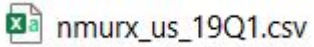
To Understand Opioids Misuse in California 2019

Team: Caffeinated Analysts

Introduction

- Objective: Study the prevalence of opioids misuse within the state of California
- Data Used: 2019 US (March ~ May)

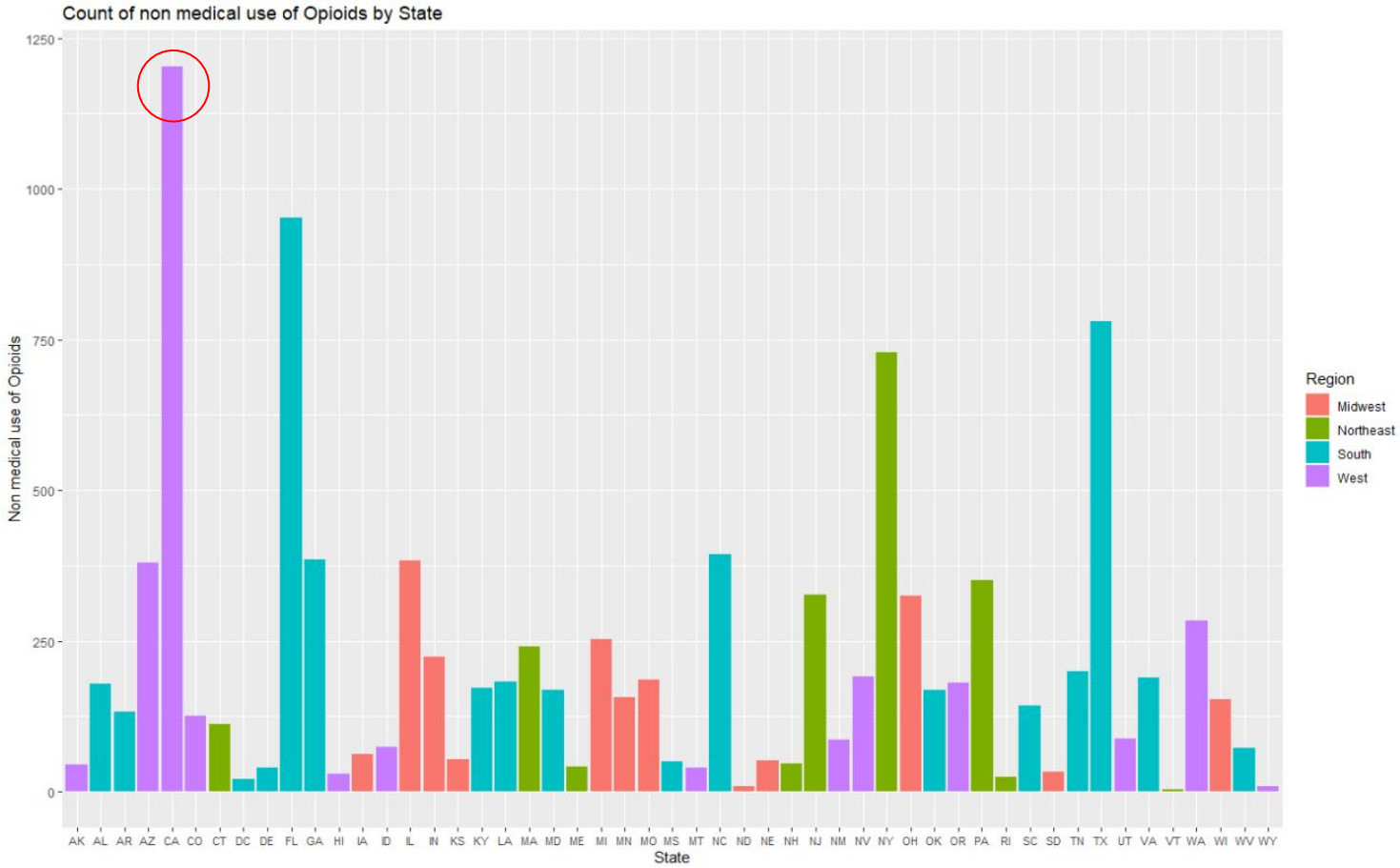


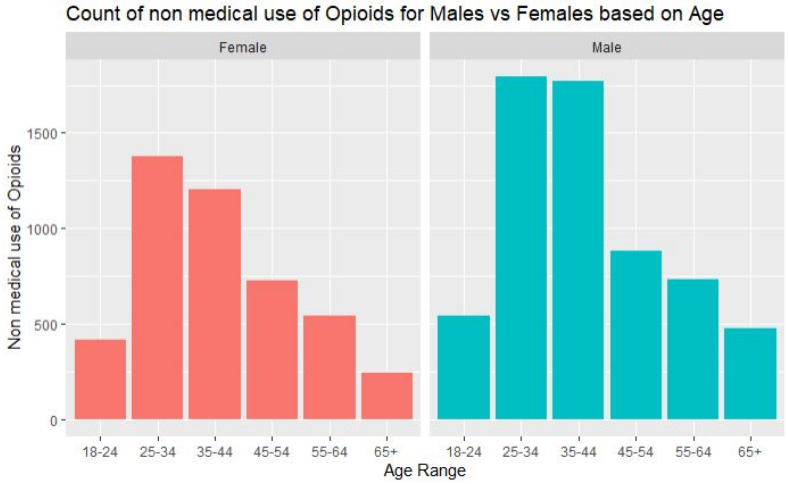
- Two Models:
