

Comparing Therapeutic Classes between MED-RT and SNOMED CT

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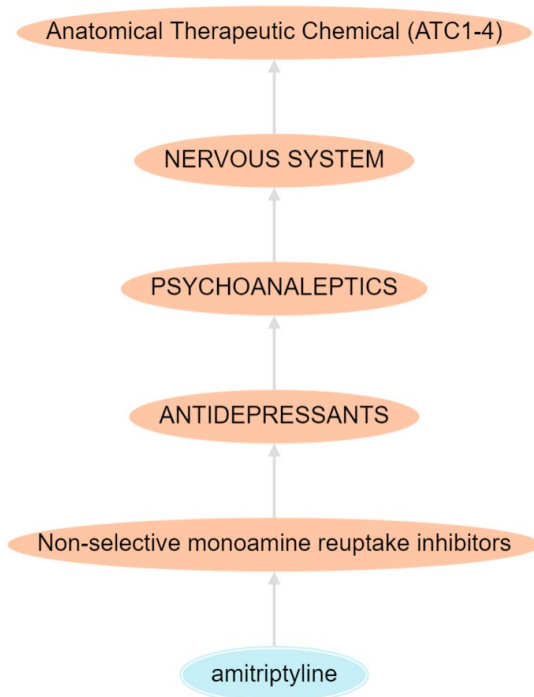


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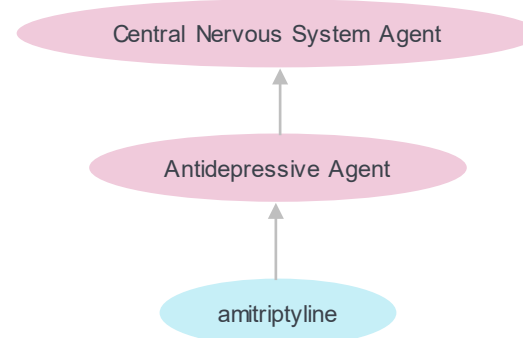
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Motivation

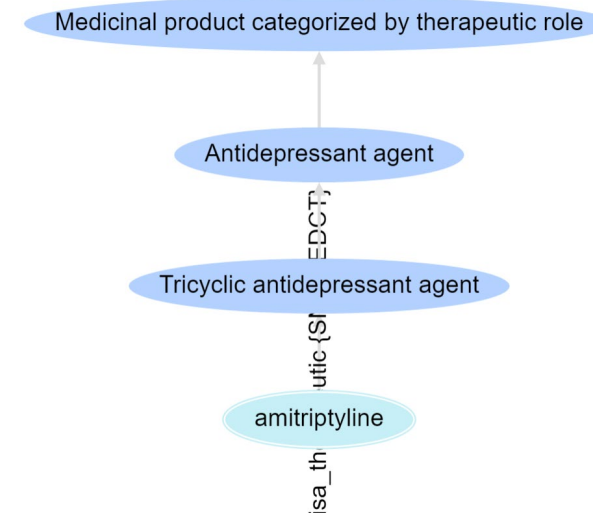
- Multiple drug classification systems (ATC, MED-RT, SNOMED CT, etc.)



