

Evaluating Pharmacologic Classes in NDF-RT

Jonathan Mortensen

Background

- Drug terminologies are used in:
 - Electronic health records systems
 - e-prescribing
 - clinical decision support
- NDF-RT is a candidate for such systems
- Not recently evaluated

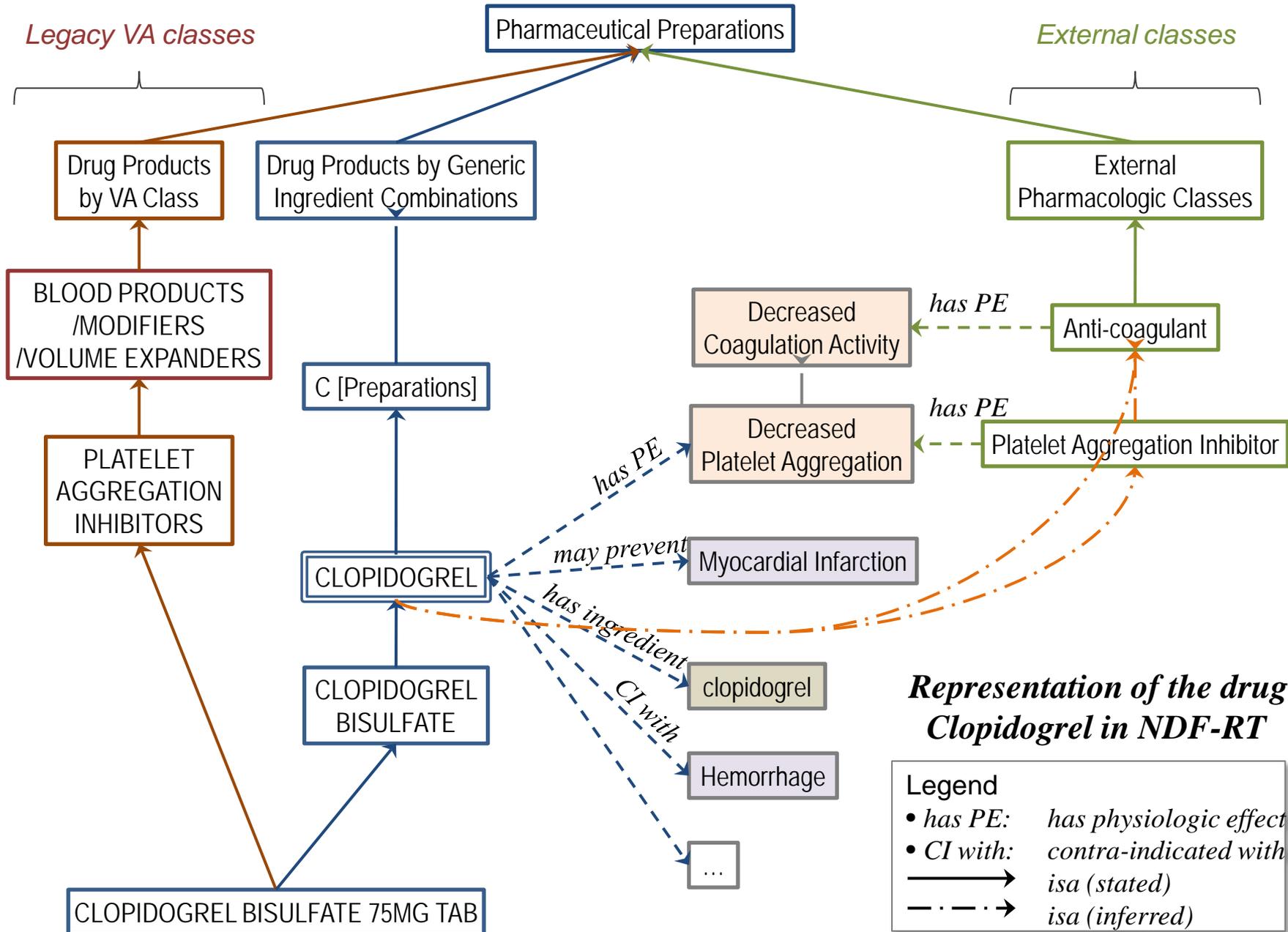
NDF-RT

- National Drug File – Reference Terminology
- Produced by the Dept. of Veteran Affairs
- Applicable in medical situations related to drugs and medications; also research
- Description Logic based
- Two main drug class hierarchies
 - VA Legacy Drug Classes (VA)
 - External Pharmacologic Classes (EPC)

