ETL Project
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U.S. Opiate Prescriptions/Overdoses

Introduction

Our group decided we wanted to do something within the medical field, so accessed a dataset on the U.S. Opiate Prescriptions/Overdoses from the Kaggle (kaggle.com) web site. This dataset, which is for 2014, is meant to be used for predictive modeling. There are 3 csv files in the collection:

1. Prescriber-info.csv - list of 25,000 rows, 1 per doctor, that provides some info, like National Practitioner Identifier, the state, gender, credentials and specialty. The also lists the number of prescriptions the doctor has written for over 250 drugs. Please see the list of columns at the end of this report and the original file has been uploaded with this report.
2. Opioids.csv - provides a list of drugs that are opioids. This list provides the generic name and the names used by the company that created the drug. Here is a screen shop of the file, plus we uploaded the original

	A	B
1	Drug Name	Generic Name
2	ABSTRAL	FENTANYL CITRATE
3	ACETAMINOPHEN-CODEINE	ACETAMINOPHEN WITH CODEINE
4	ACTIQ	FENTANYL CITRATE
5	ASCOMP WITH CODEINE	CODEINE/BUTALBITAL/ASA/CAFFEIN
6	ASPIRIN-CAFFEINE-DIHYDROCODEIN	DIHYDROCODEINE/ASPIRIN/CAFFEIN
7	AVINZA	MORPHINE SULFATE
8	BELLADONNA-OPIUM	OPIUM/BELLADONNA ALKALOIDS
9	BUPRENORPHINE HCL	BUPRENORPHINE HCL
10	BUTALB-ACETAMINOPH-CAFF-CODEIN	BUTALBIT/ACETAMIN/CAFF/CODEINE
11	BUTALB-CAFF-ACETAMINOPH-CODEIN	BUTALBIT/ACETAMIN/CAFF/CODEINE

3. Overdoses.csv - contains the number of deaths from opioids and total population for each state. Below is a screen shot of the file

	A	B	C	
1	State	Population	Deaths	Abbrev
2	Alabama	4,833,722	723	AL
3	Alaska	735,132	124	AK
4	Arizona	6,626,624	1,211	AZ
5	Arkansas	2,959,373	356	AR
6	California	38,332,521	4,521	CA
7	Colorado	5,268,367	899	CO
8	Connecticut	3,596,080	623	CT

Database Choice

Examination of the prescriber-info.csv data shows that the drug list has over 250 entries and most of the time, for a given doctor, most of the entries are 0 (which makes sense, since most doctors would not prescribe that many drugs). Our plan is to use a cloud-based database, so this many columns might cause issues with the free cloud-based options, plus, this is an inefficient way to store the data if most of the columns are usually 0. It is also the case that none of the columns are always zero, so we could not eliminate any columns. This leads to the conclusion that a MongoDB database would best fit our needs. The advantage of Mongo is that we could eliminate the columns that are zero for each doctor. As our data is relatively small (25,000 records), we do not have to worry about query speed under Mongo. Our records will also be fairly small (usually less than 50 items which will mostly be a key and an integer), so this also means query speed should not be an issue using Mongo. Another advantage is that Mongo also has a free cloud-based DB server we can use.

Cleaning

(Note that all steps are well documented in our program)

Our next step was to determine what data from each of the tables we needed to include in our database. Since we are using Mongo, we will need to have a self-contained collection without any secondary cross-reference tables, which in turn means we have to design a document that will contain all needed info.

Our initial dataset, the prescriber-info file, does not indicate if any of the drugs are opioids. This info is contained in the opioids.csv file, so our next step is to reconcile these 2 files. We started by reading both into a pandas dataframe and tried to match drug names between the two files. This was a disaster as 0 drugs matched. The first problem was that the opioids list was right justified, which means there was extra white space to the left of each name, so we eliminated this using the python lstrip method for strings. The drug name in the presciber-info file also contained periods instead of spaces or dashes for word breaks, so we changed the periods to dashes in the program.

Our opioids file also contains both a generic name and an industry name given by the company that developed said drug. Upon inspection of the list, it was clear that the industry name would be very complicated to reconcile between the two lists because of inconsistent naming conventions. Plus, we really only want to use the generic opioid names as they are way more descriptive as what is happening, so we decided to use

the generic names. It was clear that even the generic names would be difficult to match as is and would need attention.

