Welcome!
The presentation will begin shortly

@GLSummits
#AnalyticsSummit2020
The Team
Andrea Smith  
Director of Clinical Practice Improvement  
Detroit Wayne Integrated Health Network

Robert B. Dunlap  
Chief  
Wayne County Sheriff's Office

Gregory Parrish  
Analytics Manager  
WIT Inc.
Jail Diversion

Andrea Smith, Director of Clinical Practice Improvement
Background

The Detroit Wayne Integrated Health Network (DWIHN) is a safety net organization that provides a full array of services and supports to roughly 80,000 adults with mental illness, individuals with developmental disabilities, children with serious emotional disturbances and persons with substance use disorders.
Goals

Reduce and/or eliminate jail time for individuals with mental illness (SMI) or substance use disorder (SUD).

Provide a safety net of community-based services that can provide treatment and support through care coordination.

1) Showing genuine concern for those impacted by mental illness and substance abuse
2) A desire to develop talent otherwise lost to the jail system
3) A desire to encourage diversity within the community and workforce
4) Dedication to the elimination of stigmatization and criminalization of mental illness, substance use, and socioeconomically oppressed communities.
Purpose

Mental health and substance abuse consumers make up a vast majority of the criminal justice system across the nation, including Wayne County, Michigan.

THE FACTS

93% Male
76% People of Color (PoC)
51% Age 31+
42% Without secure housing

Of the 30,000 individuals incarcerated in Wayne County Jail, approx. 1,800 were booked on misdemeanor charges. 83% of that 1,800 population were current or previous DWIHN consumers.

It costs Wayne County millions of dollars annually to jail individuals with SMI or SUD.

$8.5 M spent in 2017
$6 M coming from DWIHN
Plan

DWIHN & Wayne County Jail continue working together to implement a seamless pre/post-jail system for individuals with SMI and/or SUD.

Update screening and Assessment systems

Improve in-jail services

Connect community integrated health services with the criminal justice system symbiotically

Step 1 – What data are available, and how do we utilize these data to identify goals and anticipated outcomes.
Plan

Block Grant awarded by the State of Michigan - this project used data from the Wayne County Jail (WCJ) system and the Detroit Wayne Integrated Health Network (DWIHN) to build and refine an algorithm to identify individuals with serious mental illness (SMI) at risk for committing criminal offenses.
Robert B. Dunlap
Chief
Wayne County Sheriff's Office
WAYNE COUNTY JAIL SYSTEM
Wayne County Jail Population 2017

As of: October 2017

Division I: 513
- Males: 324, 63%
- Females: 189, 37%

Division II: 606
- Males: 606

Division III: 671
- Males: 671

EMU Population: 705

Total Jail Population: 1790
JAIL POPULATION HEALTH

Medical & Mentally Ill – All Divisions

As of: October 2017

Competency Evaluations

- OIST: 7
- IST: 10
- PIST: 0
- MGRI: 1

As of: October 2017
<table>
<thead>
<tr>
<th>Year</th>
<th>Felony</th>
<th>Misd.</th>
<th>Ord.</th>
<th>Felony</th>
<th>Misd.</th>
<th>Ord.</th>
<th>Cost of Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>10,513</td>
<td>7,787</td>
<td>7,520</td>
<td>30</td>
<td>15</td>
<td>14</td>
<td>$50,462,400</td>
</tr>
<tr>
<td>2016</td>
<td>9,458</td>
<td>8,013</td>
<td>6,654</td>
<td>34</td>
<td>15</td>
<td>14</td>
<td>$51,451,520</td>
</tr>
<tr>
<td>2017</td>
<td>7,001</td>
<td>5,976</td>
<td>5,998</td>
<td>34</td>
<td>12</td>
<td>16</td>
<td>$38,085,440</td>
</tr>
</tbody>
</table>

If an inmate has multiple arrests, he/she are counted once under the most severe. 
$Misdemeanor  €Ordinance  ¥Costs are calculated by the daily rate x average length of stay x total number of inmates.
Total 2017 Ordinance Violator & Misdemeanor Bookings = 13107
Total 2017 Ordinance Violator Bookings = 5275
- 2017 Ordinance Violator Mental Health Consumer Bookings = 834
- 2017 Ordinance Violator Non-Mental Health Consumer Bookings = 4441