Methods

- Comparison of NDF-RT to Other Terminologies
 - Intension, Extension
 - Itself, MeSH and SNOMED CT
- Preliminary work:
 - NDF-RT Enrichment
 - Overview of NDF-RT Structure
 - RDF-Store on Virtuoso

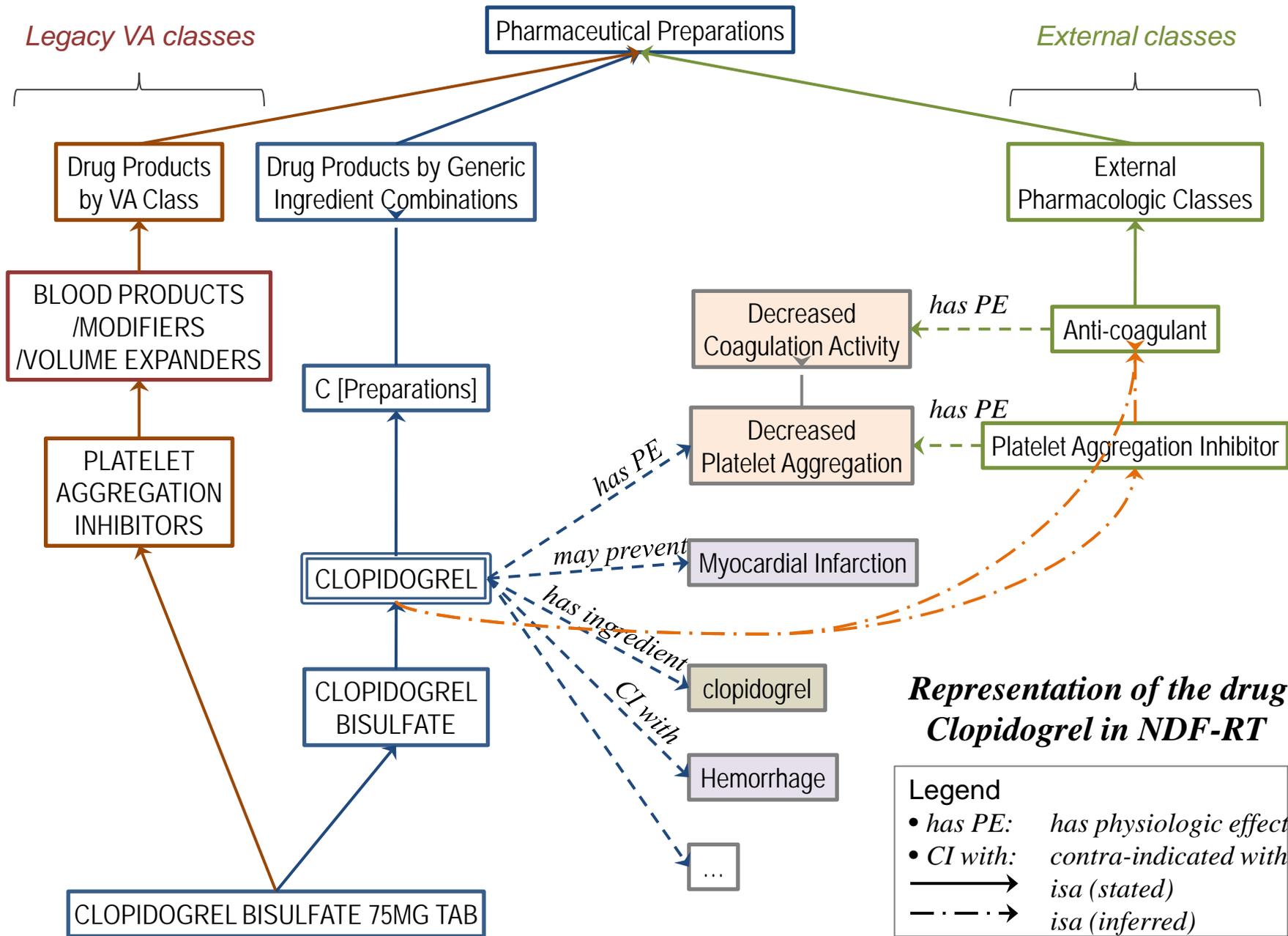
NDF-RT Structure



NDF-RT Enrichment + Classification

- XML distribution conversion to OWL (XSLT)
- OWL Enrichment (XSLT)
 - Convert EPCs to Defined Classes
 - has_Ingredient = has_ChemicalStructure
 - Add may_treat_or_prevent property
- Classification of drugs using Hermit
- **Enables the use of EPCs in the comparison**