ATC



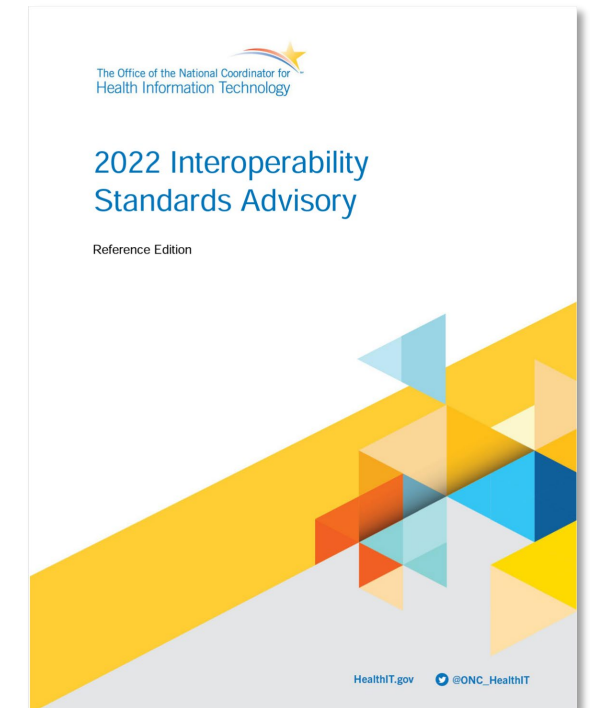
MED-RT
Therapeutic category



SNOMED CT
Therapeutic role

Motivation

- Unclear which drug classification system is better for some use case
 - e.g., defining intensional value sets for encoding allergy information
- Recent change in recommendation from Interoperability Standards Advisory
 - Since 2019, SNOMED CT is recommended for representing medications in the context of patient allergies and intolerances “when a medication allergy necessitates capture by medication class”
 - Earlier, NDF-RT was recommended
 - MED-RT, NDF-RT’s successor, is listed as an emerging standard



Background

MED-RT

1. Developed by the U.S. Department of Veterans Affairs
2. Succeeded to NDF-RT in 2018
3. Types of classes

Mechanism of action

Chemical structure

Therapeutic category

others: physiologic effect, conditions, ...

Medications = RxNorm

SNOMED CT

1. Developed by SNOMED International
2. Significantly remodeled in 2018
3. Types of classes

Disposition

Structure

Therapeutic role

Medications = SNOMED CT

MED-RT: June. 2022
SNOMED CT: March. 2022 (US Ed)
RxNorm: July. 2022

Previous work

MED-RT vs. SNOMED CT

SNOMED CT EXPO 2021
Virtual Conference Oct 28 - 29

Comparing Drug Classes between MED-RT and SNOMED CT

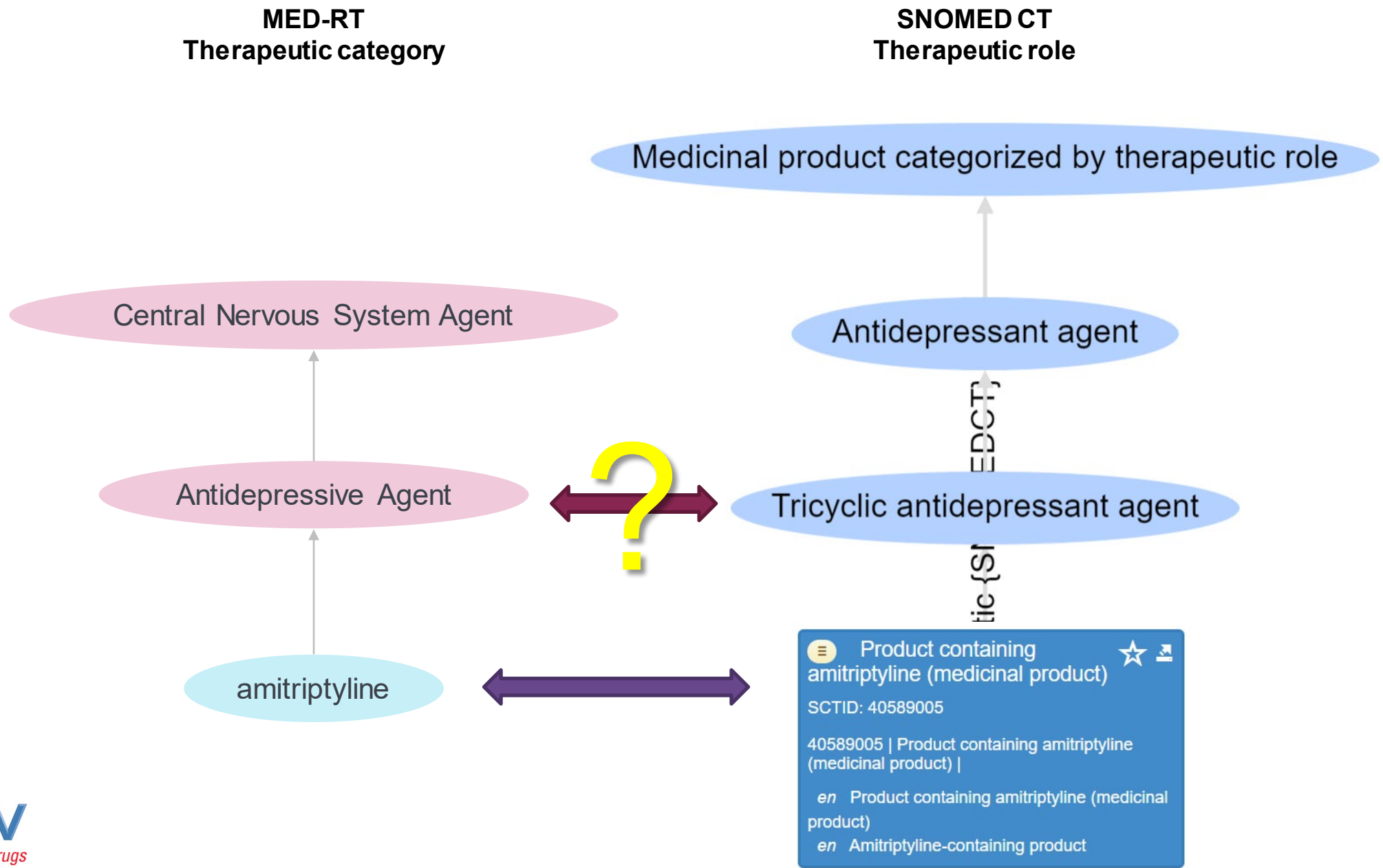
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Click to zoom
SNOMED International picture