We discussed handling this step using code, but decided to manually edit the file as there were only about 100 entries and most of the generic names were pretty straight forward, with a base name, like oxycontin, and then a secondary name appended to the end, which usually did not match what was used in the prescriber-info. However, there were enough differences in the special cases to likely lead to several need special case rules for coding, which we could easily manually handled in a more timely fashion.
By shortening the opioid list to only the 'generic' drug name meant that this was often a subset of the longer names used in the prescriber-info file, so problem solved… we could now indicate which drugs on the list were opioids. Below is a screen shot of the cleaned up opioids-clean.csv file.

	A	B
1	Drug Name	Generic Name
2	ABSTRAL	FENTANYL
3	ACETAMINOPHEN-CODEIN	CODEINE
4	ACTIQ	FENTANYL
5	ASCOMP WITH CODEINE	CAFFEIN
6	ASPIRIN-CAFFEINE-DIHYDR	CAFFEIN
7	AVINZA	MORPHINE
8	BELLADONNA-OPIUM	BELLADONNA

The third file contains data on the number of deaths from opioid overdoses (overdoses.csb) by state, and also provides the total population for each state.
The overdose file was slurped into a dataframe and compared to the prescriber-info data. This indicated several issues where several state abbreviations in the prescriber-info file that were not in the overdoses file. Inspection of these showed that they were for Puerto Rico, Washington DC and several branches of the military. We felt that the state info was somewhat of a secondary goal of the project, so instead of eliminating these records, we would set the state data to a missing value of -1, which would be easy to filter out if need be. This could have been done by editing the original overdoses file and adding the state codes with -1 values for all data, however, in this case, this was easy to do in the program. The advantage of this option is that if more state codes are found in the future, we would not have to edit the file again, just add new rules to the code.

At this time, we had reconciled our 3 files and decided what data we needed from each, however, we needed to decide how to indicate which drugs were opioids in our database. One option was to append 'opioid' to the drug name or capitalize only the

opioid drugs. We decided the best thing would be to split the drug list into 2… one for opioid drugs and one for non-opioid drugs. This means that documents will have 2 sub-dictionaries.

One other concern was that the drug list also contained a flag that indicated if each doctor prescribed opioids. This was included in our drug dictionary, but we wanted this info in the primary info part of our document, so this was moved from the drug list into the primary part so that we could easily query and get all doctors that prescribed opioids.

Inspection of our document lead to the conclusion that it would be nice to add 2 computed fields to our primary info which would track the total number of opioid prescriptions each doctor wrote and the total number of non-opioid prescriptions written by the doctor. We felt this would be extremely useful when examining how many doctors may be leading to the opioid prescription abuse.

We now have a document we felt meant our goals. Please see below for a screenshot of one of the documents in the mongodb collection.

The keys in our document

NPI, Gender, State, Credentials and **Specialty** are taken from the *prescriber-info.csv* file, as is.

The **Deaths** and **Population** come from the *overoses.csv* file.

The **NumberofOpioids** and **NumberofNonopiods** are *computed* by us and are taken from a combination of the *prescriber-info.csv* and *opioids.csv* files.

The **Drugs** list comes from the *prescriber-info.csv* file, where we eliminated all entries that were 0.

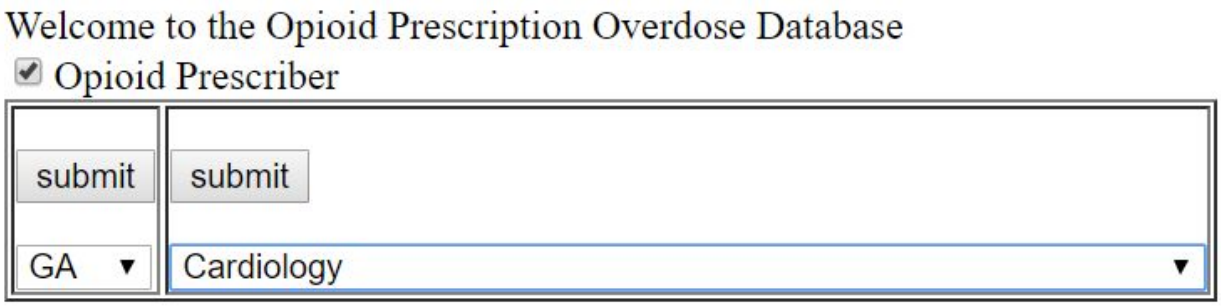
The **Opioids** dictionary is combined using the *prescriber-info.csv* file and the *opiods.csv* file.

