NCCD – RxNorm/Extension: Linking Chinese Clinical Drugs to International Drug Vocabulary

Yaoyun Zhang, Hua Xu, Jing Li, Mui Van Zandt

Melax Technologies, Inc, 7000 Fannin St Suite 1900, Houston, TX, USA;
Real World Solutions, IQVIA, Durham, NC, USA
Observational Health Data Science and Informatics (OHDSI), China Working Group

Outline

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Background

- Rapid development of Health Information systems in China
- Increasing large archives of clinical data
- Promoting interoperability locally and globally

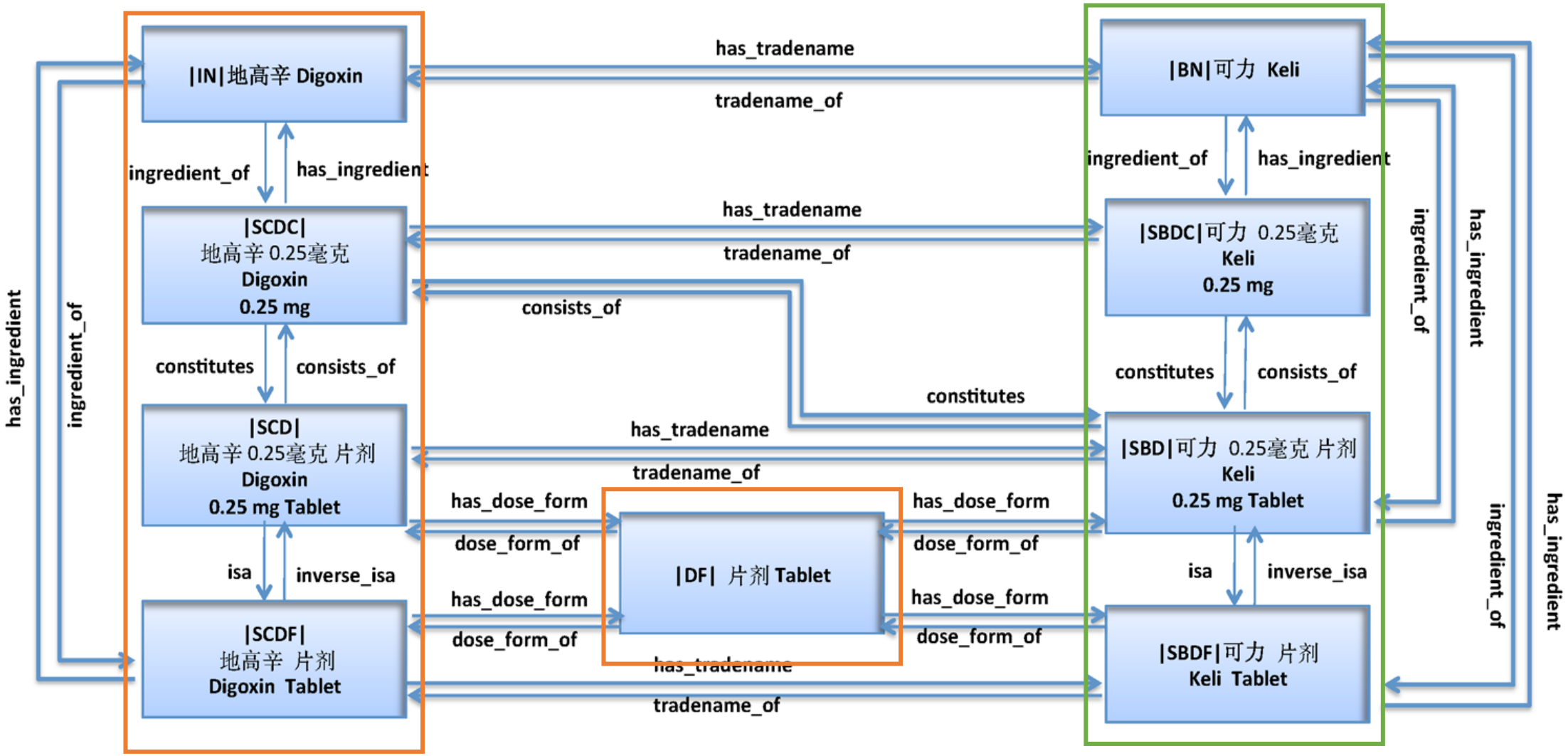
NCCD: Normalized Chinese Clinical Drug knowledge base

