RxNorm's Drug Interface Terminology Supports Interoperability

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RxNorm is a public domain drug vocabulary maintained by the National Library of Medicine (NLM) on behalf of the United States. The purpose of RxNorm is to facilitate the sharing of electronic drug information between hospitals, pharmacies, and healthcare professionals. The scope of RxNorm covers both over-the-counter (OTC) medications and prescription (Rx) drugs. Radiopharmaceuticals, contrast media, medical foods, dietary supplements, homeopathic products, and medical devices are all outside of the scope of RxNorm.

The building block of RxNorm is the "clinical drug." The clinical drug in RxNorm is the entity that most closely maps to what providers prescribe and includes a description with one or more ingredients, strengths, and dosage forms. Each concept term will represent a single meaning. The normalized RxNorm vocabulary facilitates interoperability between drug knowledge bases and pharmacy terminologies deployed in support of electronic health records, decision support systems, and pharmacy inventory controls.

Different vendors and systems may have their own terminology for medications. This makes sharing the correct drug information between systems challenging. RxNorm's normalized drug names and their unique identifiers facilitate sharing electronic information across disparate systems without ambiguity or loss of meaning. RxNorm was developed to better meet prescribers' requirements via a publicly available code set mapped to multiple proprietary drug terminologies in the US. It contains standard names and identifiers that are created by NLM to represent combinations of ingredients, strengths, and dose forms that are available in the US market.

Electronic prescribing uses machine-readable codes to identify drugs, thereby diminishing the chance of medical errors that come from dispensing medications by written orders. The Food and Drug Administration's (FDA) National Drug Code (NDC) Dictionary has unique identifiers for US prescribable drugs used by pharmacy systems during electronic prescribing. While the NDCs are unambiguous, the format contains information that is not pertinent to prescribers' intent such as specific manufacturer and package size information. One company may make the diphenhydramine hydrochloride 25 mg oral tablets in a 30-tablet blister pack and a 100-tablet bottle with each size assigned its own unique NDC. Another manufacturer's version of the same tablet in different packs receives a completely different set of NDCs. From a prescriber's perspective, this multiplicity of codes tied to a given drug increases the possibility of error in an application.

Comparison of RxNorm and NDC

RxNorm is an interface terminology that is created and derived from other drug terminology content. It preserves the names, NDC codes, and selected relationships from its source terminologies. The normalized system of drug names are tied to ingredients, strengths, and dosage forms-for both brand name and generic drugs. RxNorm then collects strings from multiple sources that mean the same thing. Using carvedilol 25 mg oral tablet as an example, "Table 1" includes sample source strings from selected vocabularies-each representing the RxNorm concept.

Table 1

Sample Source Strings from selected vocabularies for a carvedilol 25 mg oral tablet are included below.

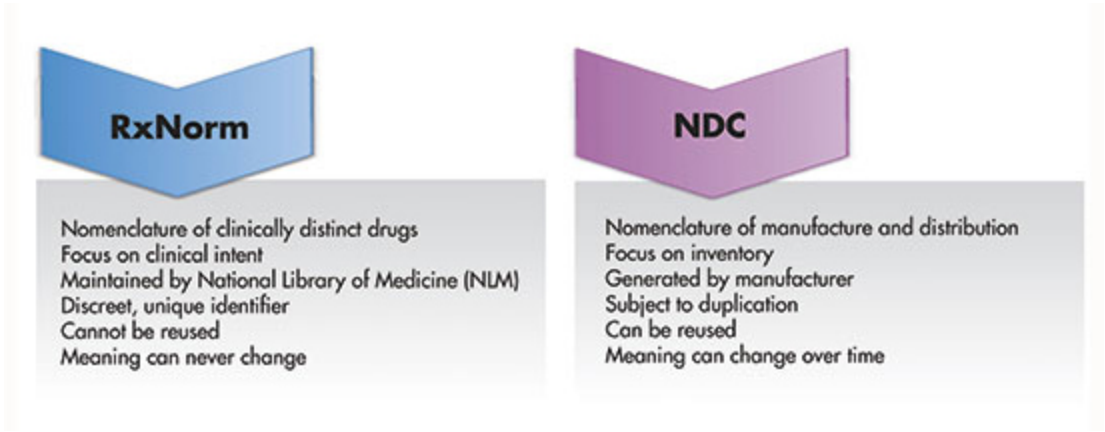
Source String	Source Vocabulary

carvedilol 25mg tablet (product)	SNOMEDCT
CARVEDILOL@25 MG@ORAL@TABLET	NDDF
Carvedilol 25 MILLIGRAM In 1 TABLET ORAL TABLET, COATED	MTHSPL
CARVEDILOL 25MG TAB	VANDF

The 11 sources that provide terminology to RxNorm are included below.

