Research IT Information & Exchange Series

Collaborative Opportunities and Tools in Informatics Research

April 28, 2017

Research IT Information & Exchange Series

- **Goal:** To educate pediatric researchers on the Research IT and Informatics resources and expertise available to facilitate their research and to identify areas where we can enhance IT methods to better support research.
- **Format:** One hour sessions led by subject matter experts to present information on the current services and expertise available.
- **Intended audience:** Researchers with an interest in capitalizing on Research IT tools to make their research better. Also, researchers who are interested in using Big Data and Healthcare Analytic approaches in their research.

Research IT Information & Exchange Series:

Learn about suitable collaborators and specific areas of expertise in Atlanta based institutions. We will also highlight and discuss best practices in these types of collaborations.

Research IT Information & Exchange Series

Our presenters today

- **Gari D. Clifford, PhD,** Interim Chair, Associate Professor, Biomedical Informatics, Emory University, Associate Professor, Biomedical Engineering, Georgia Institute of Technology
  - gari.clifford@bme.gatech.edu

- **Jon Duke, MD,** Director of Health Data Analytics, Georgia Tech Research Institute
  - Jon.Duke@gatech.edu

- Dr. Gari Clifford and his team presented work that is to be published and therefore cannot be shared until it is published.
- The video from today's session does NOT include this part of the presentation, but starts with the presentation by Dr. Jon Duke.
- Dr. Jon Duke's slides follow

Georgia Tech Research Institute
Problem. Solved.

CHAI
It's not too latte.

Applying Big Data to Big Ideas: Collaborating with Georgia Tech in Health Analytics