- Information sources
  - China Food and Drug Administration
  - China Health Insurance Systems
  - Hospital Pharmacy Systems
  - China Pharmacopoeia

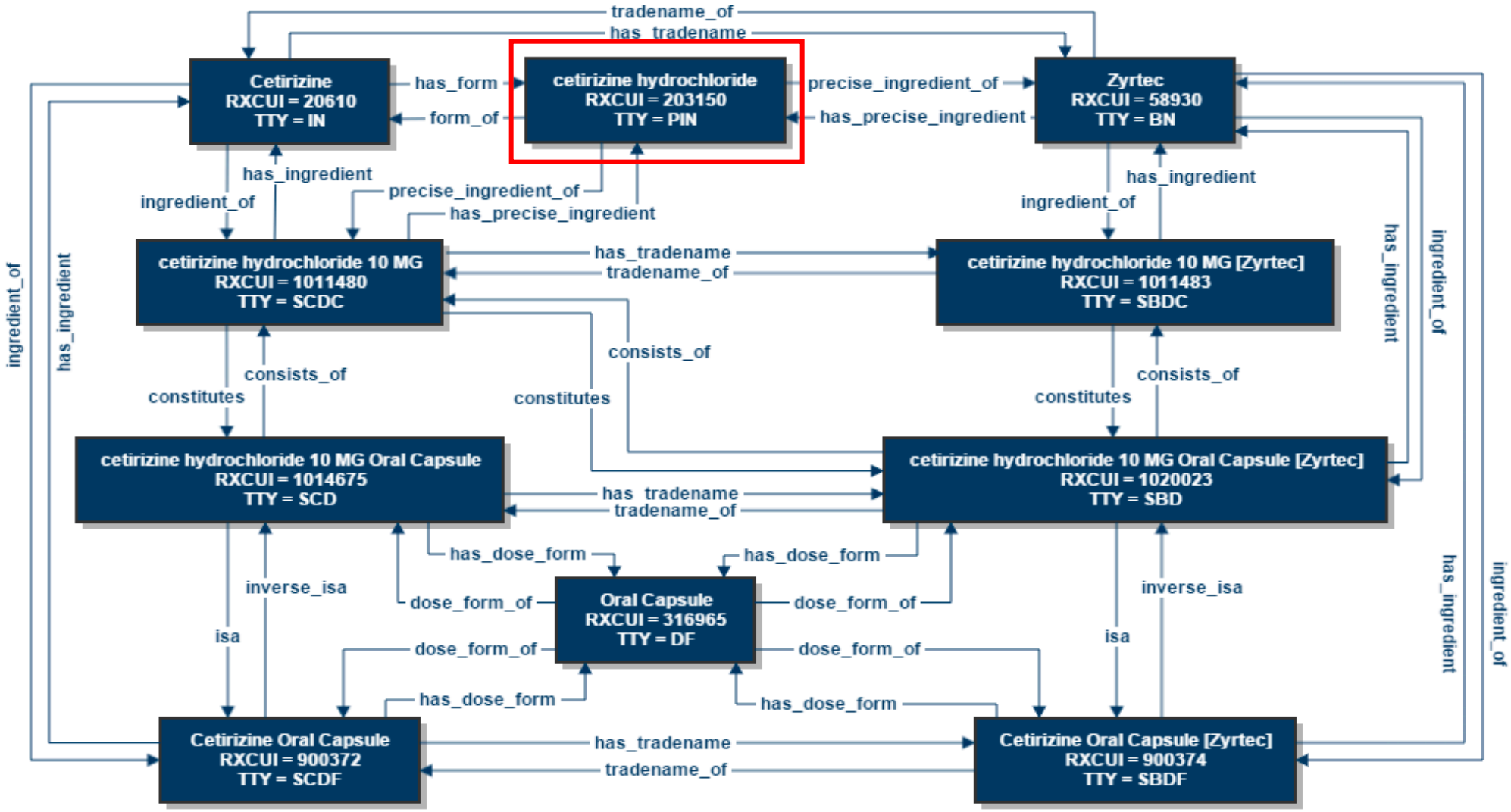
- Drugs
  - **Chemical drugs**
  - Chinese patent drugs