Enriched NDF-RT Structure



Representation of the drug Clopidogrel in NDF-RT

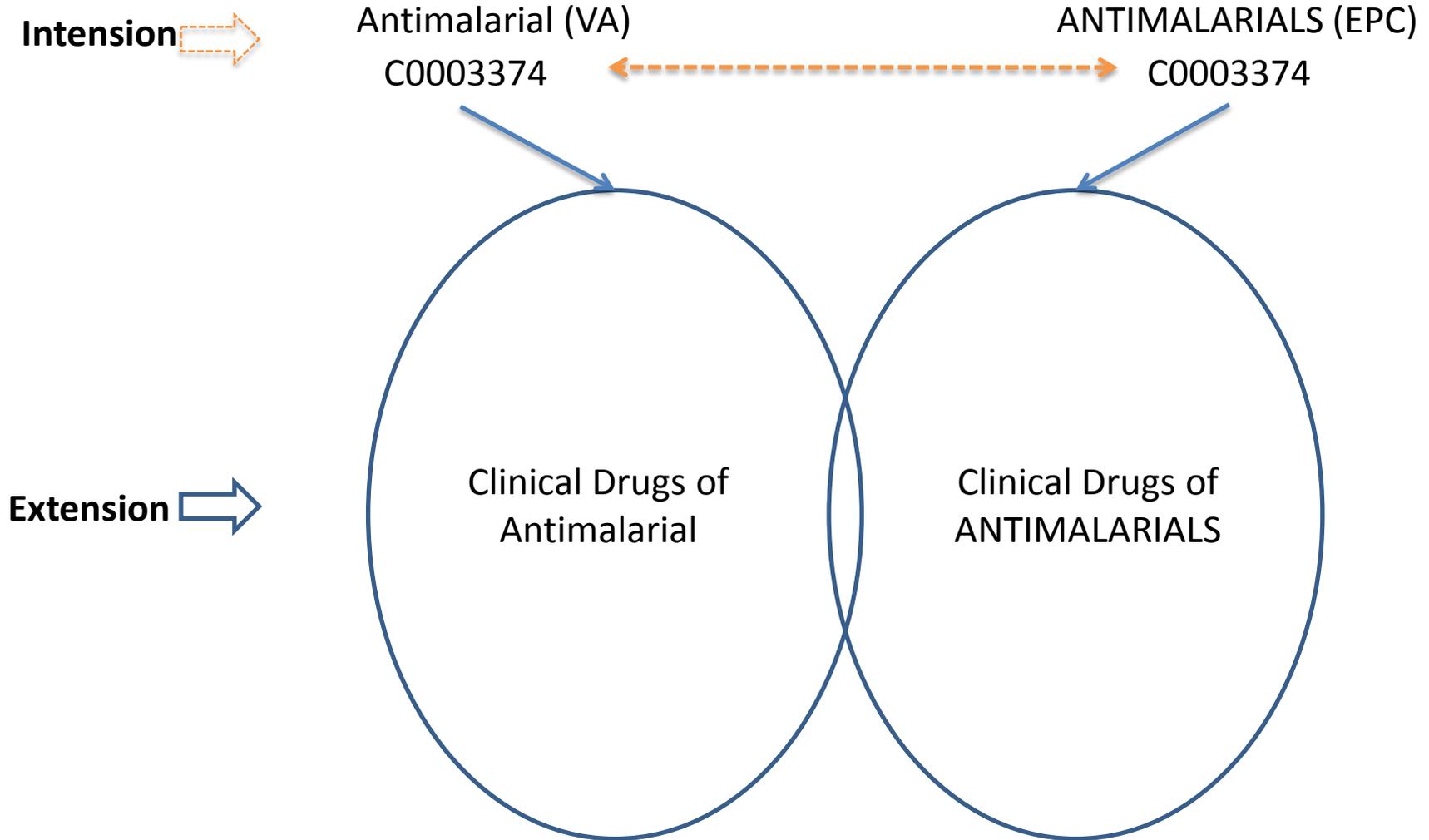
Legend

- *has PE:* has physiologic effect
- *CI with:* contra-indicated with
- *isa (stated)*
- · - · → *isa (inferred)*