April 28th, 2017

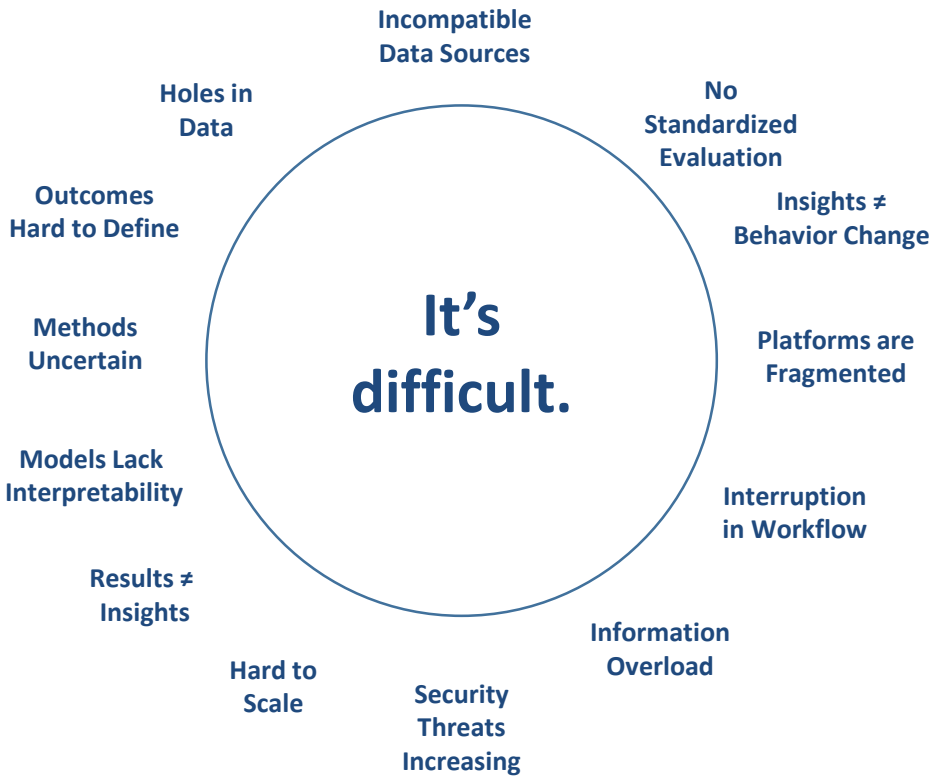
Jon Duke, MD, MS

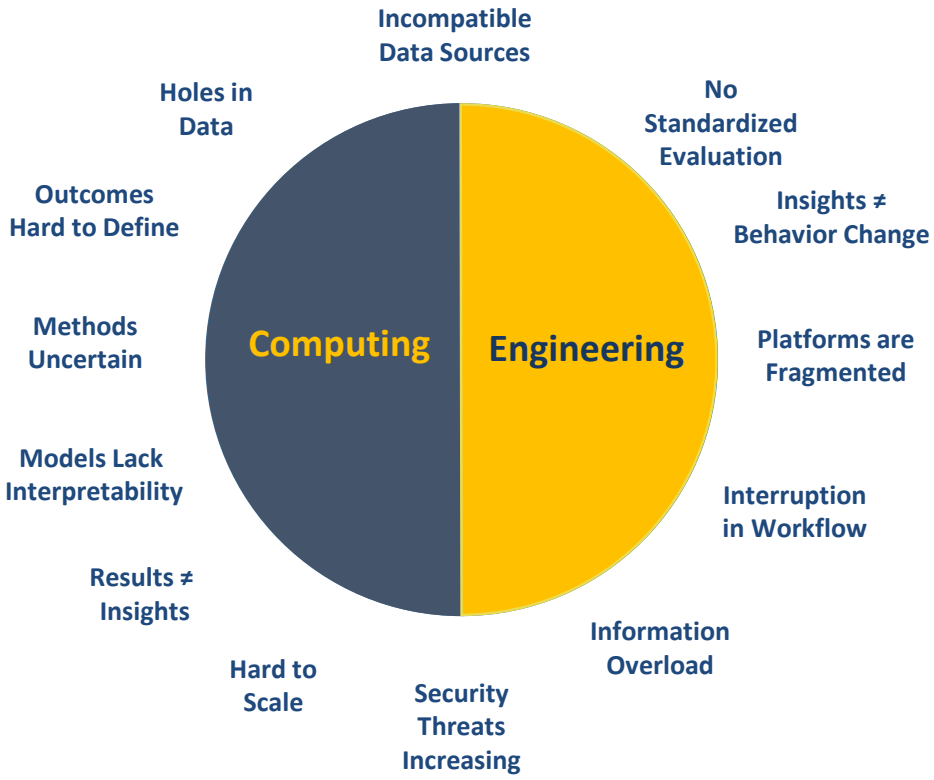
(Big) Data

Analysis

Decision Support

Targeted Action


Incompatible Data Sources
No Standardized Evaluation
Insights ≠ Behavior Change
Platforms are Fragmented
Interruption in Workflow
Information Overload
Security Threats Increasing
Hard to Scale
Results ≠ Insights
Models Lack Interpretability
Methods Uncertain
Outcomes Hard to Define
Holes in Data
It's difficult.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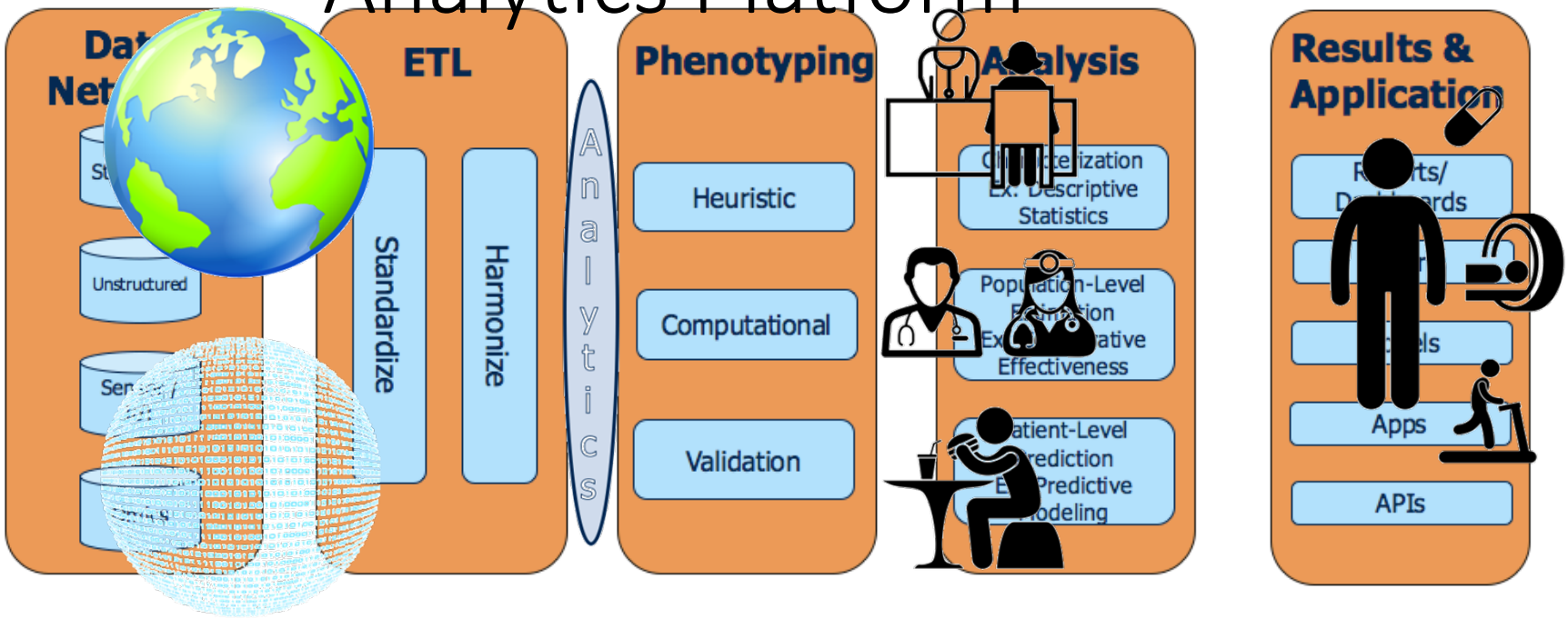
GT Health Data Analytics Platform