Wang, L., Zhang, Y., Jiang, M., Wang, J., Dong, J., Liu, Y., Tao, C., Jiang, G., Zhou, Y. and Xu, H., 2018. Toward a normalized clinical drug knowledge base in China—applying the RxNorm model to Chinese clinical drugs. *Journal of the American Medical Informatics Association*, *25*(7), pp.809-818.

Semantic network of Chemical drugs in NCCD



RxNorm: A normalized naming system for generic and branded drugs in US



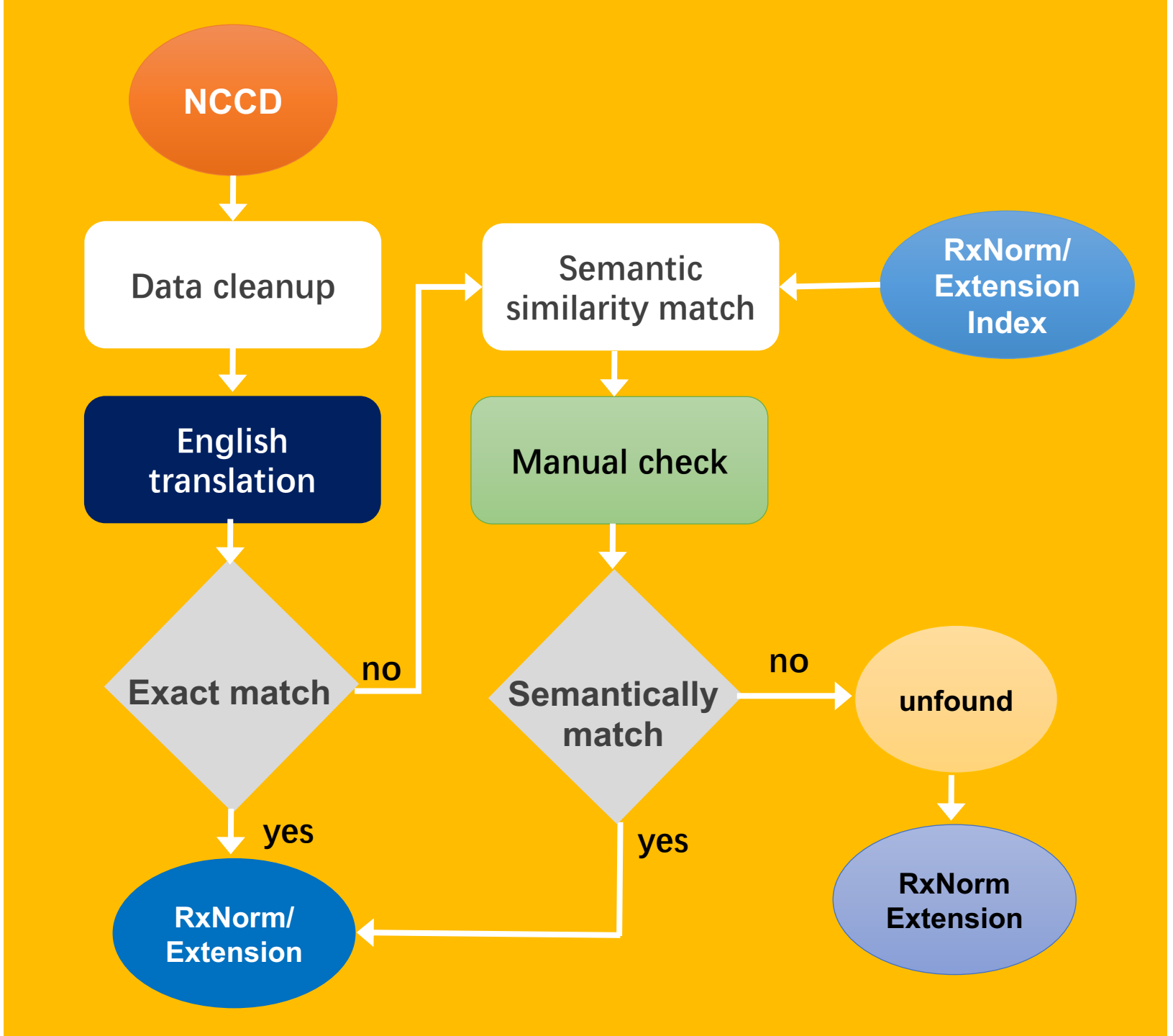
Liu, S., Ma, W., Moore, R., Ganesan, V. and Nelson, S., 2005. RxNorm: prescription for electronic drug information exchange. *IT professional*, *7*(5), pp.17-23.