It should be noted that in any case where we manually changed the original data files, we kept an original version and changed a copy, as should always be done.

Web Interface

We also created a web interface to our database. This will read the db and create queries based on user input and show the results. This has been done using flash with templates and pymongo.

Here is a screenshot of the front page: where we query all doctors that have prescribed opioids from Georgia with a specialty of Cardiology.



And the results look like:

NIP	Credentials	Specialty	Gender	State	Number of Opiods	Number of Non Opiods
1215923701	MD	Cardiology	M	GA	37	8925
1215923701	MD	Cardiology	M	GA	37	8925
1215923701	MD	Cardiology	M	GA	37	8925
1215923701	MD	Cardiology	M	GA	37	8925
1215923701	MD	Cardiology	M	GA	37	8925

Appendix I - List of all columns in the prescriber-info.csv file

NPI
Gender
State
Credentials
Specialty
ABILIFY
CODEINE
ACYCLOVIR

ADVAIR.DISKUS
AGGRENOX
ALENDRONATE.SODIUM
ALLOPURINOL
ALPRAZOLAM
AMIODARONE.HCL
AMITRIPTYLINE.HCL
AMLODIPINE.BESYLATE
AMLODIPINE.BESYLATE.BENAZEPRIL
AMOXICILLIN
AMOX.TR.POTASSIUM.CLAVULANATE
AMPHETAMINE.SALT.COMBO
ATENOLOL
ATORVASTATIN.CALCIUM
AVODART
AZITHROMYCIN
BACLOFEN
BD.ULTRA.FINE.PEN.NEEDLE
BENAZEPRIL.HCL
BENICAR
BENICAR.HCT
BENZTROPINE.MESYLATE
BISOPROLOL.HYDROCHLOROTHIAZIDE
BRIMONIDINE.TARTRATE
BUMETANIDE
BUPROPION.HCL.SR
BUPROPION.XL
BUSPIRONE.HCL
BYSTOLIC
CARBAMAZEPINE
CARBIDOPA.LEVODOPA
CARISOPRODOL
CARTIA.XT
CARVEDILOL
CEFUROXIME
CELEBREX
CEPHALEXIN
CHLORHEXIDINE.GLUCONATE
CHLORTHALIDONE
CILOSTAZOL
CIPROFLOXACIN.HCL
CITALOPRAM.HBR
CLINDAMYCIN.HCL
CLOBETASOL.PROPIONATE
CLONAZEPAM

CLONIDINE.HCL
CLOPIDOGREL
CLOTRIMAZOLE.BETAMETHASONE
COLCRYS
COMBIVENT.RESPIMAT
CRESTOR
CYCLOBENZAPRINE.HCL
DEXILANT
DIAZEPAM
DICLOFENAC.SODIUM
DICYCLOMINE.HCL
DIGOX
DIGOXIN
DILTIAZEM.24HR.CD
DILTIAZEM.24HR.ER
DILTIAZEM.ER
DILTIAZEM.HCL
DIOVAN
DIPHENOXYLATE.ATROPINE
DIVALPROEX.SODIUM
DIVALPROEX.SODIUM.ER
DONEPEZIL.HCL
DORZOLAMIDE.TIMOLOL
DOXAZOSIN.MESYLATE
DOXEPIN.HCL
DOXYCYCLINE.HYCLATE
DULOXETINE.HCL
ENALAPRIL.MALEATE
ESCITALOPRAM.OXALATE
ESTRADIOL
EXELON
FAMOTIDINE
FELODIPINE.ER
FENOFIBRATE
FENTANYL
FINASTERIDE
FLOVENT.HFA
FLUCONAZOLE
FLUOXETINE.HCL
FLUTICASONE.PROPIONATE
FUROSEMIDE
GABAPENTIN
GEMFIBROZIL
GLIMEPIRIDE
GLIPIZIDE