Total 2017 Misdemeanor Violator Bookings = 7832
- 2017 Misdemeanor Mental Health Consumer Bookings = 953
- 2017 Misdemeanor Non-Mental Health Consumer Bookings = 6879

Total 2017 Ordinance Violator & Misdemeanor Mental Health Consumers Bookings = 1787
Total 2017 Ordinance Violator & Misdemeanor Non-Mental Health Consumers Bookings = 11320
Case Study: “Charlie Brown”
WAYNE COUNTY JAIL POPULATION 2020

As of: February 2020

Division I
Males: 358, 63%
Females: 147, 37%
Total: 505

Division II
Males: 437

Division III
Males: 439

EMU Population

Total Jail Population

1,381

665
Potential Savings

\[409 \text{ persons} \times \$160/\text{day} \times 365 \text{ days} = \$23,885,600\]
Harness the Power of Analytics

www.witinc.com
info@witinc.com
PROJECT RESOURCES

Gregory Parrish
Analytics Manager

Quaid Saifee
Huzefa Barwaniwala
Javier Ortiz
Vince McCoy
Ali Kanchwala
Pauljin Kochuplooth
DWIHN Projects

Training Website

WCSO JAIL Dashboard 2017

State of Michigan Grant 2019-2020
DWIHN and WCSO JAIL Datasets

- DWIHN demographics data is from January 2010 to October 2019 and has ~225K people.
- Wayne County Sheriff’s Office Jail booking data is from January 2013 to December 2019 and has ~100K people. Data also contains Jail history records of this group back to 2000.
DWIHN and WCSO JAIL Overlap

- Datasets with different IDs, different timeframes
- Data entered Names are difficult
- Joined datasets by Fuzzy Match (First Name, Last Name, Date of Birth), Misc exclusions
- Overlap of ~34K people having records in both systems

Jan 2010 - Oct 2019

Jan 2013 - Dec 2019

~225K

~34K

~100K

~34K
DWIHN and WCSO JAIL – True & False Targets

- Target only Misdemeanors ~4.5K, Exclude Felonies
- Reduce to only first occurrence as Misdemeanor and DWIHN record happened prior
- Reduce to only ICD 10 codes, post Oct 1, 2015
- ICD 10 frequency profile, too many codes, reduce to Top 15 codes
- Test dataset 1,955 (True 453 records, False 1502 records)
WIT has developed technology partnerships with top business intelligence software vendors. Let us help you harness the full power of your enterprise or business intelligence platform, and help you maximize the return on your overall analytics investments.
WIT has developed technology partnerships with top business intelligence software vendors. Let us help you harness the full power of your enterprise or business intelligence platform, and help you maximize the return on your overall analytics investments.
LEVERAGE ALL YOUR DATA

Qlik’s Associative Engine

✓ Use all your data
✓ Explore without boundaries
✓ Speed of thought
✓ Unexpected insights
AUTOMATED MACHINE LEARNING

Business Understanding
- Business Problem Definition
- Data Understanding
- Data Preparation
- Feature Engineering

Modeling
- Model Building
- Model Deployment
- Feature Engineering

Operationalization
- Prediction
- Monitoring
- Application / Business Process

DataRobot
- Start a project by dragging a dataset here
- Simply import from .csv

Summary
- What to predict?
  - risk
- Metrics to Optimize:
  - Recommended: LogLoss (Accuracy)

Graph
- Display of predicted vs actual values
Feature Engineering using Alteryx
WIT used DataRobot to train the features for machine learning models which finds which columns (features) are most predictive. DataRobot trains 100s of machine learning models and ranks them according to the models predictive value, the most accurate models being on the top of the list, and the best model ‘Recommended for Deployment’ is on top of the list, “RandomForest Classifier”. This model has the best validation and cross-validation score, and is the optimal model even though the “ENET Blender” has a slightly higher accuracy.
As shown above, CMH_SUD, R69 (Illness, unspecified), Avg_Claims_per_Service_Date, Age_DWIHN_enter are some of the top predictors which determine if an individual from DWIHN will go on to have a misdemeanor occurrence in the WCJ or not.
Many of the variables have positive impacts and association with graphs with increasing effects on the Target (Booked in Jail). The ICD 10 code for R69 is defined as illness, unspecified. This may be a catchall ICD code but it has a very strong correlation in our model.
Some variables have impact but it is in a negative direction with inverse effect on our Target prediction. The ICD 10 code for F29 is defined as unspecified psychosis not due to a substance or known physiological condition.
### Top Features and Direction of Feature Prediction