RxNorm-Extension: an OHDSI resource to represent international drugs

- To support the expansion of the OHDSI research network beyond the US
- Include active ingredients, dose forms, brand names, relations, ATC classification, additional attributes necessary for foreign drug markets
- Specific international drug markets in Canada (DPD), UK (dm+d), France (BDPM), Germany (AMIS), Japan (JMDB), Australia (AMT), etc.

https://www.ohdsi.org/web/wiki/doku.php?id=documentation:international_drugs

Workflow of Drug Term Mapping



Results

NCCD Chemical Drug	RxNorm	Coverage
Ingredient (IN)	Ingredient	2 159 / 64.83%
	Precise ingredient	538 / 16.16%
	Unmatched	633 / 19.00%
Dose form (DF)	Dose form	931 / 90.92%
Brand name (BN)	Brand name	88 / 1.80%
	RxNorm and RxNorm Extension	
Semantic clinical drug form	Semantic clinical drug form	3 075 / 37.63% 788 / 9.64%
Semantic clinical drug component	Semantic clinical drug component	2 226 / 33.06% 578 / 8.58%
Semantic clinical drug	Semantic clinical drug	2 370 / 22.70% 588 / 5.63%

Ingredient mapping

- Matched : 2 159

NCCD_NAME	NCCD_CODE	TRANSLATION	RXN_NAME	RXN_CODE	RXN_TYPE
克林霉素磷酸酯	100378	clindamycin	clindamycin	2582	IN
硝苯地平	183394	nifedipine	nifedipine	7417	IN
阿莫西林	76759	amoxicillin	amoxicillin	723	IN
别嘌醇	76964	allopurinol	allopurinol	519	IN

- Unmatched : 633

NCCD_NAME	NCCD_CODE	TRANSLATION
复方维生素U	87252	vitamin u
氨苯伪麻	134746	amphibian
乙氧苯柳胺	115142	etofesalamide
复方甲麻	190447	Methylene
帕司烟肼	190444	pasiniazide
重组人干扰素α1b	190672	recombinant human interferon α1b

Brand name mapping

- Exact match: 88/4 875 (1.8%)
- Potential problem: Chinese Brands are not covered in RxNorm

NCCD_NAME	NCCD_CODE	TRANSLATION	RXN_NAME	RXN_CODE	RXN_TYPE
美卓乐	174622	medrol	medrol	202702	BN
保达琳	174196	fortolin	fortolin	1540829	BN
卢美根	174268	lumigan	lumigan	284771	BN
普米克令舒	174402	pulmicort respules	pulmicort respules	284850	BN
思真	173197	saizen	saizen	202830	BN
耐信	104516	nexium	nexium	284799	BN
择泰	174858	zometa	zometa	285143	BN
美卓乐	174622	medrol	medrol	202702	BN
保达琳	174196	fortolin	fortolin	1540829	BN