Drug Class Comparisons

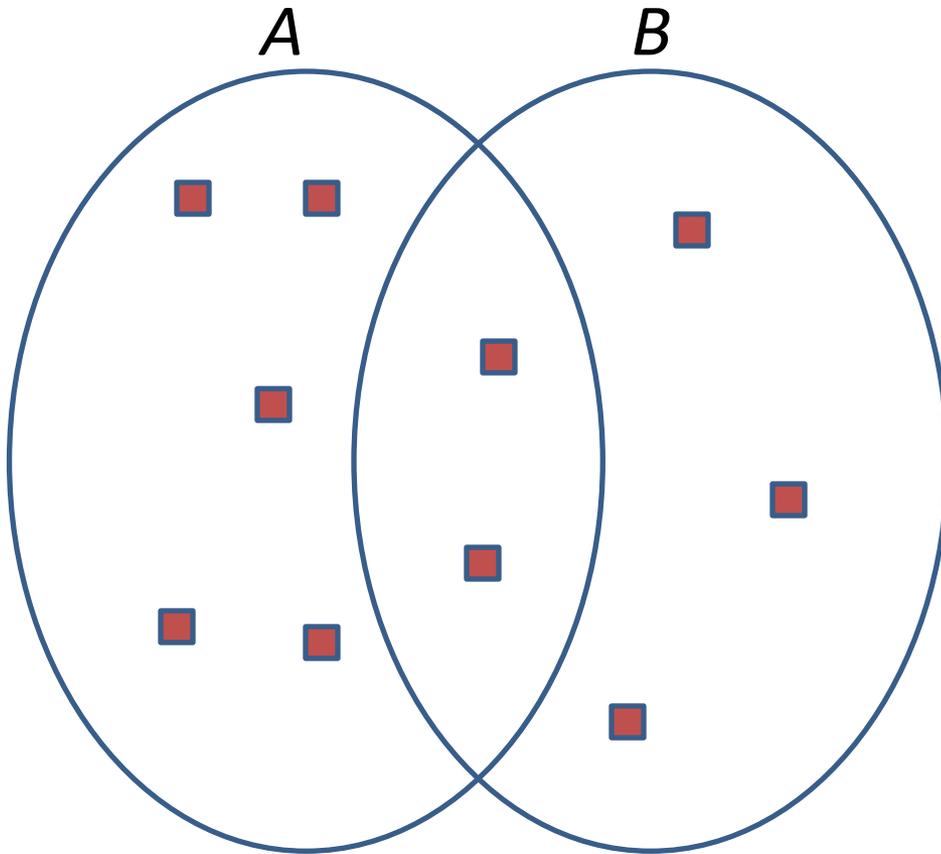
- 2 Methods
 - Compare drug class intension (Unique ID)
 - Compare drug class extension (Drug Members)
- 2 “Places”
 - Internally (VA vs. EPC)
 - Externally (NDF-RT vs. MeSH and SNOMED CT)