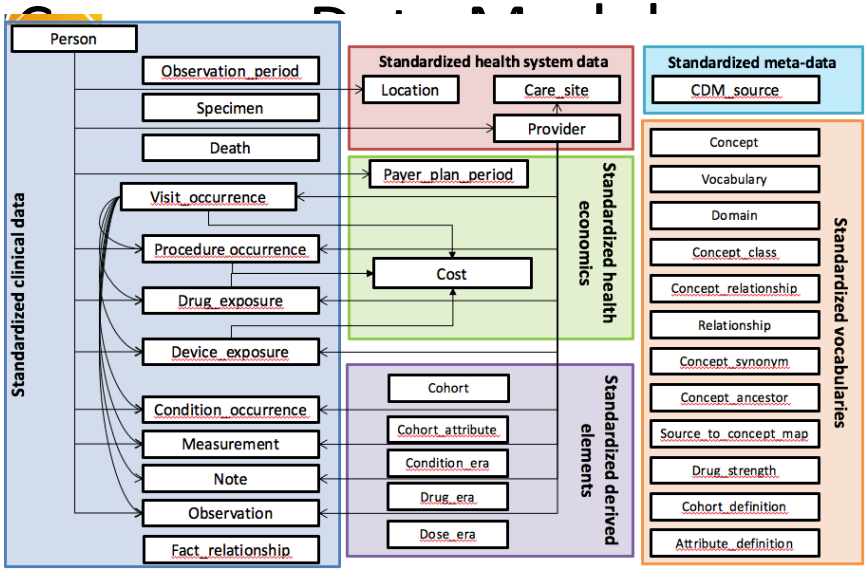


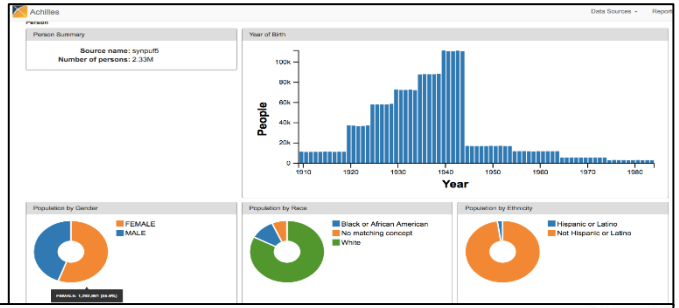
Example: C. Difficile

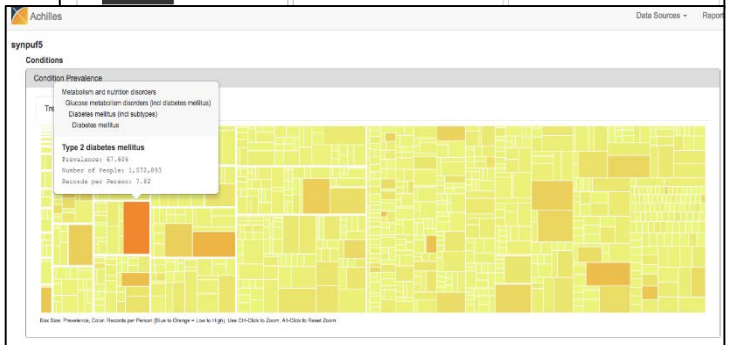
- *Clostridium Difficile* colitis is a hospital-borne infection associated with antibiotic use
- C. Diff costs the US Healthcare System $4.8 billion annually and is a major target for infection control efforts nationally and internationally
- Predicting risk of C Diff infection can optimize prescribing and early detection

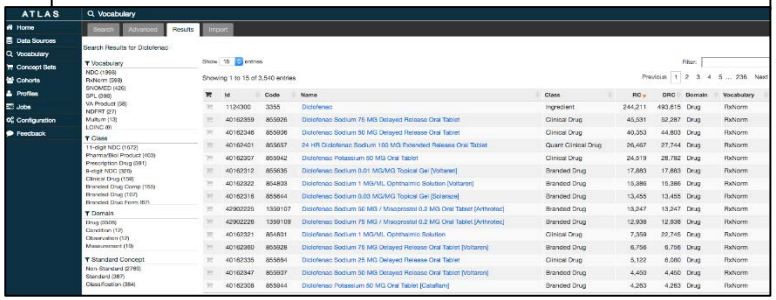
Step One: Harmonize Data

- Structured data is harmonized to the OMOP









OHDSI Collaborators:

- >200 researchers in academia, industry, government, health systems
- >20 countries
- Multi-disciplinary expertise: epidemiology, statistics, medical informatics, computer science, machine learning, clinical sciences

Databases converted to OMOP CDM within OHDSI Community:

- >55 databases
- >660 million patients

Step One: Harmonize Data

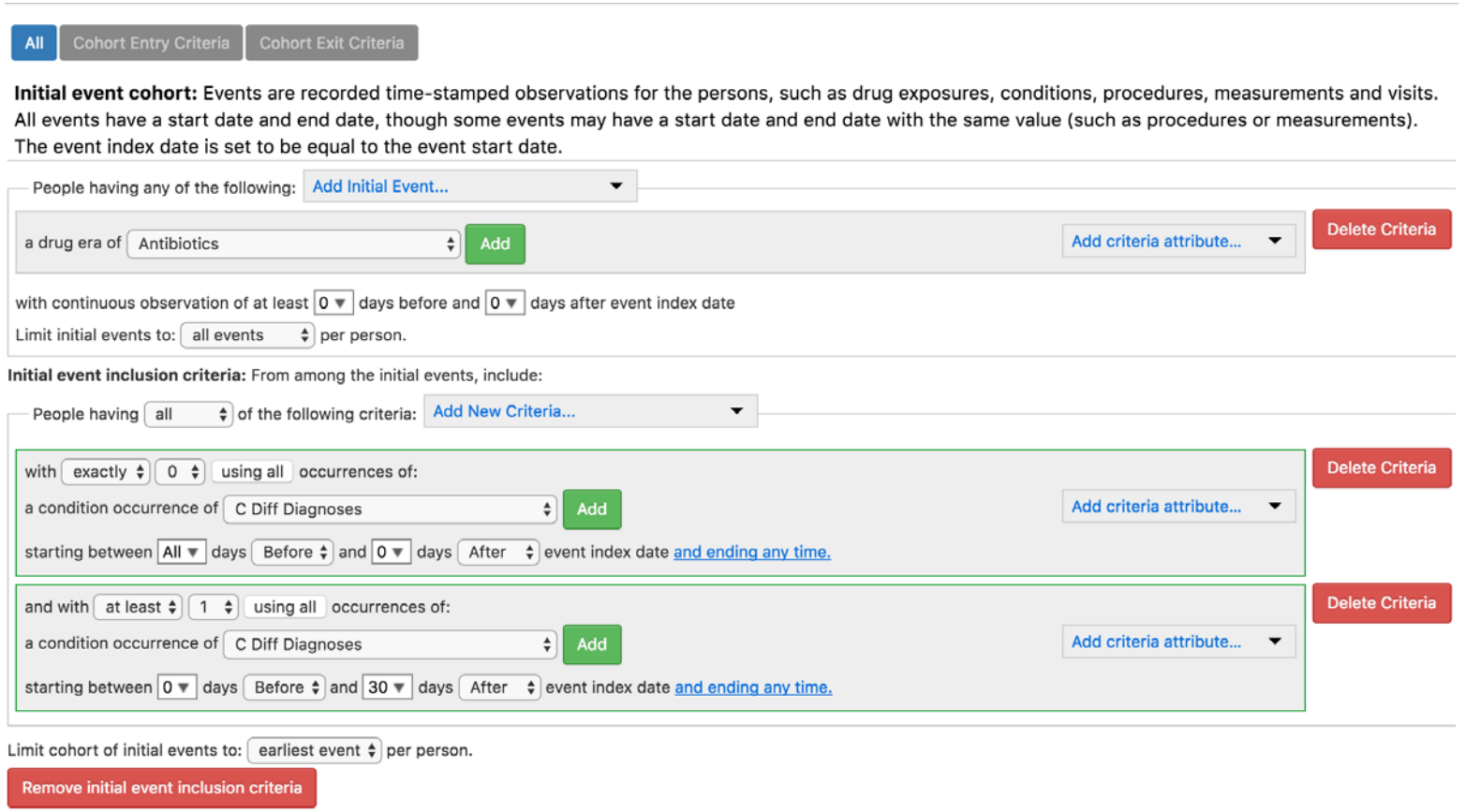
- Unstructured data is analyzed via NLP tools including cTakes and GT-developed open-source applications

She subsequently came to the medical floor, and then developed
diffuse abdominal pain, diarrhea, and cramping, with nausea. She was given bowel rest, anti-emetics, and treated emperically
for c. difficile colitis. One stool sample was obtained, and was negative for c. difficile, but given the clinical picture, the decision was made to plan an empiric 14 day
course of oral metronidazole to treat this. .
Afib - rate controlled with home meds. Should not resume
warfarin until at least 10 days after procedure ([**3371-6-24**]) given the bleeding that she experienced. Despite being off of warfarin, her INR remained elevated, however; t
his is likely due diminished po intake during the course of this illness.
Code: DNR/DNI

Medications on Admission:
Diltiazem 60
Mirtazapine 7.5 QHS:PRN
Zolpidem 5 QHS:PRN
Acetaminophen 500-1000mg PO PRN
HCTZ 37.5
Alphagan one drop daily per eye
Procrit 20,000 SQ QWed
[**Doctor First Name 943**] 60 PO daily
Zoloft 100mg PO Daily
Colace 100 PO BID
Fleet Enema 1 sup PR PRN

Discharge Medications:
1. Bisacodyl 5 mg Tablet, Delayed Release (E.C.) Sig: Two (2)
Tablet, Delayed Release (E.C.) PO DAILY (Daily) as needed.
2. Senna 8.6 mg Tablet Sig: One (1) Tablet PO BID (2 times a
day) as needed. 3. Diltiazem HCl 60 mg Tablet Sig: One (1) Tablet
times a day). 4. Mirtazapine 15 mg Tablet Sig: 0.5 Tablet PO QHS
needed for insomnia. 5. Zolpidem 5 mg Tablet Sig: One (1) Tablet

