMT forgoes the specificity of ”lozenge” as the denominator unit, simply stating that the lozenge contains X micrograms per “thing”. This is sufficient despite being less specific, but as less specific it is easier to reproduce.

Note also that AMT and the international edition have different forms – in this size AMT has a “sublingual tablet” and an “orally disintegrating tablet”, while the international edition has only a “buccal tablet”.

Generally speaking AMT uses dose forms that do not imply route of administration – e.g. “tablet” as opposed to “conventional release oral tablet”. More problematic for dm+d is the use of dispensed forms as opposed to manufactured forms. While for most products these are the same, there are a suite of products where this differs.

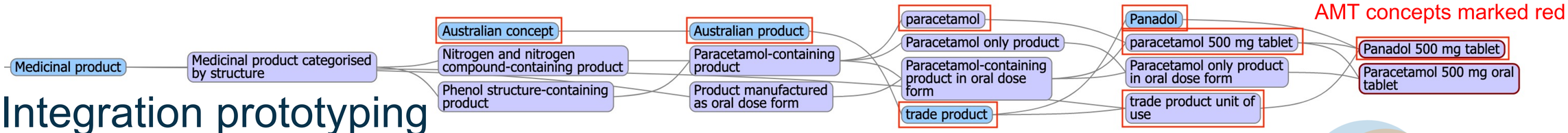


Overly specific denominator units also affect interpretation of strength. Given this example from the international edition, to the classifier 500mg/tablet is **not equal** to 500mg/capsule. Yet clearly both have a strength of 500 mg.

The “tablet-ness” and “capsule-ness” of the concept is already represented in the form, and over stating the denominator unit only has negative consequences

Integration points to facilitate drug extension integration

Matt Cordell and Dion McMurtrie | CSIRO



Integration prototyping

Integration between AMT, dm+d and the SNOMED International Edition was prototyped. The method used was to generate axioms using the international model for dm+d, and to generate equivalence axioms between the modelling patterns in AMT and the international content using SNOMED CT's DL features.

As neither AMT nor dm+d had a presentation/concentration strength distinction, these properties were made equivalent. This had no impact on the international content, suggesting that this distinction is irrelevant.

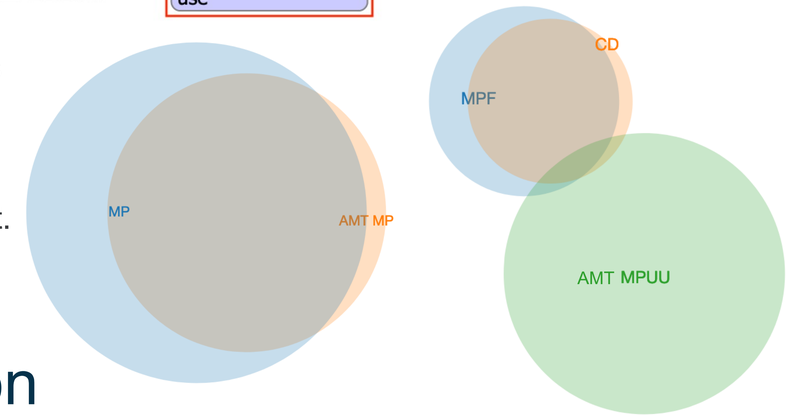
The use of route specific forms, which neither dm+d nor AMT have, was also a barrier. Although possibly not correct, optimistically mapping to route laden international forms was applied in this experiment as without this almost no correlation with international content occurs.

No reliable method to match the "Unit of presentation" values from the international content was found. Only generalised editorial guidelines are available, no rules machinable or manual. Similar AMT and dm+d notions were translated, but correlation was understandably inconsistent affecting subsumption. This similarly impacted strength denominator units.

Modelled unit of measure also varied which further restricted subsumption. AMT and dm+d have rules to ensure units for an ingredient are consistent for classification. However international content such as Fentanyl 1.2mg and Fentanyl 200mcg modelled with mg and mcg was not similarly consistent.

The result was quite limited integration achieved below Medicinal Product.

The Venn diagrams show great overlap at the Medicinal Product level, but very little below that.



Conclusion

The current International Drug Model is general at the Medicinal Product level becoming specific very quickly with redundant modelling distinctions that are hard to replicate. Integration at the Clinical Drug level is very problematic with a number of significant barriers.

Aligning the AU, UK and US models with the International content (and each other) is non-trivial; it is much more complex than considering AU-MPUUs and UK-VMPs equivalent to International-ClinicalDrug. Integration at this level is challenging, but fortunately not always necessary with most use cases largely ingredients driven.

Inserting a more specific yet still general level between Medicinal Product and Clinical Drug would provide a lower yet achievable integration point.

Something at the level of ingredient, strength (agnostic of presentation / concentration distinction), and basic form, without "Unit of Presentation" and with "at least" semantics would likely provide an achievable integration point.