Dose form mapping

- Matched dose forms: 931 out of 1 024 (90.92%)
- Problem: granularity, definition
- Solution: exact match or match to the upper level

NCCD_NAME	NCCD_CODE	TRANSLATION	RXN_NAME	RXN_CODE	RXN_TYPE
片剂（素片）	43734	Tablet (Plain)	tablet	10311	DF
软胶囊剂	176021	soft capsule	Capsule	1995	DF
片剂	59625	tablet	tablet	10311	DF
咀嚼片	98275	chewable tablet	chewable tablet	91058	DF
片剂(包衣片)	53501	Tablet (coated)	tablet	10311	DF
糖衣片	40890	sugar coated tablet	Tablet	10311	DF

Mapping of Semantic Clinical Drug

- SCD: Semantic Clinical Drug
- Total RxNorm Match: 2 370/10 441 (22.70%)
- Total RxNorm_Extension Match: 588/10 441 (5.63%)

NCCD_NAME	NCCD_CODE	IN	DF	RX_NAME	RX_CODE
克林霉素磷酸酯 150 毫克/毫升 注射剂	106424	clindamycin	['150 mg/ml']|injection	clindamycin 150 mg/ml injection	1737246
克林霉素磷酸酯 150毫克 片剂	106466	clindamycin	['150 mg']|tablet	clindamycin 150 mg oral tablet	433773
克林霉素磷酸酯 1200 毫克 注射剂	106421	clindamycin	['1200 mg']|injection	None	
克林霉素磷酸酯 75 毫克/毫升 注射剂	106473	clindamycin	['75 mg/ml']|injection	None	

Mapping of Semantic Branded Drug

- SBD: Semantic Branded Drug
- Total RxNorm Match: 22/ 7 257 (0.30%)
- Total RxNorm_Extension Match: 7/7 257 (0.09%)

NCCD_NAME	NCCD_CODE	IN	DF	RXN_NAME	RXN_CODE
乳果糖 667毫克/毫升 口服溶液剂 [杜密克]	110965	lactulose	['667 mg/ml']|oral solution	lactulose 667 mg/ml oral solution [duphalac]	755469
依非韦伦 600毫克 片剂 [施多宁]	122759	efavirenz	['600 mg']|tablet	efavirenz 600 mg oral tablet [sustiva]	352143
对乙酰氨基酚 0.5克 片剂 [保达琳]	141509	acetaminophen	['500 mg']|tablet	acetaminophen 500 mg oral tablet [fortolin]	1540834
佐米曲普坦 2.5毫克 片剂 [佐米格]	144797	zolmitriptan	['2.5 mg']|tablet	zolmitriptan 2.5 mg oral tablet [zomig]	153353
尼古丁 2毫克 咀嚼胶 [力克雷]	147598	nicotine	['2 mg']|chewing gum	nicotine 2 mg chewing gum [nicorette]	209326
伏立康唑 50毫克 片剂 [威凡]	151281	voriconazole	['50 mg']|tablet	voriconazole 50 mg oral tablet [vfend]	352218

Coverage of common medications

- 1, 000 most frequent medications in hospital
- Coverage
  - 673 drugs mapped to RxNorm at the Ingredient level **– 67.3% RxNorm Ingredient Mapping**
  - Out of these 673 drugs, 358 mapped to RxNorm semantic drugs, and 52 mapped to RxNorm Extension semantic drugs **– 41.0% RxNorm/RxNorm Extension Semantic Drugs Mapping**

Discussion&Conclusion

- Promising results of NCCD-RxNorm/Extension mapping
- Incomplete drug attribute information, especially in hospital data
- Future work
  - Enrich RxNorm-Extension
  - Validation in clinical research use cases

COVID-19 SignSym: A fast adaptation of general clinical NLP tools to identify and normalize COVID-19 signs and symptoms to **OMOP common data model**

Online Demo: https://clamp.uth.edu/covid/nlp.php

Paper: https://arxiv.org/abs/2007.10286

Thank you

Q&A

yaoyun.zhang@melaxtech.com