Step Two: Create Phenotypes



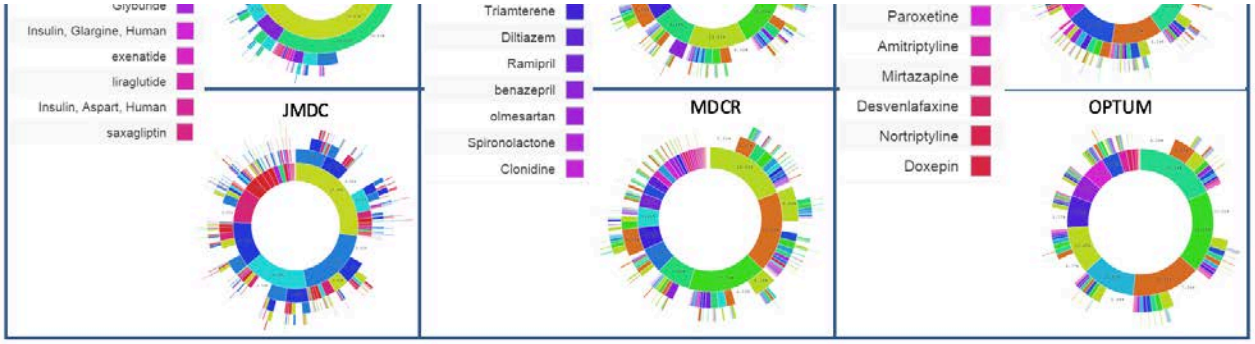
Step Three: Run Analyses

- Description

Search: difficil | Show / hide columns

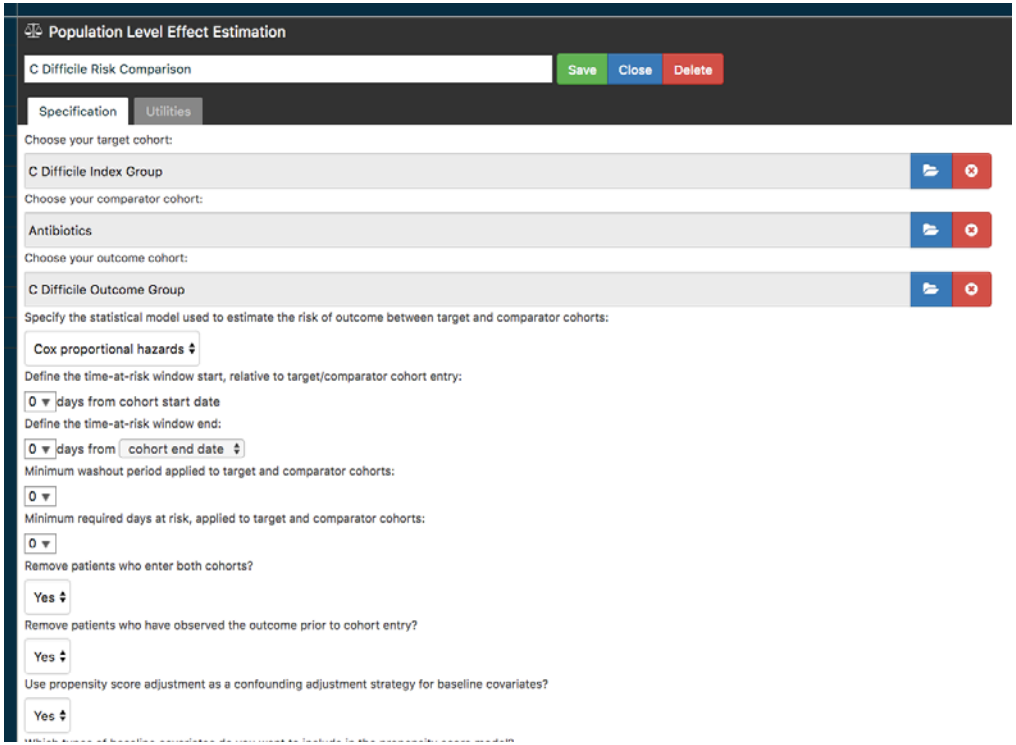
SNOMED	Person Count	Prevalence	Records per Person
Clostridium difficile infection	71,848	3.09%	1.41

