

RxClass – Navigating between Drug Classes and RxNorm Drugs

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Abstract— Objectives: To demonstrate RxClass, a web interactive browser to explore the relationships between RxNorm drugs and drug classes from several sources including ATC, MeSH and NDF-RT. RxClass is publicly available at: <http://mor.nlm.nih.gov/RxClass/>

I. MOTIVATION

Drug classes constitute important information about the drugs and are critical to important use cases, such as clinical decision support (e.g., for allergy checking). *RxNav*, our RxNorm browser, already displays the classes for RxNorm drugs, but its drug-centric perspective does not accommodate the exploration of drug classes. This is the reason why we developed a web-based companion browser, *RxClass*, which supports navigation between RxNorm drugs and drug classes from several sources, including ATC, MeSH, NDF-RT and Structured Product Labels from the Food and Drug Administration (FDA).

II. SOURCES OF CLASS TYPES AND DRUG-CLASS RELATIONS

The Anatomical Therapeutic Chemical drug classification (*ATC*) is a resource developed for pharmacoepidemiology purposes by the World Health Organization Collaborating Centre for Drug Statistics Methodology.

The Medical Subject Headings (*MeSH*), developed by the National Library of Medicine (NLM), provides a rich description of pharmacological actions for the purpose of indexing and retrieval of biomedical articles.

The National Drug File-Reference Terminology (*NDF-RT*), developed by the Department of Veterans Affairs, provides clinical information about drugs and contains FDA Established Pharmacologic Classification (EPC), Disease classification, Chemical Structure and Classification (Chem), Mechanism of Action (MOA), Physiologic Effects (PE) and Pharmacokinetics (PK) class types.

ATC and MeSH provide both the vocabulary for drug classes and the drug-class membership relations. In contrast, as shown in Table 1, several sources (DailyMed, FDASPL and NDF-RT) provide drug-class membership relations in reference to the NDF-RT vocabulary for classes. All drugs are normalized to RxNorm.

III. RXCLASS INTERFACE

Like *RxNav*, *RxClass* is supported by functions from an application programming interface (API), which can be used independently for integrating drug class information in programs. The API serves the latest information available from the drug information sources.

RxClass provides a graphical interface to explore the hierarchical class structures of each source and examine the corresponding RxNorm drug members for each class. Some features of *RxClass*:

- The user can navigate through the drug classes via the hierarchical menu, or use the search feature to identify a drug class or RxNorm drug (Figure 1).
- *RxClass* supports the exploration of all classes for a given drug across multiple classifications (Figure 2).
- *RxClass* contains an autocomplete function which will help identify class or drug names in search mode, as well as spelling suggestions for misspelled drug and class names during search.

TABLE I. CLASS TYPE MAPPING BY DRUG SOURCES

Class Type	Source of Drug-Class Relations				
	ATC	MeSH	DailyMed	FDASPL	NDF-RT
ATC	X				
MeSH		X			
Chem			X	X	X
Disease					X
EPC			X	X	X
MOA			X	X	X
PE			X	X	X
PK					X

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RxClass - exploring drug classes and their RxNorm drug members About FAQ Tutorial

Class Browser

- ▼ Anatomical Therapeutic Chemical (ATC1-4)
 - > ALIMENTARY TRACT AND METABOLISM (350)
 - > ANTIINFECTIVES FOR SYSTEMIC USE (282)
 - > ANTINEOPLASTIC AND IMMUNOMODULATING AGENTS (216)
 - > ANTIPARASITIC PRODUCTS, INSECTICIDES AND REPELLENTS (66)
 - > BLOOD AND BLOOD FORMING ORGANS (140)
 - > CARDIOVASCULAR SYSTEM (305)
 - > AGENTS ACTING ON THE RENIN-ANGIOTENSIN SYSTEM (32)
 - > ANTIHYPERTENSIVES (29)
 - > BETA BLOCKING AGENTS (25)
 - ▼ BETA BLOCKING AGENTS (25)
 - Alpha and beta blocking agents (2)
 - Beta blocking agents, non-selective (13)
 - Beta blocking agents, selective (10)
 - > BETA BLOCKING AGENTS AND OTHER ANTIHYPERTENSIVES (0)
 - > BETA BLOCKING AGENTS AND OTHER DIURETICS (0)
 - > BETA BLOCKING AGENTS AND THIAZIDES (0)
 - > BETA BLOCKING AGENTS AND VASODILATORS (0)
 - > BETA BLOCKING AGENTS, THIAZIDES AND OTHER DIURETICS (0)
 - > CALCIUM CHANNEL BLOCKERS (22)
 - > CARDIAC THERAPY (79)
 - > DIURETICS (35)
 - > LIPID MODIFYING AGENTS (32)
 - > PERIPHERAL VASODILATORS (26)
 - > VASOPROTECTIVES (30)
- > DERMATOLOGICALS (224)
- > GENITO URINARY SYSTEM AND SEX HORMONES (150)
- > MUSCULO-SKELETAL SYSTEM (119)
- > NERVOUS SYSTEM (395)
- > RESPIRATORY SYSTEM (198)
- > SENSORY ORGANS (163)
- > SYSTEMIC HORMONAL PREPARATIONS, EXCL. SEX HORMONES AND INSULINS (61)
- > VARIOUS (117)
- > Established Pharmacologic Classes (EPC)
- > MeSH Pharmacologic Actions (MESHFA)
 - > Disease
 - > Chemical Structure (Chem)
 - > Mechanism of Action (MoA)
 - > Physiologic Effect (PE)
 - > Pharmacokinetics (PK)

Source of drug-class relations

ATC
 MeSH
 DailyMed
 NDFRT
 FDA SPL

Q

by class name/id
 by RxNorm drug name/id

Beta blocking agents, selective ⌵

class: **Beta blocking agents, selective** / id: C07AB / class type: ATC1-4 / [show context](#)

10 RxNorm generic drugs in ATC

Type	RXCUI	RxNorm Name	Source Id	Source Name	Relation	All classes
IN	149	Acebutolol	C07AB04	acebutolol	DIRECT	Show
IN	1202	Atenolol	C07AB03	atenolol	DIRECT	Show
IN	1520	Betaxolol	C07AB05	betaxolol	DIRECT	Show
IN	19484	Bisoprolol	C07AB07	bisoprolol	DIRECT	Show
IN	20498	Celiprolol	C07AB08	celiprolol	DIRECT	Show
IN	49737	esmolol	C07AB09	esmolol	DIRECT	Show
IN	6918	Metoprolol	C07AB02	metoprolol	DIRECT	Show
IN	31555	nebivolol	C07AB12	nebivolol	DIRECT	Show
IN	8620	Practolol	C07AB01	practolol	DIRECT	Show
IN	37546	talinolol	C07AB13	talinolol	DIRECT	Show

Fig. 1. Drugs from the ATC class *Beta blocking agents, selective*, with the ATC hierarchy of classes on the left navigation pane and the list of RxNorm drug members on the right

7 classes found for drug 'Acebutolol'

- [Beta blocking agents, selective](#) in ATC1-4
- [beta-Adrenergic Blocker](#) in EPC (has_EPC)
- [Adrenergic beta-1 Receptor Antagonists](#) in MESHFA
- [Anti-Arrhythmia Agents](#) in MESHFA
- [Antihypertensive Agents](#) in MESHFA
- [Sympathomimetics](#) in MESHFA
- [Adrenergic beta-Antagonists](#) in MOA (has_MoA)

Fig. 2. Membership of the drug *Acebutolol* to drug classes from various sources.