Source String	**Source Abbreviation**
Gold Standard Drug Database	GS
Medi-Span Master Drug Data Base	MDDB
Medical Subject Headings (MeSH)	MSH
Multum MediSource Lexicon	MMSL
Micromedex RED BOOK	MMX
FDA National Drug Code Directory	MTHFDA
FDA Structured Product Labels	MTHSPL
FDB MedKnowledge (NDDF Plus)	NDDF
Veterans Health Administration National Drug File–Reference Terminology	NDFRT
SNOMED Clinical Terms (drug information only)	SNOMEDCT
Veterans Health Administration National Drug File	VANDF

RxNorm vs. NDC



RxNorm assigns each clinical drug a discreet and publicly available RxNorm concept unique identifier, the RxCui. The RxCui will never change and is never deleted or reused in any way. The RxCui functions as the computer-coded identifier for that clinical drug. Each medication product that has the same active ingredient(s), strength(s), and dosage form will share the same RxCui, regardless of manufacturer or package type.

When a RxCui is created, other descriptions and relationships are created to support different levels of abstraction for communicating drug information. RxNorm has term types and identifiers to allow drug information at various levels to support different use cases. Whereas the clinical drug supports the exchange of prescribing information, the ingredients can support the exchange of allergy information.

As RxNorm is produced, the normalized and complete name for a drug with the ingredient name, strength, and dosage form is called the semantic clinical drug (SCD) for generic drugs and the semantic branded drug (SBD) for brand name drugs. RxNorm also contains drug packs, such as birth control pills, and other products that must be administered in sequence.

