

***RxNav*: Browser and Application Programming Interfaces for RxNorm**

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The *RxNav* browser

Released in September 2004, *RxNav* [1] was first developed as an interface to the *RxNorm* database [2] and was primarily designed for displaying relations among drug names. The various kinds of drug entities (ingredient, brand name, clinical drug, branded drug, etc.) form a graph, of which *RxNav* provides a graphical representation and enables the navigation. Any name and code from the eleven source vocabularies integrated in *RxNorm* can be resolved into an *RxNorm* concept. The entry module supports autocompletion and spelling correction. In addition to drug names, *RxNav* provides access to the National Drug Codes (NDC codes) for clinical and branded drugs, as well as external links to resources, such as DailyMed.

The *RxNorm* dataset is updated weekly. *RxNav* always displays the most recent release (from a server at the National Library of Medicine) and does not require users to maintain a local copy of the dataset. *RxNav* is a standalone Java Web Start application available on Windows, Mac and Linux platforms. It requires an Internet connection and the Java Runtime Environment to run on the user's computer. *RxNav* can be used behind a proxy server.

Application Programming Interfaces (APIs)

Originally developed for *RxNav* itself, the SOAP API was made publicly available in 2008. A REST API was developed more recently. These APIs enable users to integrate *RxNorm* data into their applications. For example, the API can be used for resolving "Zyrtec" into an *RxNorm* identifier (58930) and for finding which ingredients are associated with the branded drug "Bactrim 400 MG / 80 MG Oral Tablet" (Sulfamethoxazole + Trimethoprim).

SOAP. The original API [3] is based on web services and relies on the Simple Object Access Protocol (SOAP). It can easily be called from programming languages, such as Java, Perl and .NET. The list of available functions is described in the service description (WSDL) file. Example programs are available as part of the documentation.

REST. More recently, in order to facilitate the use of *RxNorm* by a wider range of users, we developed a

RESTful version of the API [4], compatible with the Representational State Transfer (REST) architecture. The list of resources (roughly corresponding to SOAP-based functions) is listed in the documentation. The HTTP method GET is used to query the service and the results are returned in XML or JSON format.

Usage and uses

Usage has increased steadily over time, reaching a monthly average of 500,000 queries (browser and APIs) and 5000 browsing sessions. The API is used in applications including *MyMedicationList* and *MyRxPad* (e-prescribing). Based on feedback from users, *RxNav* and the APIs have been used in academic environments, by health insurance companies, EHR vendors, and drug information providers. Mapping NDC codes to *RxNorm* concepts is one of the main uses of the API, which has been employed to process large amounts of queries. We also used the API to run quality assurance tests against *RxNorm*.

Recent and future developments

In addition to the RESTful API, we recently developed a drug-specific normalization approach, *RxNormNorm*, now available as a service. Since July 2010, we have established a redundant system for continuity of service, anticipating integration of our services in production applications. We are also working on the integration of *RxNorm* with sources of clinical information, such as NDF-RT, in order to link drugs to therapeutic classes, indications, and pharmacokinetic properties. A prototype of *RxNav* integrating RxTerms and NDF-RT was developed in 2009. These two resources will be integrated in future releases of *RxNav*. Finally, we are planning to release two new applications: *RxMap*, for mapping names and codes to *RxNorm* identifiers and *RxCrossMap*, for navigation across the source vocabularies in *RxNorm*.

References

1. <http://rxnav.nlm.nih.gov/>
2. <http://www.nlm.nih.gov/research/umls/rxnorm/index.html>
3. <http://rxnav.nlm.nih.gov/RxNormAPI.html>
4. <http://rxnav.nlm.nih.gov/RxNormRestAPI.html>