Intension and Extension



Jaccard Coefficient

$$Jaccard(A, B) = \frac{A \cap B}{A \cup B}$$

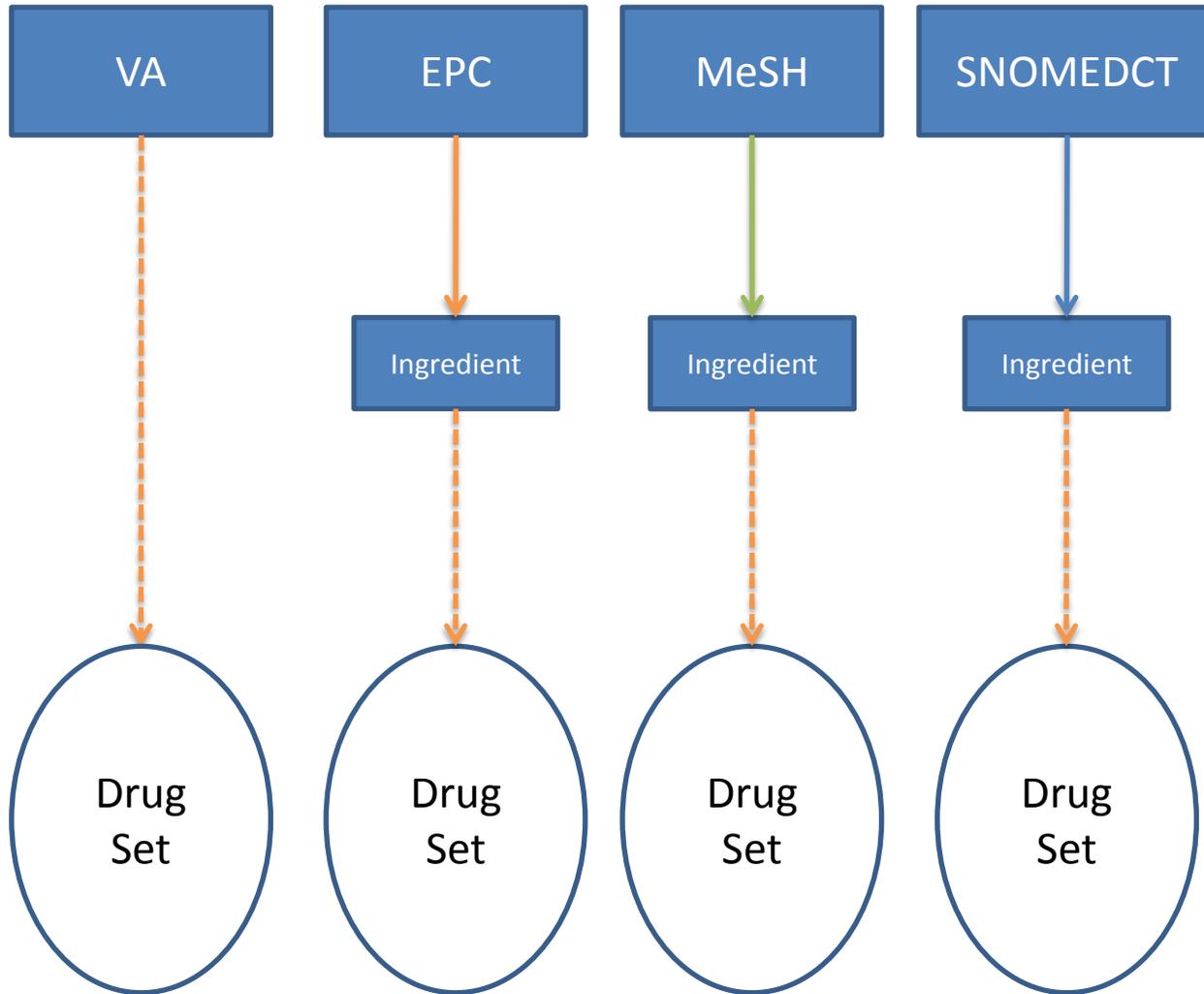


$$A \cap B = 2$$

$$A \cup B = 10$$

$$\frac{A \cap B}{A \cup B} = \frac{2}{10} = .2$$

Internal and External



*Conversion only to drugs in NDF-RT

Comparison Summary

Internal

External

Intension

Same Identifier
between
VA and EPC

Same Identifier
between
NDF-RT and MeSH,
NDF-RT and SNOMED CT

Extension

Jaccard Coefficient
of class drug sets
between
VA and EPC

Jaccard Coefficient
of class drug sets
between
NDF-RT and MeSH,
NDF-RT and SNOMED CT

Qualitative Analysis

Comparison of Intension to Extension		Synonymy / Intension	
		Yes	No
Jaccard / Extension	High	Thrombolytic	Heparin Antagonist
	Low	Anti-Arrhythmics	X

- Types of Errors
 - Omission
 - Commission
 - Missed Synonymy

High Jaccard, Synonym: Thrombolytics

Thrombolytics (EPC)

