

## Track, control, and improve drug sales with Analance

Opioid use disorders are more common in younger patients, but prevalence among the elderly is growing, and misuse poses unique risks in the geriatric population. From 1996 through 2010, the number of opioid prescriptions provided to older patients increased ninefold. More alarmingly, 35% of patients aged older than 50 years with chronic pain reported misuse of their opioid prescriptions in the past days.

# OPIOID ADDICTION AMONG SENIOR CITIZENS

USE CASE



## DANGEROUS SIDE OF OPIOID DRUGS

Drug or alcohol abuse among the elderly is particularly dangerous because senior citizens are more susceptible to the deteriorating effects of these substances.

Individuals over 65 have a decreased ability to metabolize drugs or alcohol along with an increased brain sensitivity to them. This makes it dangerous for seniors to use drugs or alcohol at all, even if the person isn't addicted.

Benzodiazepines, which are used to treat anxiety, pain or insomnia, are some of the most dangerous prescription drugs for seniors. These are generously prescribed and highly addictive. The rate of senior citizens addicted to benzos has increased every year.

Most clinicians can distinguish which of the following fictional cases is an inappropriate use of opioids: a 78-year-old in hospice care for terminal lung cancer; a 65-year-old who underwent major surgery that morning; or a 68-year-old with a history of depression, anxiety, and chronic pain, and a urine drug screen positive for cocaine, opioids, and benzodiazepines (prescribed). Contrast that with more complex, typical clinical scenarios in which the distinction can be a real challenge.