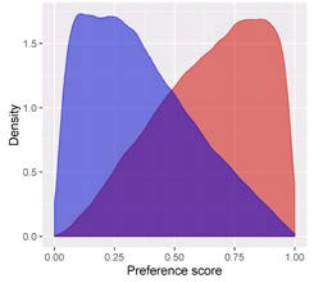
s) Previous 1 Next

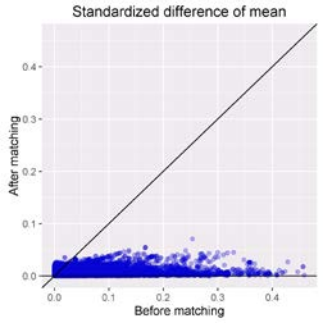


Step Three: Run Analyses

- Comparison







Step Three: Run Analyses

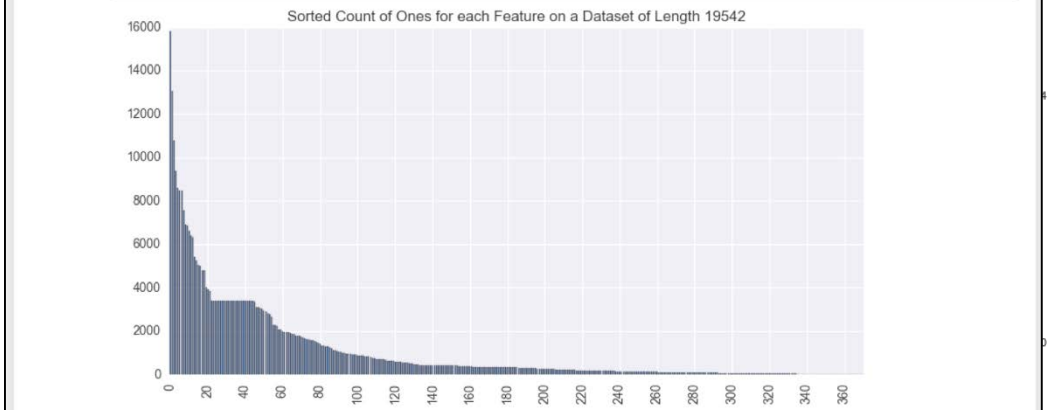
- Prediction

jupyter PythonClassesWorkflowCDiff Last Checkpoint: 02/09/2017 (autosaved)

File Edit View Insert Cell Kernel Widgets Help | Python [conda env:health]

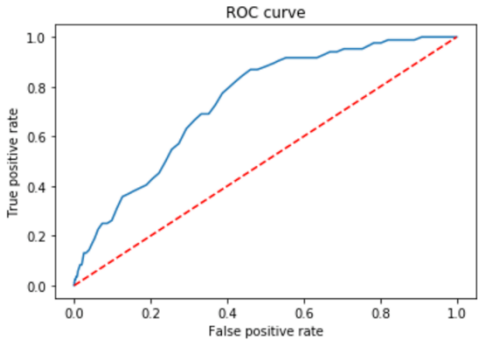
Code CellToolbar

In [23]:
```
fig, ax = plt.subplots(1, 1, figsize=(10, 5))
ones.n_ones.plot(kind='bar', ax=ax)
ax.set_xticks(range(0, len(ones), 20))
ax.set_xticklabels(range(0, len(ones), 20))
ax.set_title('Sorted Count of Ones for each Feature on a Dataset of Length {}'.format(len(model.X_train)))
ax.legend().set_visible(False)
```



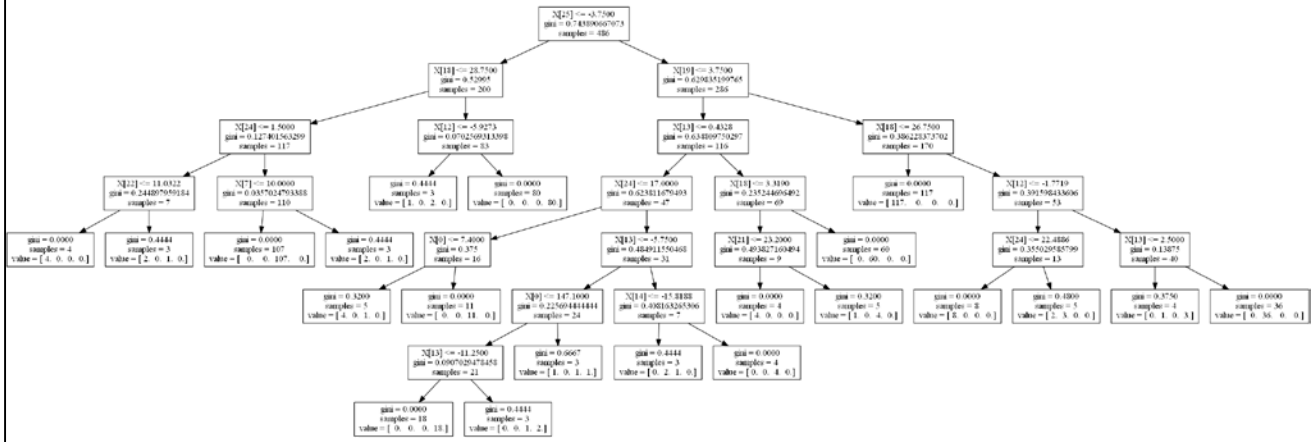
Look at the correlation matrix for these features

```
Accuracy
0.797697620875
Confusion matrix
[[5162 1269]
 [  49   35]]
Normalized confusion matrix
[[ 0.80267455  0.19732545]
 [ 0.58333333  0.41666667]]
Precision
0.0268404907975
F1 score
0.0504322766571
AUC
0.740352718603
```