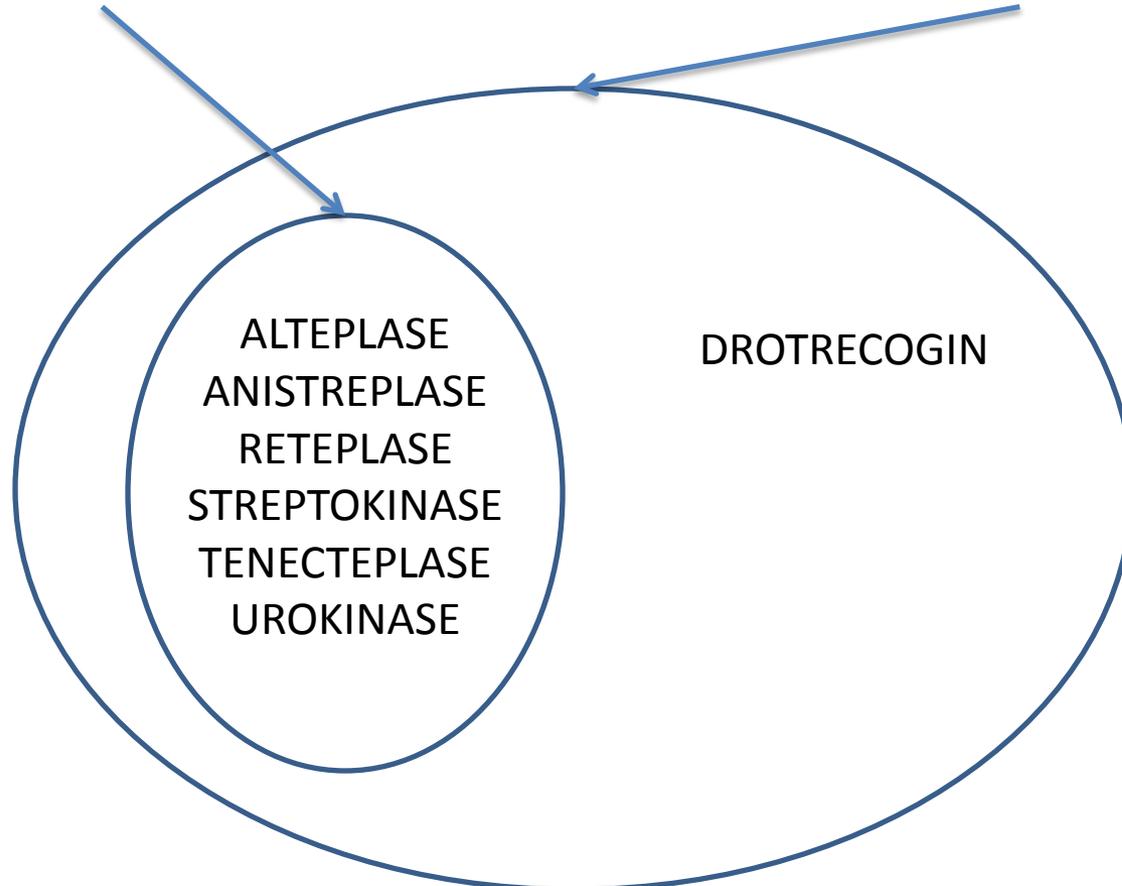
Thrombolytic (SNO)