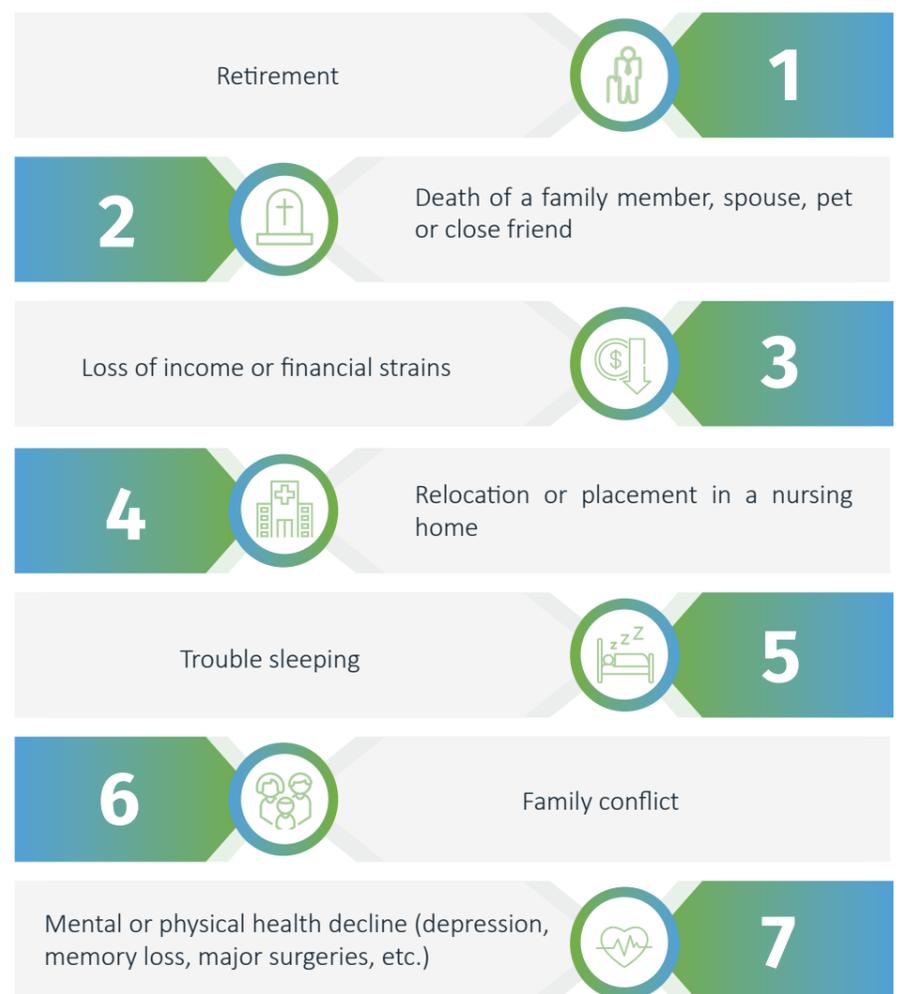


## BUSINESS CHALLENGE

The OPIOID prescribers can be predicted in advance by analyzing the characteristics or by comparing the similarities of new patients with the history of patients who have the same features. The features NPI, Gender, State, Credentials, and Specialty contribute the most in predicting whether the patient has an OPIOID prescription or not.

## CAUSES OF ADDICTION

Potential triggers for drug or alcohol addiction in the elderly are:



## ABOUT DUCEN

Ducen IT helps Business and IT users of Fortune 1000 companies with advanced analytics, business intelligence and data management through its unique end-to-end data science platform called Analance. Analance is an enterprise-class, state of the art integrated platform that delivers power and ease of use to business users and data scientists with a seamless experience and platform scalability to support business growth and strategy.



## PREDICTIVE MODELING STAGES

- Acquiring data from the data warehouse
- Exploratory data and analysis to check for interrelationships between variables and outcomes
- Variable selection and feature engineering
- Exploratory data and analysis to check for interrelationships between variables and outcomes
- Modeling
- Model validation and accuracy checking
- Deployment
- Comparison of models



## SOLUTIONING PROCESS AT A GLANCE

The process of statistical consulting and solutions starts with a thorough understanding of the business challenge, its impact, and the data available for analysis. With this information, we arrive at a solution to mitigate or control the challenge, offer continued client support, and adjust models over time.



## OUR PROCESS

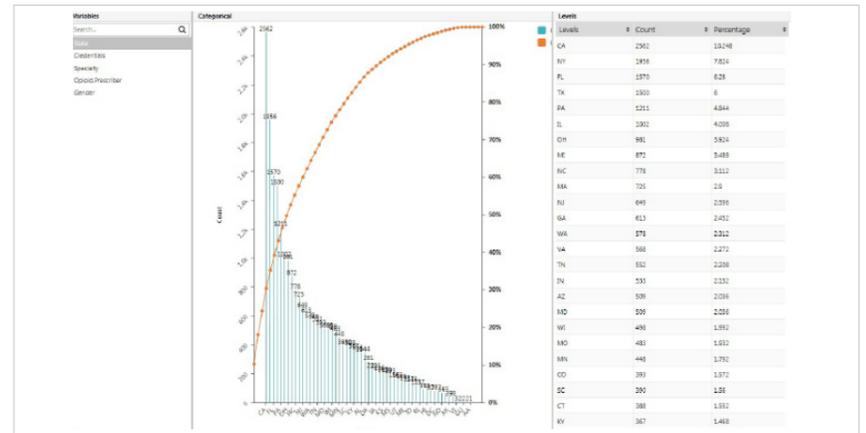
A dataset was acquired and put through a stringent exploratory process before trying to correlate what information was available to solve the challenge at hand.

