

# Automated Inference of Patient Problems from Medications using NDF-RT and the SNOMED-CT CORE Problem List Subset

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## Objective

To apply clinical indication relationships from NDF-RT and usage frequency from the SNOMED-CT CORE problem list subset to infer patient problems as an automated method for summarizing large, complex patient records.

## Inference Knowledge Base

For each medication, we extracted indicated problems from NDF-RT, mapped to SNOMED-CT and RxNorm, limiting problems to those in the CORE Subset.

## Background

NDF-RT provides a formal content model to describe medications and definitional relationships, such as drug indication. RxNorm provides normalized drug names and links to drug vocabularies. The CORE Problem List Subset of SNOMED-CT includes the most commonly used terms and usage frequency from seven institutions

## Evaluation of Inferred Problems

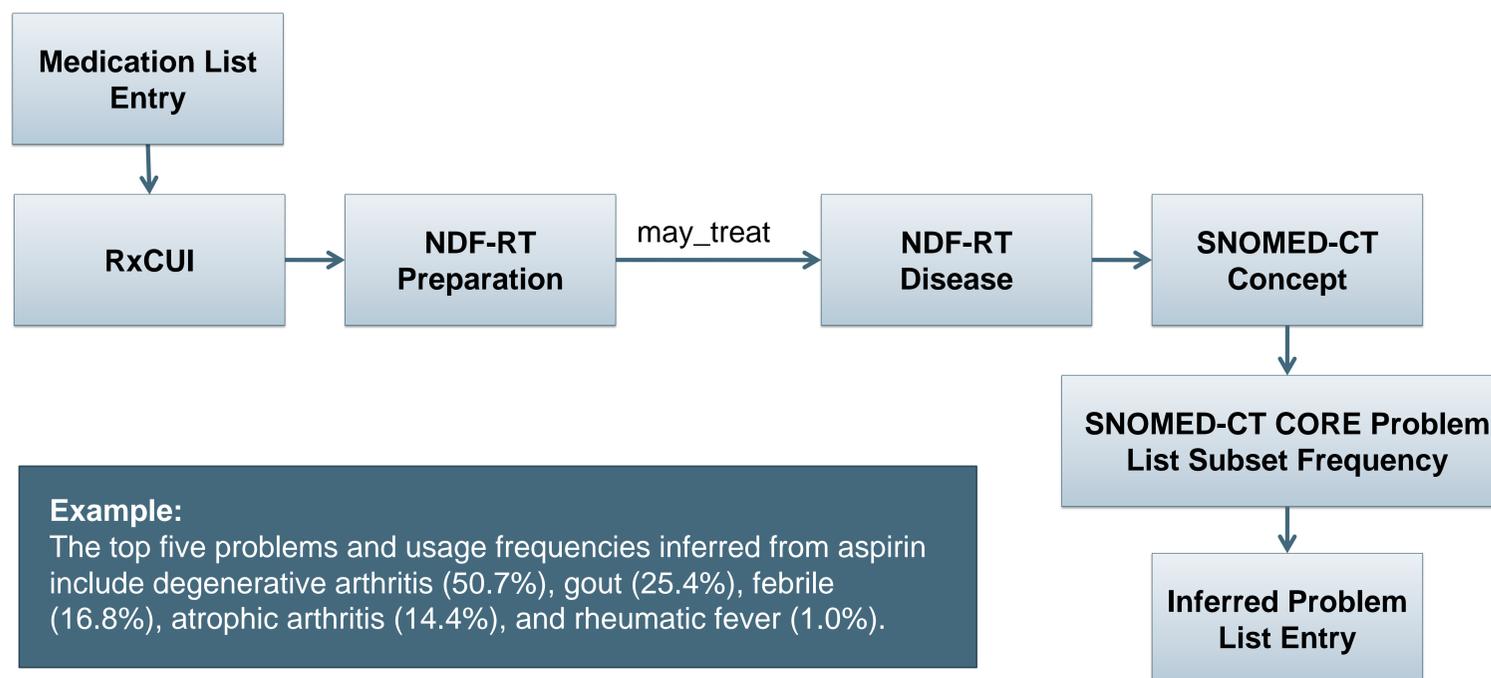
We randomly selected 50 patients with an ambulatory visit during July 1, 2010 through December 31, 2010 and at least one active medication. For each medication, we reviewed the patient's chart to determine if any of the ten most frequent CORE problems inferred existed in the patient's active problem list or if the term was an exact match.

## Relevancy Rating for Inferred Problems

	All Ratings	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
All Potential Problems	847	191	166	136	117	81	57	42	32	18	7
Median Rating	4	2	4	4	4	5	5	5	5	5	4
Relevant	26.6%	58.1%	25.3%	26.5%	15.4%	13.6%	5.3%	0%	6.3%	0%	28.6%
Neither	10.4%	7.3%	13.3%	11.0%	15.4%	8.6%	10.5%	9.5%	3.1%	5.6%	0%
Not Relevant	62.9%	34.6%	36.7%	15.4%	48.7%	77.8%	84.2%	90.5%	90.6%	94.4%	62.9%

We rated each inferred problem on its relevancy to the medication's actual indication using a 5-point Likert scale . (1=Definitely Relevant, 2=Slightly Relevant, 3=Neither Relevant nor Irrelevant, 4=Slightly Irrelevant, 5=Not Relevant)

## Inference Knowledge Base



**Example:**  
The top five problems and usage frequencies inferred from aspirin include degenerative arthritis (50.7%), gout (25.4%), febrile (16.8%), atrophic arthritis (14.4%), and rheumatic fever (1.0%).

## Results

We evaluated 191 medications with 847 inferred problems (4.4 per medication). Of these, 118 (61.8%) inferred problem lists contained an entry also in the patient's active problem list, and 62 (32.5%) contained exact matches.

Of the 73 medications without an inferred problem in the patient's active problem list, 45 (62%) had an inferred problem rated as definitely or slightly relevant based on the chart review, indicating that the problem should have been entered on the active problem list.

The first inferred problem was more often definitely or slightly relevant than lower rated problems. CORE frequency more often corresponded with relevance to a patient's clinical scenarios for medications with fewer potential indications, such as anti-inflammatory drugs.

## Conclusion

Utilization of NDF-RT medication indications with CORE problem frequencies performed reasonable well and may facilitate problem-oriented patient record summarization. Some improvements are necessary for optimal problem-medication matching.

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