Conclusions

- First investigation of MED-RT and SNOMED CT drug classes
- Detailed comparison of the coverage of MED-RT and SNOMED CT
- Coverage provided by SNOMED CT compares favorably to MED-RT's for MOA and CHEM classes
- Except for open access, no other characteristic of MED-RT makes it superior to SNOMED CT for drug classification



Objectives

- To compare therapeutic classes between MED-RT and SNOMED CT
 - **Quantitative** analysis of drug-class membership to assess coverage of the two systems
 - Number of classes
 - Hierarchical organization
 - Drug-class membership (Coverage)
 - Classes → drugs
 - Drugs → classes
 - Comparison between MED-RT and SNOMED CT
 - **Qualitative** analysis to assess the consistency of drug-class assertions between the two systems
 - Top-200 commonly prescribed drugs
 - 178 single-ingredient drugs
 - Classes in MED-RT and SNOMED CT



The Top 200 of 2019
Provided by the ClinCalc DrugStats Database

Methods

- SNOMED CT classes x MED-RT classes
- Count of prescribable drug products in RxNorm

(Matrix available upon request)

...																				
Anticoagulant agent 81839001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	54	0%		
Anticonvulsant agent 63094006	0	0	0	0	0	108	0	0	0	0	0	32	0	32	79	251	69%			
Antidementia agent 358926001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	24	0%			
Antidepressant agent 36236003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	108	108	0%			
Antidiabetic agent 384953001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
...																				
Triazole antifungal agent 350208007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27	93%			
Tricyclic antidepressant agent 33219003	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	46	100%			
Tumor imaging agent 767427005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Ultrasound contrast media 356442006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Uricosuric agent 49157004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0%			
Vasodilator agent 58944007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Vasopressor agent 870407007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Vinca alkaloid antineoplastic agent 8955	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6	0%			
Viscosity modifier 350105004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Vitamin A supplement agent 787546003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Vitamin supplement agent 226314006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
X-ray contrast media 349359008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0%			
Unclassified SNOMED CT UC_S	0	0	4	119	5	6	0	0	5	0	0	6	1	6	6216	6541	5%			
Total	0	0	4	119	9	116	0	0	256	0	0	84	1	38	7949					
% classified	0%	0%	0%	0%	44%	95%	0%	0%	98%	0%	0%	93%	0%	84%						
	Analgesics N00000193809	Anesthetics N00000193810	Anti-anginal Agent N00000178310	Anti-arrhythmic Agent N00000178311	Anti-emetic Agent N00000178371	Anti-epileptic Agent N00000178313	Anti-infective Agent N00000178295	Anti-inflammatory Agent N00000178306	Antibacterial Agent N00000178296	Anticonvulsants N00000193811	Antidementia Agents N00000193812	Antidepressive Agent N00000178314	Antidiarrheal Agent N00000178373	...	Antimanic Agent N00000178315	...	Unclassified MED-RT UC_M	Total	% classified	