The following variables were used for the analysis:

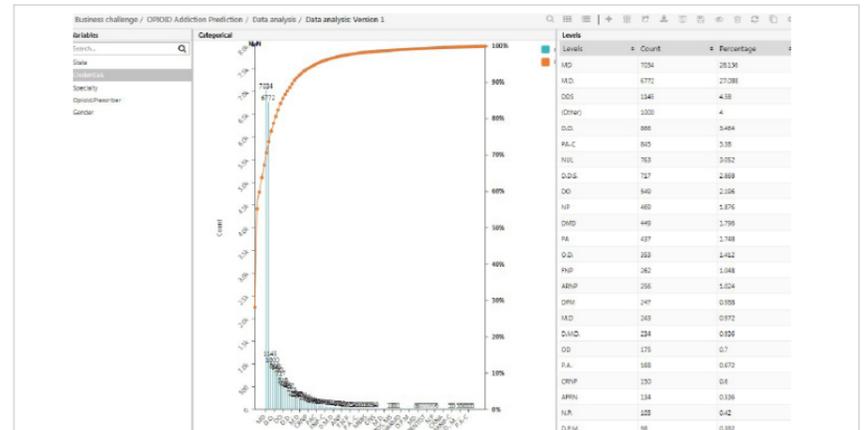
- NPI - unique National Provider Identifier number
- Gender- M/F
- State- U.S. State by abbreviation
- Credentials- set of initials indicative of medical degree
- Specialty- description of type of medicinal practice

### Sample Data:

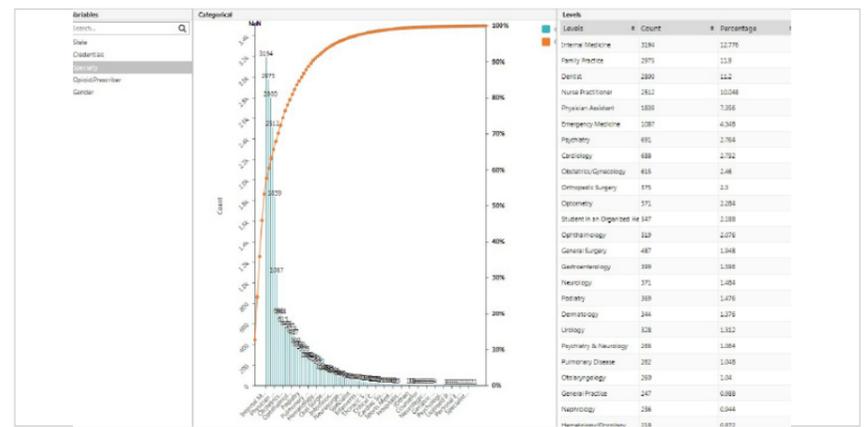
Unique ID	NPI	Gender	State	Credentials	Specialty	OPIOID Prescriber
1438	1851660278	F	MI	MSN, ACNP-BC, CCRN	Nurse Practitioner	1
3941	1063417632	F	TX	MD	Family Practice	1
2045	1770559635	M	AR	M.D.	Family Practice	1
4413	1699703322	F	AL	MD	Psychiatry	0
4699	1417151234	F	NC	M.D.	Physical Medicine and Rehabilitation	1
228	1063464808	M	NJ	M.D.	Internal Medicine	1
2638	1114289519	M	SC	D.O.	Internal Medicine	1
4456	1326119231	M	CA	Md	Psychiatry	0
2753	1154397412	M	NC	M.D.	Pulmonary Disease	0
2279	1831176841	M	MN	M.D.	Gastroenterology	1
4775	1598845844	F	TX	MD	Psychiatry	0



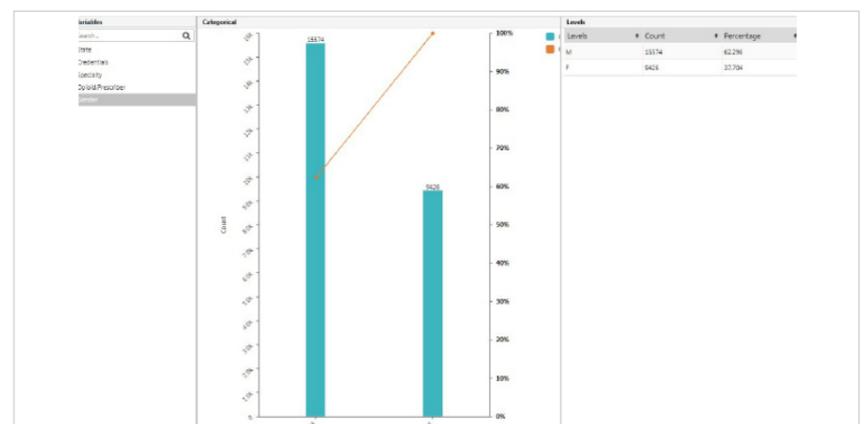
Majority of the population is from California.