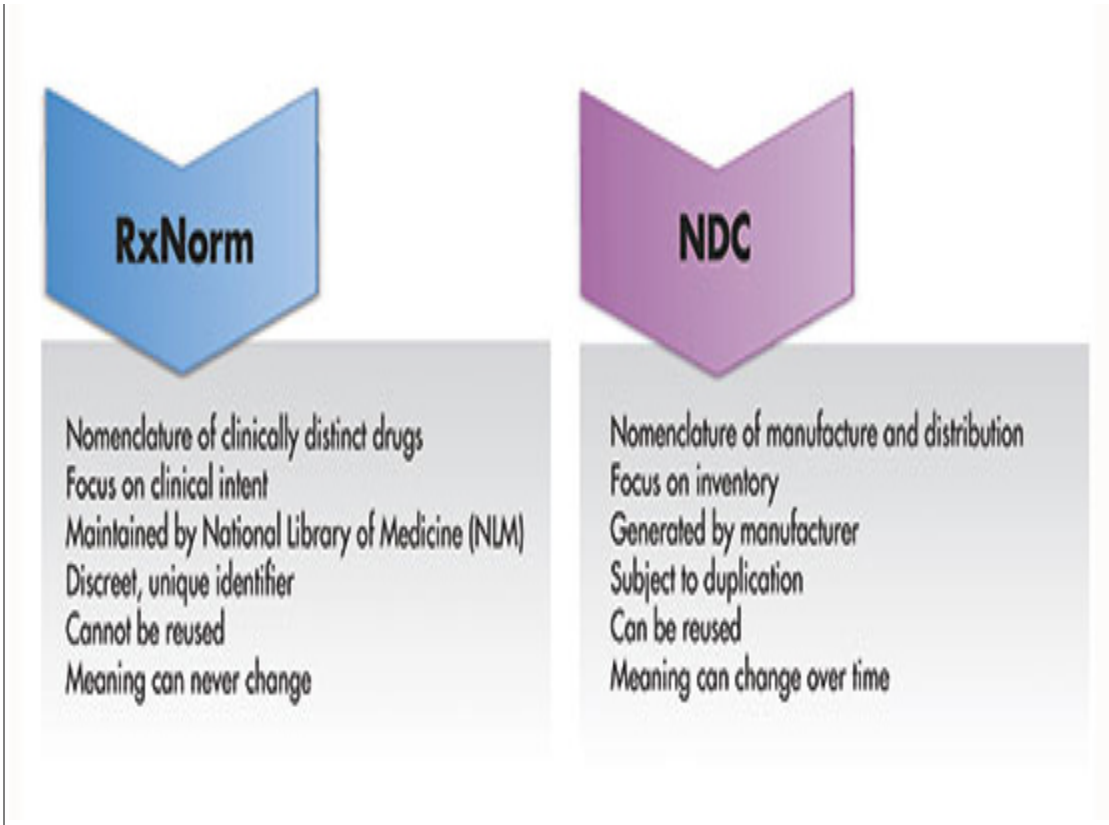
Simplified View of the RxNorm Model

Like any drug terminology, RxNorm is updated in near real time by feeds from the National Library of Medicine's *DailyMed* website, including the prescribing information from the Structured Product Labeling Initiative. RxNorm is published on a weekly, incremental update release cycle, with a full monthly release. A recent addition to the release is the Current Prescribable Content Subset. This subset is the best approximation of the current set of human prescribable drugs on the US market, since RxNorm also includes veterinary drugs. A significant enhancement to RxNorm content resulted from the addition of First Databank's NDC dataset in 2011. The impact of these and other content enhancements was reflected in a 2011 RAND Corporation study, which assessed RxNorm's utility in prescription error checking during pharmacy dispensing practices.

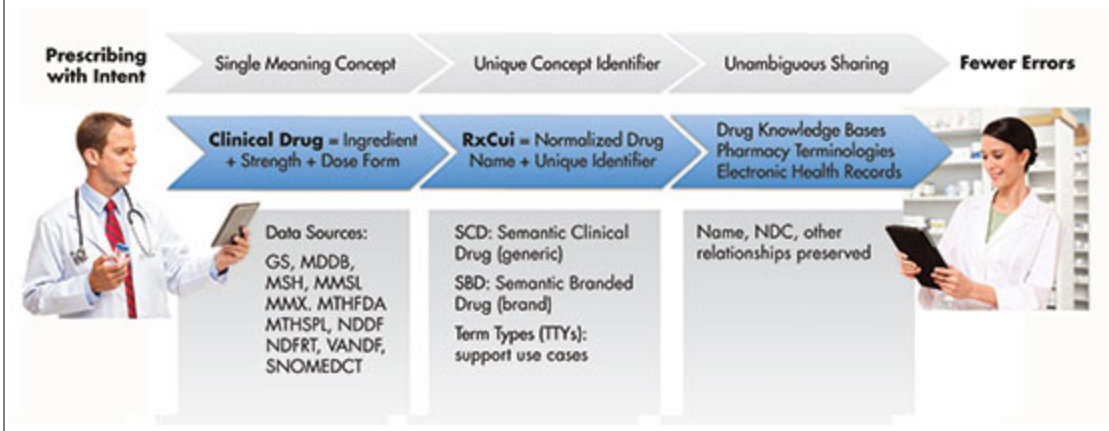
As the number and complexity of electronic healthcare systems evolve over time, RxNorm will continue to provide an interoperable, prescriber-focused standard drug terminology. RxNorm codes are required to fulfill medication-related requirements in electronic health records for the "meaningful use" EHR Incentive Program, as specified under the 2014 Edition of the Office of the National Coordinator for Health Information Technology (ONC) Standards and Certification Criteria.

RxNorm is available from the Unified Medical Language System Metathesaurus at NLM. A free license is required to obtain the files, which can be accessed at https://uts.nlm.nih.gov/home.html.

Simplified View of the RxNorm Model



RxNorm Overview



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Article citation:
McGinness, Doris; Bronnert, June; Masarie, Chip; Naeymi-Rad, Frank. "RxNorm's Drug Interface Terminology Supports Interoperability" *Journal of AHIMA* 84, no.2 (February 2013): 44-47.