GLIPIZIDE.ER
GLIPIZIDE.XL
GLYBURIDE
HALOPERIDOL
HUMALOG
HYDRALAZINE.HCL
HYDROCHLOROTHIAZIDE
ACETAMIN
HYDROCORTISONE
HYDROMORPHONE
HYDROXYZINE.HCL
IBANDRONATE.SODIUM
IBUPROFEN
INSULIN.SYRINGE
OPIUM
IRBESARTAN
ISOSORBIDE.MONONITRATE.ER
JANTOVEN
JANUMET
JANUVIA
KETOCONAZOLE
KLOR.CON.10
KLOR.CON.M10
KLOR.CON.M20
LABETALOL.HCL
LACTULOSE
LAMOTRIGINE
LANSOPRAZOLE
LANTUS
LANTUS.SOLOSTAR
LATANOPROST
LEVEMIR
LEVEMIR.FLEXPEN
LEVETIRACETAM
LEVOFLOXACIN
LEVOTHYROXINE.SODIUM
LIDOCAINE
LISINOPRIL
LISINOPRIL.HYDROCHLOROTHIAZIDE
LITHIUM.CARBONATE
LORAZEPAM
LOSARTAN.HYDROCHLOROTHIAZIDE
LOSARTAN.POTASSIUM
LOVASTATIN
LOVAZA

LUMIGAN
LYRICA
MECLIZINE.HCL
MELOXICAM
METFORMIN.HCL
METFORMIN.HCL.ER
METHADONE
METHOCARBAMOL
METHOTREXATE
METHYLPREDNISOLONE
METOCLOPRAMIDE.HCL
METOLAZONE
METOPROLOL.SUCCINATE
METOPROLOL.TARTRATE
METRONIDAZOLE
MIRTAZAPINE
MONTELUKAST.SODIUM
MORPHINE
MORPHINE
MUPIROCIN
NABUMETONE
NAMENDA
NAMENDA.XR
NAPROXEN
NASONEX
NEXIUM
NIACIN.ER
NIFEDICAL.XL
NIFEDIPINE.ER
NITROFURANTOIN.MONO.MACRO
NITROSTAT
NORTRIPTYLINE.HCL
NOVOLOG
NOVOLOG.FLEXPEN
NYSTATIN
OLANZAPINE
OMEPRAZOLE
ONDANSETRON.HCL
ONDANSETRON.ODT
ONGLYZA
OXCARBAZEPINE
OXYBUTYNIN.CHLORIDE
OXYBUTYNIN.CHLORIDE.ER
ACETAMIN
OXYCODONE

OXYCONTIN
PANTOPRAZOLE.SODIUM
PAROXETINE.HCL
PHENOBARBITAL
PHENYTOIN.SODIUM.EXTENDED
PIOGLITAZONE.HCL
POLYETHYLENE.GLYCOL.3350
POTASSIUM.CHLORIDE
PRADAXA
PRAMIPEXOLE.DIHYDROCHLORIDE
PRAVASTATIN.SODIUM
PREDNISONE
PREMARIN
PRIMIDONE
PROAIR.HFA
PROMETHAZINE.HCL
PROPRANOLOL.HCL
PROPRANOLOL.HCL.ER
QUETIAPINE.FUMARATE
QUINAPRIL.HCL
RALOXIFENE.HCL
RAMIPRIL
RANEXA
RANITIDINE.HCL
RESTASIS
RISPERIDONE
ROPINIROLE.HCL
SEROQUEL.XR
SERTRALINE.HCL
SIMVASTATIN
SOTALOL
SPIRIVA
SPIRONOLACTONE
SUCRALFATE
SULFAMETHOXAZOLE.TRIMETHOPRIM
SUMATRIPTAN.SUCCINATE
SYMBICORT
SYNTHROID
TAMSULOSIN.HCL
TEMAZEPAM
TERAZOSIN.HCL
TIMOLOL.MALEATE
TIZANIDINE.HCL
TOLTERODINE.TARTRATE.ER
TOPIRAMATE

TOPROL.XL
TORSEMIDE
TRAMADOL.HCL
TRAVATAN.Z
TRAZODONE.HCL
TRIAMCINOLONE.ACETONIDE
TRIAMTERENE.HYDROCHLOROTHIAZID
VALACYCLOVIR
VALSARTAN
VALSARTAN.HYDROCHLOROTHIAZIDE
VENLAFAXINE.HCL
VENLAFAXINE.HCL.ER
VENTOLIN.HFA
VERAPAMIL.ER
VESICARE
VOLTAREN
VYTORIN
WARFARIN.SODIUM
XARELTO
ZETIA
ZIPRASIDONE.HCL
ZOLPIDEM.TARTRATE
Opioid.Prescriber