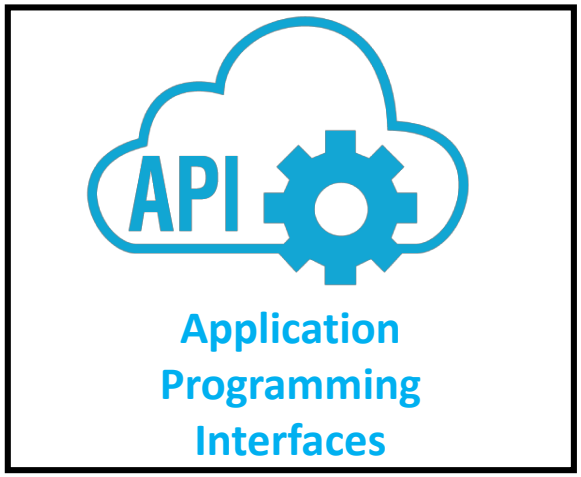


Long Way from Predictive Models to Decision Support

Classification Tree	P(Target)	# Inst
<root>	0.090	2071
MAX_POT <=5.050	0.050	1655
MAX_CALCIUM <=10.150	0.048	1467
PRE_HYPERK = 0	0.038	1416
AGE <=65.500	0.032	753
AGE >65.500	0.045	663
PRE_HYPERK = 1	0.333	51
DM = 0	0.500	24
DM = 1	0.185	27
MAX_CALCIUM >10.150	0.059	188
HTN = 0	0.167	6
HTN = 1	0.055	182
Max_CR <=3.700	0.050	179
Max_CR >3.700	0.333	3
MAX_POT >5.050	0.250	416
PRE_HYPERK = 0	0.138	327
AGE <=55.500	0.098	51
AGE >55.500	0.145	276
AGE <=65.500	0.148	88
AGE >65.500	0.144	188
PRE_HYPERK = 1	0.663	89
MAX_POT <=6.250	0.519	52
DM = 0	0.933	15
DM = 1	0.351	37
MAX_POT >6.250	0.865	37
CHF = 0	0.778	9
CHF = 1	0.893	28