<table>
<thead>
<tr>
<th>Feature</th>
<th>Prediction Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMH_SUD</td>
<td>Highest positive for CMH-SUD, positive SUD, negative for CMH</td>
<td>CMH claims only, SUD claims only, CMH-SUD mix of claims</td>
</tr>
<tr>
<td>R69</td>
<td>Positive</td>
<td>ICD10 Code: Illness, unspecified</td>
</tr>
<tr>
<td>Avg_Claims_per_Service_Date</td>
<td>Mixed</td>
<td>Average Number of claims for the same service date.</td>
</tr>
<tr>
<td>Age_DWMHA_enter</td>
<td>Positive at younger ages, Negative at older ages</td>
<td>Consumer's age for first DWMHA claim</td>
</tr>
<tr>
<td>ICDCodeMostFrequent</td>
<td>Mixed</td>
<td>Top ICD Code for that consumer</td>
</tr>
<tr>
<td>F1020</td>
<td>Positive</td>
<td>ICD10 Code: Alcohol dependence, uncomplicated</td>
</tr>
<tr>
<td>F1010</td>
<td>Positive</td>
<td>ICD10 Code: Alcohol abuse, uncomplicated</td>
</tr>
<tr>
<td>F1420</td>
<td>Positive</td>
<td>ICD10 Code: Cocaine dependence, uncomplicated</td>
</tr>
<tr>
<td>F1120</td>
<td>Positive</td>
<td>ICD10 Code: Opioid dependence, uncomplicated</td>
</tr>
<tr>
<td>F1220</td>
<td>Positive</td>
<td>ICD10 Code: Cannabis dependence, uncomplicated</td>
</tr>
<tr>
<td>F1210</td>
<td>Positive</td>
<td>ICD10 Code: Cannabis abuse, uncomplicated</td>
</tr>
<tr>
<td>F332</td>
<td>Mixed</td>
<td>ICD10 Code: Major depressive disorder, recurrent severe without psychotic features</td>
</tr>
<tr>
<td>F411</td>
<td>Mixed</td>
<td>ICD10 Code: Generalized anxiety disorder</td>
</tr>
<tr>
<td>F339</td>
<td>Positive</td>
<td>ICD10 Code: Major depressive disorder, recurrent, unspecified</td>
</tr>
<tr>
<td>F329</td>
<td>Positive</td>
<td>ICD10 Code: Major depressive disorder, single episode, unspecified</td>
</tr>
<tr>
<td>Z0389</td>
<td>Positive</td>
<td>ICD10 Code: Encounter for observation for other suspected diseases and conditions ruled out</td>
</tr>
<tr>
<td>F331</td>
<td>Negative</td>
<td>ICD10 Code: Major depressive disorder, recurrent, moderate</td>
</tr>
<tr>
<td>F29</td>
<td>Negative</td>
<td>ICD10 Code: Unspecified psychosis not due to a substance or known physiological condition</td>
</tr>
<tr>
<td>F333</td>
<td>Negative</td>
<td>ICD10 Code: Major depressive disorder, recurrent, severe with psychotic symptoms</td>
</tr>
</tbody>
</table>

**CMH ICD10 Code**

**SUD ICD10 Code**
Andrea Smith  
Director of Clinical Practice Improvement  
Detroit Wayne Integrated Health Network

Robert B. Dunlap  
Chief  
Wayne County Sheriff's Office

Gregory Parrish  
Analytics Manager  
GParrish@witinc.com  
248-641-5900 ext. 237
Thank you for attending!

@GLSummits
#AnalyticsSummit2020