Number of classes

Class type	MED-RT	SNOMED CT
MOA	689	324
CHEM	9968	330
THERAP	66	271

— Hierarchical organization – Max depth

Class type	MED-RT	SNOMED CT
MOA	8	5
CHEM	13	6
THERAP	2	6

Coverage (classes → drugs)

- Classes with at least 1 drug member

Class type	MED-RT	SNOMED CT
MOA	487/678 (71%)	303/324 (94%)
CHEM	526/9968 (5.3%)	302/330 (92%)
THERAP	45/66 (68%)	179/271 (66%)

Coverage (drugs → classes)

- Drug products with at least 1 class*

Class type	MED-RT	SNOMED CT
MOA	885	1283
CHEM	1291	2380
THERAP	1073 (12%)	2481 (28%)

*9,022 product-class associations for the 8,810 single ingredient, prescribable clinical drugs in RxNorm

Top-178 drugs - THERAP

- Drugs with at least 1 class

Class type	Both	MED-RT only	SNOMED CT only	Neither
THERAP	21	5	29	123
	<i>amitriptyline</i> <i>benzonatate</i> <i>ciprofloxacin</i> <i>ketoconazole</i> <i>levetiracetam</i>	<i>amiodarone</i> <i>aripiprazole</i> <i>meclizine</i> <i>quetiapine</i> <i>risperidone</i>	<i>furosemide</i> <i>hydrochlorothiazide</i> <i>mirtazapine</i> <i>ondansetron</i> <i>paroxetine</i> <i>warfarin</i>	<i>allopurinol</i> <i>atorvastatin</i> <i>clopidogrel</i> <i>diltiazem</i> <i>omeprazole</i>

Top-178 drugs - THERAP

- SNOMED CT's therapeutic class associations tend to be more specific than MED-RT's

Ingredient	MED-RT	SNOMED CT
amitriptyline	Antidepressive Agent	Tricyclic antidepressant agent
benzonatate	Antitussive Agent	Antitussive agent
ciprofloxacin	Antimicrobial Agent	Fluoroquinolone antibacterial agent
ketoconazole	Antifungal Agent	Imidazole antifungal agent

Top-178 drugs - MOA

- Drugs with at least 1 class

Class type	Both	MED-RT only	SNOMED CT only	Neither
MOA	86	16	23	53
	<i>atorvastatin, clonidine, estradiol, prednisone, sertraline</i>	<i>acyclovir, bupropion, fluticasone, tizanidine, warfarin</i>	<i>amoxicillin, gabapentin, lamotrigine, loratadine, progesterone</i>	<i>alprazolam, buspirone, metformin, nitroglycerin, phentermine</i>