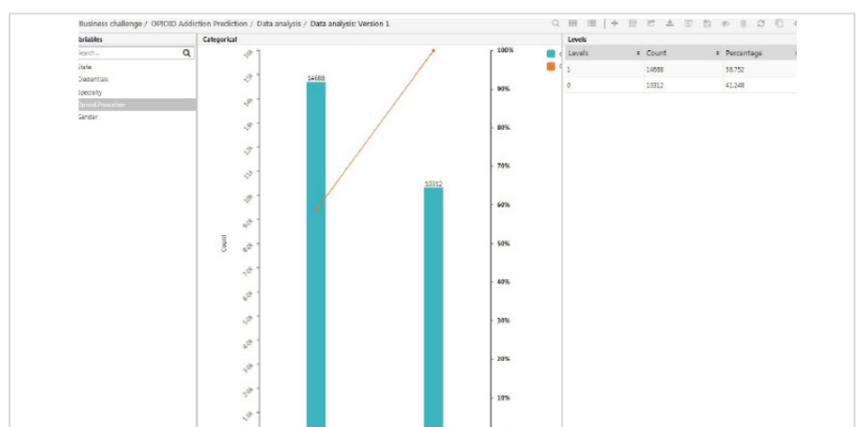
The doctors who have completed MD are prescribing more OPIOID drugs.



The Internal Medicine specialty has the largest number of prescribers.



Majority of the population is male.



Among 25,000 doctors, 14,688 doctors have prescribed OPIOID drugs.

## THE MODELING PROCESS

With the characteristics of Gender, State, Credentials and Specialty, it can be predicted whether the doctor is an OPIOID prescriber or not. Here, the target is OPIOID. Prescriber, which is a categorical variable, have 1's and 0's in it; the 1 denotes OPIOID prescriber and 0 denotes a non-OPIOID prescriber. The Two Class Gradient Boosting machine learning algorithm satisfies the requirement of higher accuracy.

### Feature information :

▼ / ... / OPIOID Prescriber Prediction / TwoClassGradientBoostingMachineClassification					
Feature Information					
FeatureName	DataType	IsFactor	FeatureRole	FeatureStatus	
Credentials	Category	true	Input	Selected	
Gender	Category	true	Input	Selected	
Opioid.Prescriber	int32	NA	Target	Selected	
Specialty	Category	true	Input	Selected	
State	Category	true	Input	Selected	
Total	Numeric	false	Input	Selected	
UniqueId	Numeric	NA	UniqueId	Generated	

## MODEL USED

The algorithm Two Class Gradient boosting classification is used to predict the prescribers in advance, as seen below. It was used since it is a machine learning ensemble meta-algorithm for primarily reducing bias and also variance in supervised learning, and it belongs to a family of machine learning algorithms that convert weak learners to strong ones.

### Predicted data :

UniqueId	Opioid.Prescriber	Predicted_Opioid.Prescriber	Probability_1	Probability_0
1	1	1	0.7639028185795373	0.23609718142046265
5	1	1	0.6554524354554241	0.3445475645445759
6	1	1	0.6826724952183393	0.3173275047816607
12	0	0	0.4576322727657002	0.5423677272342998
14	1	1	0.6554524354554241	0.3445475645445759
18	1	1	0.6545049320864545	0.34549506791354545
20	1	1	0.6423145577599707	0.3576854422400293
22	0	0	0.3868704461897308	0.6131295538102692
29	1	1	0.7058191986207393	0.2941808013792607

As per the variable importance, Gender and Specialty are considered to be most influencing factors in deciding whether a doctor is an OPIOID prescriber or not. Optimal threshold value helps in deciding the margin between an OPIOID prescriber and a Non-OPIOID Prescriber.