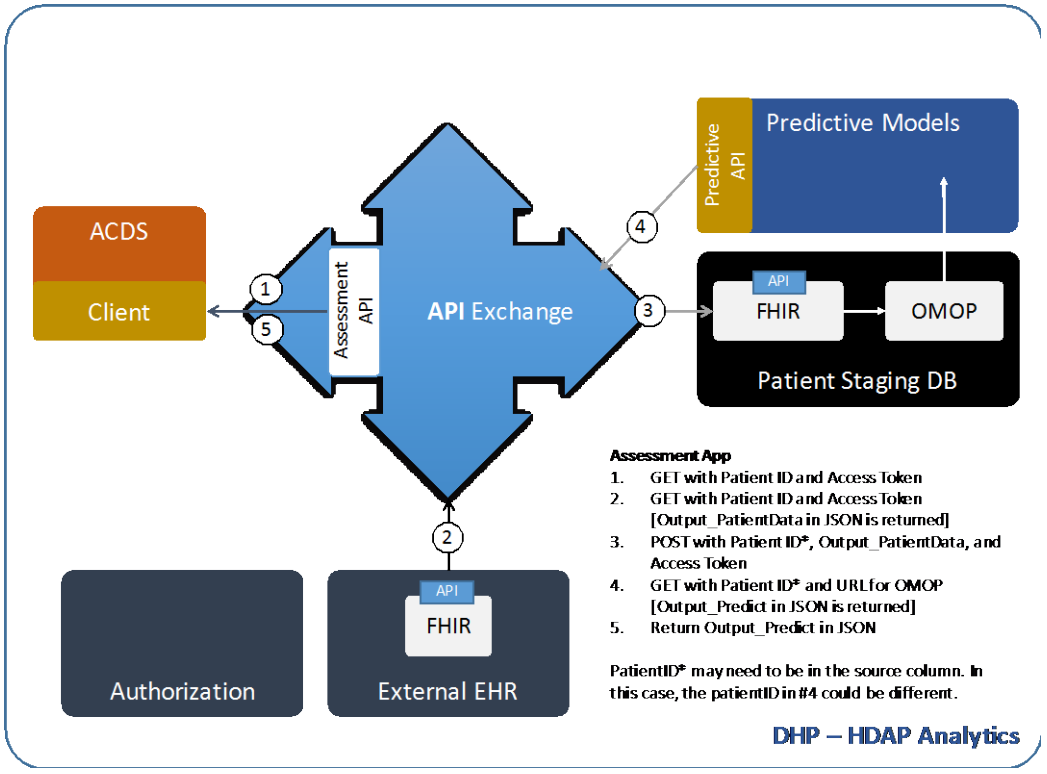


Step Four: Connect to the World with APIs

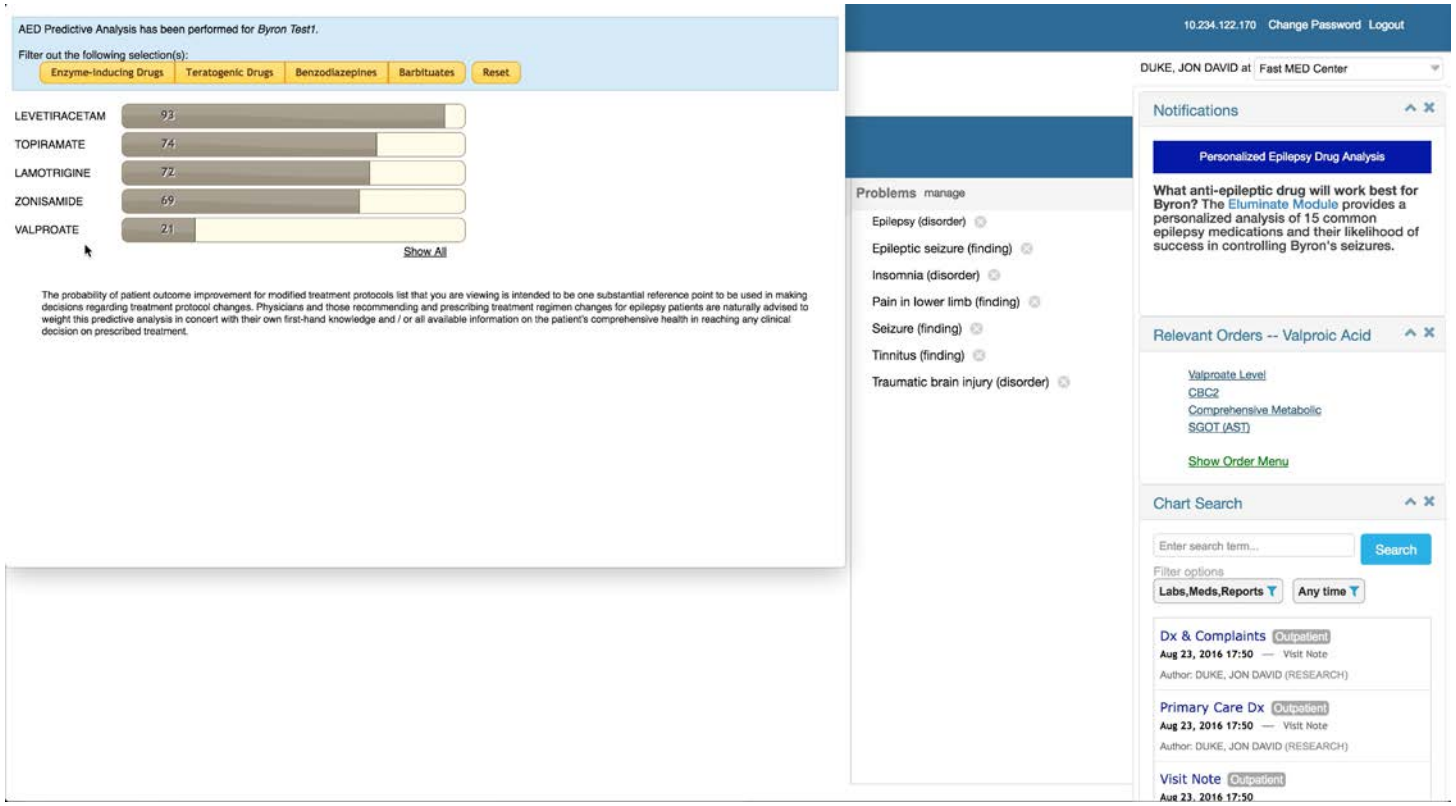


Fast Healthcare Interoperabilty Resources

Step Four: Connect to the World with APIs



Step Five: Build Applications



Demonstration

Billy Bob Thornton

Search a term...

- ZOCOR
- AMIODARONE
- CEFUROXIME
- LEVAQUIN
- CEFPODOXIME
- LOSARTAN
- LASIX
- TOPAMAX
- LISINOPRIL

Amiodarone

Interactions

- Methotrimeprazine
- Simvastatin
- Vandetanib
- cilostazol

Warnings

Amiodarone is intended for use only in patients with the indicated life-threatening arrhythmias because its use is accompanied by substantial toxicity. Amiodarone has several potentially fatal toxicities, the most important of which is pulmonary toxicity (hypersensitivity pneumonitis or interstitial/alveolar

Dosage

BECAUSE OF THE UNIQUE PHARMACOKINETIC PROPERTIES, DIFFICULT DOSING SCHEDULE, AND SEVERITY OF THE SIDE EFFECTS IF PATIENTS ARE IMPROPERLY MONITORED, AMIODARONE SHOULD BE ADMINISTERED ONLY BY PHYSICIANS WHO ARE EXPERIENCED IN THE TREATMENT OF

Journals

- Interactions of digitalis and class-III antiarrhythmic drugs: Amiodarone versus dronedarone. *International journal of cardiology, 2017 Feb 1*
- Acute hospital administration of amiodarone and/or lidocaine in shockable patients presenting with out-of-hospital cardiac arrest: A nationwide cohort study. *International journal of cardiology, 2017 Jan 1*
- High-resolution sub-cellular imaging by correlative NanoSIMS and electron

News

- With A-Fib Rhythms, Higher Odds of Stroke *2013-12-30*
- Muscle Aches From Statins? Drug Interactions May Play a Role *2013-12-04*
- Heart Warning Added to Label on Popular Antipsychotic Drug *2011-07-19*
- Fix a Health Problem or Live With It? *2009-03-17*
- Sanofi Drug Found Promising for Heart Ailment *2009-02-12*

Huge Thanks To…

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Questions