Top-178 drugs - CHEM

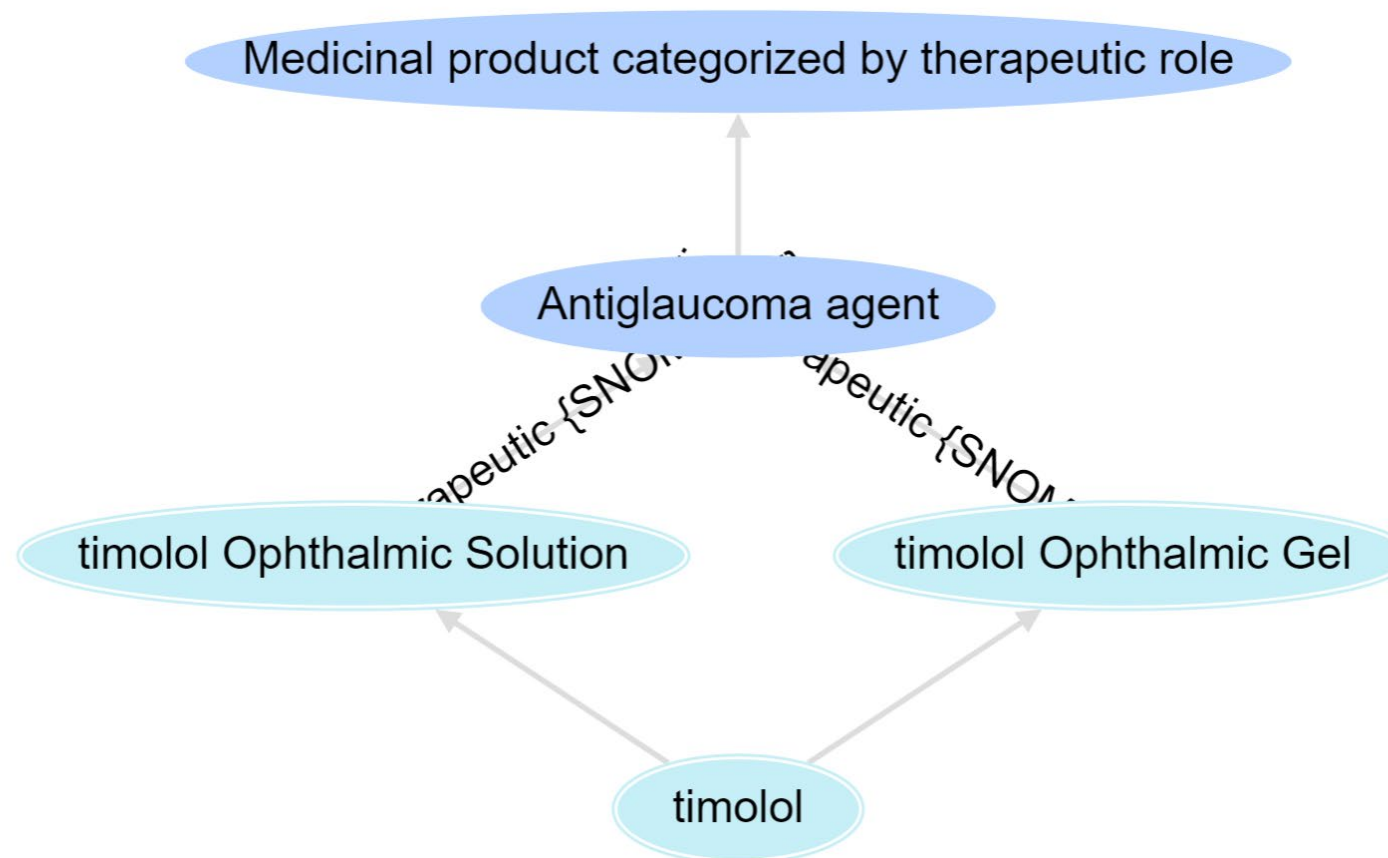
- Drugs with at least 1 class

Class type	Both	MED-RT only	SNOMED CT only	Neither
CHEM	47	3	107	21
	<i>acyclovir, amoxicillin, clindamycin, fluconazole, lorazepam</i>	<i>isosorbide, levothyroxine, liothyronine</i>	<i>albuterol, aspirin, atorvastatin, gabapentin, tramadol</i>	<i>allopurinol, baclofen, cetirizine, montelukast, paroxetine</i>

