Algorithm for Filtering Drug-Drug Interaction Alerts for

Warfarin – Non-steroidal Anti-inflammatory Drugs (NSAIDs)

Developed by:

Hansten P, Boyce R, Rosko SC, , Horn JR, Romero A, Malone DC.

1. Select NSAIDs from World Health Organization Anatomical Therapeutic Chemical Classification codes. Access the WHO website **(**[**http://www.whocc.no/atc\_ddd\_index/**](http://www.whocc.no/atc_ddd_index/))

NSAIDs of interest: ATC Code: M01A - Antiinflammatory and Antirheumatic Products, Non-Steroids.  
  
2. Open Atlas, click on the “Vocabulary” button on the left sidebar, then click on the “Import” tab at the top, then click on “Source Codes” below that. Put the ATC class code into the search box here and hit “Import Source Codes”.  
  
3. Click on the name of the ATC class, and you will be taken to the related concepts page. Here, filter the results by click on the categories on the left side. You want to select “Ingredients” under the heading “Class” and “Valid” under the heading “Invalid Reason”. This limits the concept set to the drug ingredients from the ATC class that have an RxNorm mapping.

4. Click the shopping cart symbol to add all of these to a new concept set, then navigate to the concept set management page. Do not save your concept set yet. Take the concept codes from this page (NOTE: NOT CONCEPT ID) and access the RxNorm Currently Prescribable Content Subset (CPCS), which is loaded into MySQL. Use these RXCUIs to search the RxNORM CPCS and find which drugs are still on the market.

Here is a macro for Excel/Google Sheets to flip your list of CUIs and create a single comma-delimited string: =arrayformula(concatenate(filter(A2:A45,A2:A45<>"")&"', '"))

Use the following query for RxNorm CPCS:

SELECT RXCUI FROM rxnorm\_cpcs.RXNCONSO   
WHERE SAB = 'RXNORM' and RXCUI IN (**COMMA DELIMITED LIST GOES HERE**)  
ORDER BY STR  
;

5. Go back to Atlas. Clear the concept set that you have in your cart. Click on “Vocabulary” on the left sidebar again, then click the “Import” tab, followed by the “Source Codes” tab. Here, paste the RxCUIs that you got from the RxNorm database. Delimiters do not matter. Once you hit import, all of these RxCUIs will be re-added to the concept set.

6. Navigate to the concept set page. Exclude the following products:

phenylbutazone

7. Enter a title at the top left, then save at the top right. Naming conventions: Use the class name or ingredient name, always keep the name plural for consistency’s sake, and if it is an ingredient set, add ingredients to the end of it.

8. Return to RxNORM CPCS and use the following query to find the clinical drugs for your drug ingredient concept set:

SELECT RXCUI,STR FROM rxnorm\_cpcs.RXNCONSO

WHERE TTY = 'SCD' and RXCUI in

(SELECT RXCUI2 FROM rxnorm\_cpcs.RXNREL

WHERE RELA = 'consists\_of' and RXCUI1 in

(SELECT RXCUI2 FROM rxnorm\_cpcs.RXNREL

WHERE RELA = 'has\_ingredient' and RXCUI1 in (**COMMA-DELIMITED LIST GOES HERE**)))

ORDER BY STR

;

Restrict to medications for human consumption

Delete products not of interest:

* 1. Eliminate topical NSAIDs
  2. Eliminate ophthalmic NSAIDs preparations

1. Identify warfarin via RxNorm: RXCUI: 11289
   1. Identify clinical drug components
   2. Remove products not available in US
   3. Identify clinical drug or pack with warfarin
2. Identify proton pump inhibitors or misoprostol in RxNorm: RXCUI:
   1. Dexlansoprazole: 816346
   2. Esomeprazole: 283742
   3. Lansoprazole: 17128
   4. Misoprostol: 42331
   5. Omeprazole: 7646
   6. Pantoprazole: 40790
   7. Rabeprazole: 114979
3. Pull products of interest for proton pump inhibitors or misoprostol from RxNorm
   1. Identify clinical drug components
   2. Remove products not available in US
   3. Identify clinical drug or pack
4. Exclude patients taking warfarin, NSAIDs, and proton pump inhibitor or misoprotstol
5. Determine if patient has history of gastrointestinal bleeding
   1. ICD-9 codes:
      1. 578.0 – Hematemesis
      2. 532.00 – Acute bleeding duodenal ulcer
      3. 578.9 – Gastrointestinal hemorrhage
      4. 530.21 – Ulcer of esophagus with bleeding
      5. 530.82 – Esophageal hemorrhage
      6. 531.0 – Acute gastric ulcer with hemorrhage
      7. 531.2 – Acute gastric ulcer with hemorrhage and perforation
      8. 531.4 – Chronic gastric ulcer with hemorrhage
      9. 531.6 – Chronic or unspecified gastric ulcer with hemorrhage and perforation
      10. 532.0 – Acute duodenal ulcer with hemorrhage
      11. 532.2 - Acute duodenal ulcer with hemorrhage and perforation
      12. 532.4 – Chronic or unspecified duodenal ulcer with hemorrhage
      13. 532.6 - Chronic or unspecified duodenal ulcer with hemorrhage and perforation
      14. 533.0 – Acute peptic ulcer with hemorrhage
      15. 533.2 - Acute peptic ulcer with hemorrhage and perforation
      16. 533.4 – Chronic peptic ulcer with hemorrhage
      17. 533.6 - Chronic peptic ulcer with hemorrhage and perforation
      18. 534.0 – Acute gastrojejunal ulcer with hemorrhage
      19. 534.2 - Acute gastrojejunal ulcer with hemorrhage and perforation
      20. 534.4 – Chronic gastrojejunal ulcer with hemorrhage
      21. 534.6 - Chronic gastrojejunal ulcer with hemorrhage and perforation
   2. ICD-10 codes:
      1. K92.2 – Gastrointestinal hemorrhage, unspecified
      2. K25.0 – Acute gastric ulcer with hemorrhage
      3. K25.2 – Acute gastric ulcer with hemorrhage and perforation
      4. K25.4 – Chronic or unspecified gastric ulcer with hemorrhage
      5. K25.6 – Chronic or unspecified gastric ulcer with both hemorrhage and perforation
      6. K26.0 – Acute duodenal ulcer with hemorrhage
      7. K26.2 - Acute duodenal ulcer with hemorrhage and perforation
      8. K26.4 – Chronic duodenal ulcer with hemorrhage
      9. K26.6 – Chronic duodenal ulcer with hemorrhage and perforation
      10. K27.0 – Acute peptic ulcer, site unspecified, with hemorrhage
      11. K27.2 - Acute peptic ulcer, site unspecified, with hemorrhage and perforation
      12. K27.4 – Chronic peptic ulcer, site unspecified, with hemorrhage
      13. K27.6 – Chronic peptic ulcer, site unspecified, with hemorrhage and perforation
      14. K28.0 – Acute gastrojejunel ulcer with hemorrhage
      15. K28.2 - Acute gastrojejunel ulcer with hemorrhage and perforation
      16. K28.4 – Chronic gastrojejunel ulcer with hemorrhage
      17. K28.6 – Chronic Acute gastrojejunel ulcer with hemorrhage and perforation
      18. K29.01 – Acute gastritis with bleeding
      19. K29.31 – Chronic gastritis with bleeding
      20. K29.41 – Chronic atrophic gastritis with bleeding
      21. K29.51 – Unspecified chronic gastritis with bleeding
      22. K29.61 – Other gastritis with bleeding
      23. K29.71 – Gastritis, unspecified, with bleeding
      24. K29.81 – Duodenitis with bleeding
      25. K29.91 – Gastroduodenitis, unspecified, with bleeding
      26. K31.811 – Angiodysplasia –of stomach and duodenum with bleeding
      27. K31.82 – Dieulafoy lesion (hemorrhagic) of stomach and duodenum
   3. SNOMED CT codes
      1. 61401005 - Gastric hemorrhage

Add SNOMED CT

1. Determine if the age of the patient is greater than 65 years of age. Alert if yes.
2. Determine if other therapies are being used:
   1. Selective serotonin reuptake inhibitors or Selective norepinephrine reuptake inhibitors using RxNorm codes
      1. Citalopram: 2556
      2. Escitalopram: 321988
      3. Fluoxetine: 4493
      4. Fluvoxamine: 42355
      5. Levomilnacipran: 1433212
      6. Paroxetine: 32937
      7. Sertraline: 36437
      8. Trazodone: 10737
      9. Desvenlafaxine: 734064
      10. Duloxetine: 72625
      11. Milnacipran: 588250
      12. Venlafaxine: 39786
      13. Vilazodone: 1086769
   2. Systemic corticosteroids using RxNorm codes:
      1. Betamethasone: 1514
      2. Cortisone: 2878
      3. Dexamethasone: 3264
      4. Fludrocortisone: 4452
      5. Hydrocortisone: 5492
      6. Methylprednisolone: 6902
      7. Prednisolone: 8638
      8. Prednisone: 8640
      9. Triamcinolone: 10759
      10. ~~Trilostane:~~ 38668  
            
          Exclude topical, ophthalmic, and otic preparations. Keep oral, IM, IV formulations. Alert if on systemic corticosteriods
   3. Aldosterone antagonist using RxNorm codes:
      1. Eplerenone: 298869
      2. Spironolactone: 9997  
           
         Alert if on aldosterone antagonists