C0016018

C0016018

Intension 

Extension 

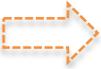


Jaccard = .86

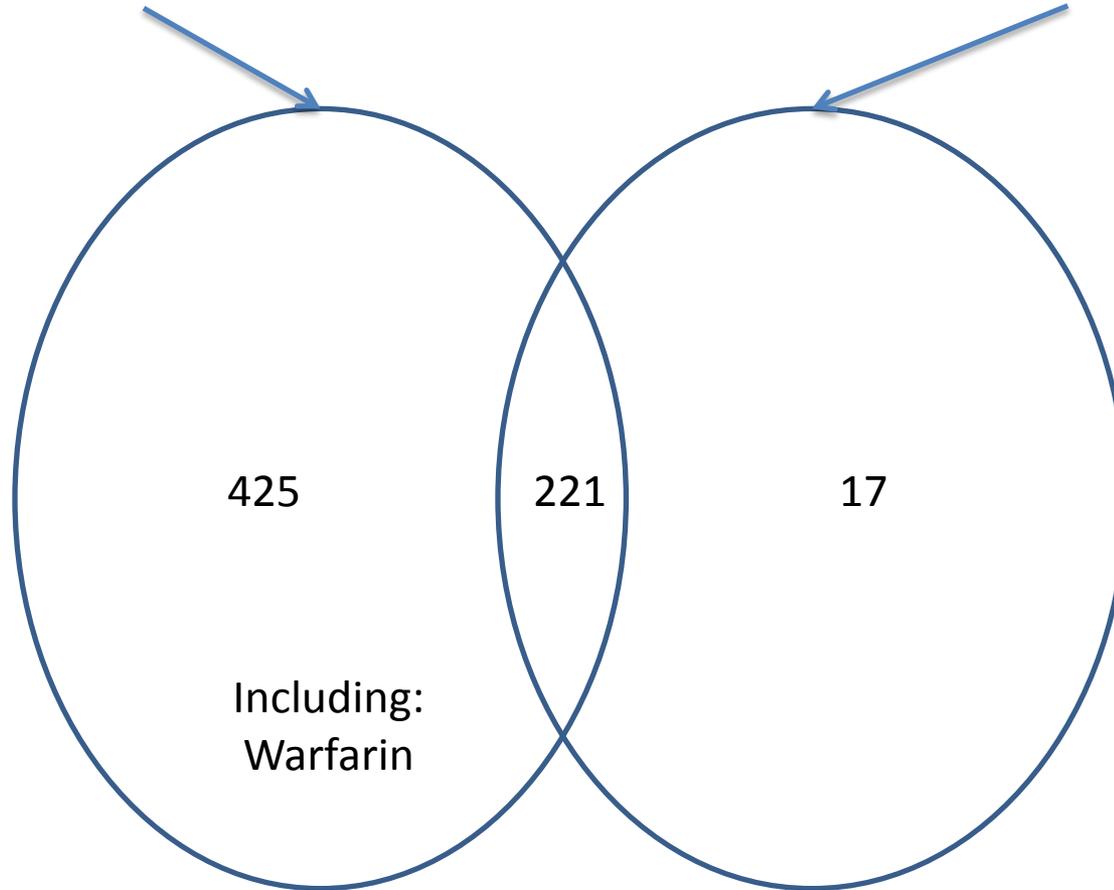
High Jaccard, Synonym: Thrombolytics

- Drotrecogin is present in SNOMED CT
- Drotrecogin is not present in VA Class
- Jaccard is not 1 even though the two classes are synonyms
- Error of Omission
 - Would expect EPC to classify Drotrecogin as a Thrombolytic based on the properties of the ingredient

Low Jaccard, Synonym: Anti-Arrhythmics

Intension  Antiarrhythmic (EPC) C0003195  Antiarrhythmic drug (SNO) C0003195

Extension 



$Jaccard = 1/3$

Low Jaccard, Synonym: Anti-Arrhythmics

- EPC of Anti-Arrhythmics includes warfarin
- SNOMED CT class does not include warfarin
- Discrepancy Lowers Jaccard coefficient
- Error of Commission – definition for warfarin has additional contradictory information
 - Causes drug classification into EPC, might not belong
- Indicates possible revision for warfarin and other drugs

High Jaccard, Non- Synonym: HEPARIN ANTAGONISTS

Intension 

HEPARIN ANTAGONISTS (VA)

Anti-heparin agent (SNO)

C0019135



X

C0304941

PROTAMINE SO4
10MG/ML (PF) INJ

PROTAMINE SO4
10MG/ML INJ

Jaccard = 1

Possible Missed Synonymy

Extension 

Discussion

- Automatic comparison drug class members using class extension
 - Complements lexical matching
 - May serve as a quality assurance tool
- Enriched NDF-RT with additional drug classification
 - NOTE: EPCs may not be appropriate for clinical decision support

Future work

- Quantitative Results
- Paper for SMBM
- Drug Centric Approach

Acknowledgements

- Olivier Bodenreider
- Brian Kirk and Emily Doughty
- Lee Peters
- May Cheh
- Dr. McDonald and the Lister Hill Center

Preliminary Quantitative

VA vs. EPC (Class Counts)		Synonymy	
		Yes	No
Jaccard	High	11	42
	Low	17	

NDF-RT vs. MeSH (Class Counts)		Synonymy	
		Yes	No
Jaccard	High	26	79
	Low	51	

NDF-RT vs. SNOMED CT (Class Counts)		Synonymy	
		Yes	No
Jaccard	High	32	85
	Low	62	