Discussion – Findings

- Types of therapeutic classes
 - Both MED-RT and SNOMED CT offer distinct classification systems for various types of classification criteria (unlike ATC)
 - MED-RT offers a larger number of classification criteria than SNOMED CT
- Number of therapeutic classes
 - SNOMED CT offers a larger number of classes than MED-RT
 - Greater depth in the SNOMED CT class tree
 - Unlike was is observed for MOA and CHEM
- Coverage of therapeutic classes
 - The coverage of drug products provided by SNOMED CT is largely superior to that of MED-RT
 - SNOMED CT assigns therapeutic classes to medicinal products or medicinal product forms as appropriate
 - Vs. assignment to ingredients (~medicinal products) in MED-RT leading to missing or wrong associations
 - Evaluation in terms of clinical drugs rather than medicinal products

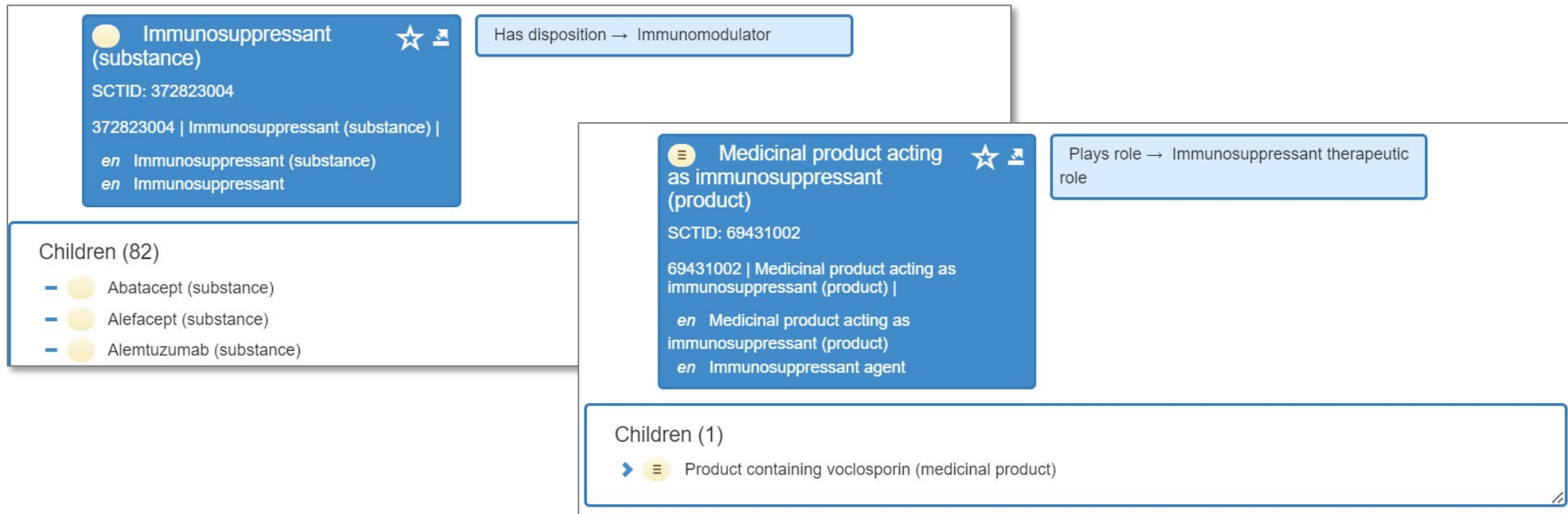
Class assignment to ingredient vs. product form



(No therapeutic class listed in MED-RT for timolol)

Discussion – Limitations

- We did not assess whether the classes provided by MED-RT and SNOMED CT for a given drug were equivalent
- We used the classes associated with products rather than those associated with substances



Conclusions

- Coverage provided by SNOMED CT compares favorably to MED-RT's for therapeutic classes
- SNOMED CT
 - Classifies more clinical drugs than MED-RT
 - Provides more specific therapeutic classes
 - Supports the restriction of members of therapeutic classes to specific medicinal product forms



Questions/End



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