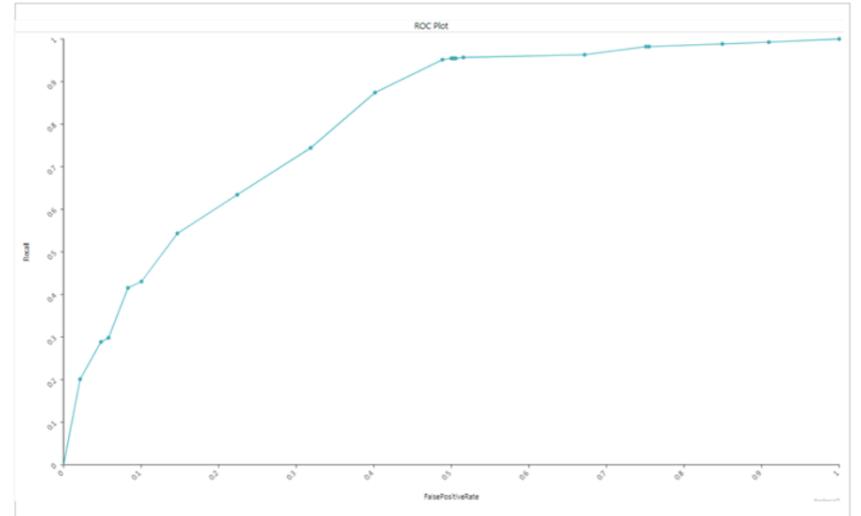
### The summary performance of the algorithm :

Metric	Value
Accuracy	0.79
Area under the curve	0.8
F1 score	0.85
Miss classification error	0.2
Optimal threshold value	0.58
Precision	0.78
Recall	0.95
Split ratio	70
Total records	5000
Hamming loss	0.2
Mathews correlation coefficient	0.54
Specilicity	0.511
True negative	265
True Positive	500
Number of train records	3500
Number of test records	1500

Here, the algorithm has an accuracy of 79% and a recall of 95%, which means that the rare event 1 is predicted correctly 95% of the time.

## ROC PLOT - AREA UNDER THE CURVE

In the ROC plot, the Area under the Curve is 80%, which shows that the True Positive rate is very high. Here, the positive class is OPIOID



## CONCLUSION AND RECOMMENDATIONS

With the advanced capabilities of Analance in analyzing and modelling the data, the prediction of OPIOID prescribers with 79% accuracy was achieved. Thereby, if new data comes in with details on Gender, Specialty, Characteristics and State of the Doctor, the prediction of his/her OPIOID prescription will be an easy task.

- Opioid prescribing is widespread—it does not result primarily from outlier prescribers.
- Prescribing patterns vary significantly by geography, even among patients undergoing similar types of care.
- Within a single region, prescribing patterns often vary significantly, even when providers are treating similar clinical problems or types of patients.
- Even within an individual provider's clinical practice, opioid prescribing patterns may vary significantly, depending on the type of problem being treated.
- Patients with opioid use disorders are heterogeneous, but can be grouped into archetypes.
- Providers frequently prescribe opioids to patients with known or potential risk factors for abuse.
- In one analysis, more than one-third of the patients had a known or potential risk factor for abuse.
- Patients with concurrent prescriptions for an opioid and a behavioral health condition appear to have a 30% or greater likelihood of developing future opioid dependence.
- Most opioids are prescribed by providers other than the natural "quarterback" of a patient's underlying complaint or condition.
- A small portion of opioid use originates in emergency departments.