  - Stochastic Partial Differential Equation (SPDE) Approach
  - Logistic Regression

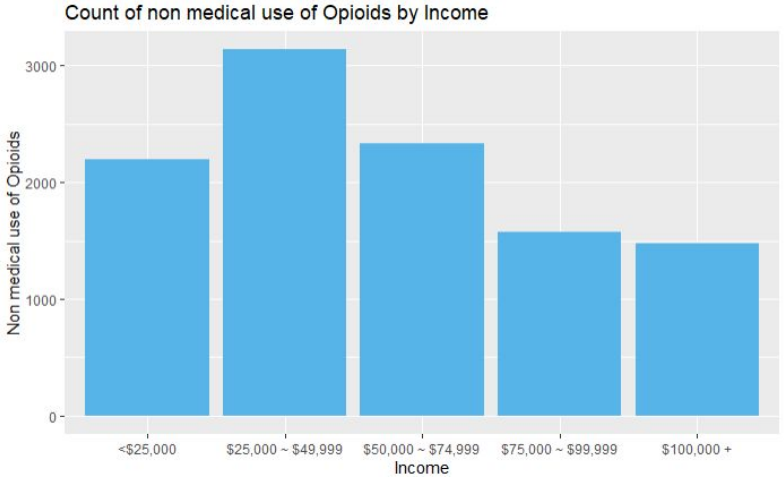
Data Exploration

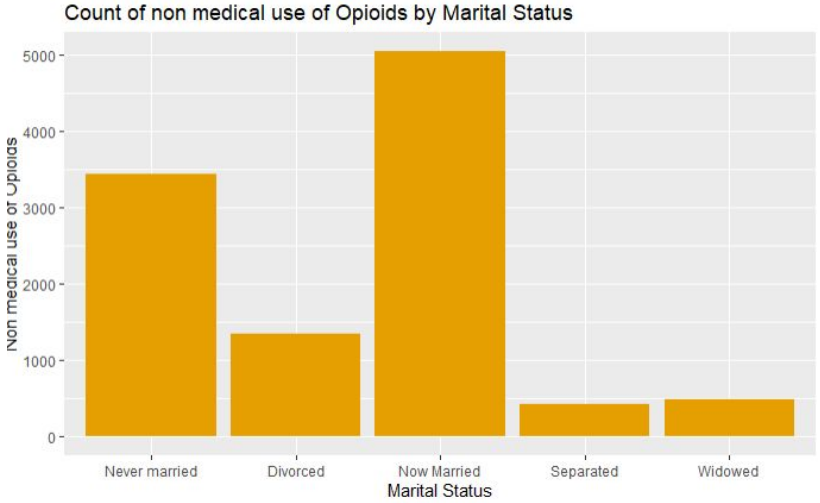
- Variables Explored:
  - **Demographics** - DEM_AGE10, DEM_INCOME, DEM_GENDER, etc.
  - **Drug Use** - TOB_LIFE, OTH_RX_DRUG_USE, ALC_US, etc.
  - **Health Conditions** - PAIN_CHRONICYR_RX, TRT_USEYR, etc.

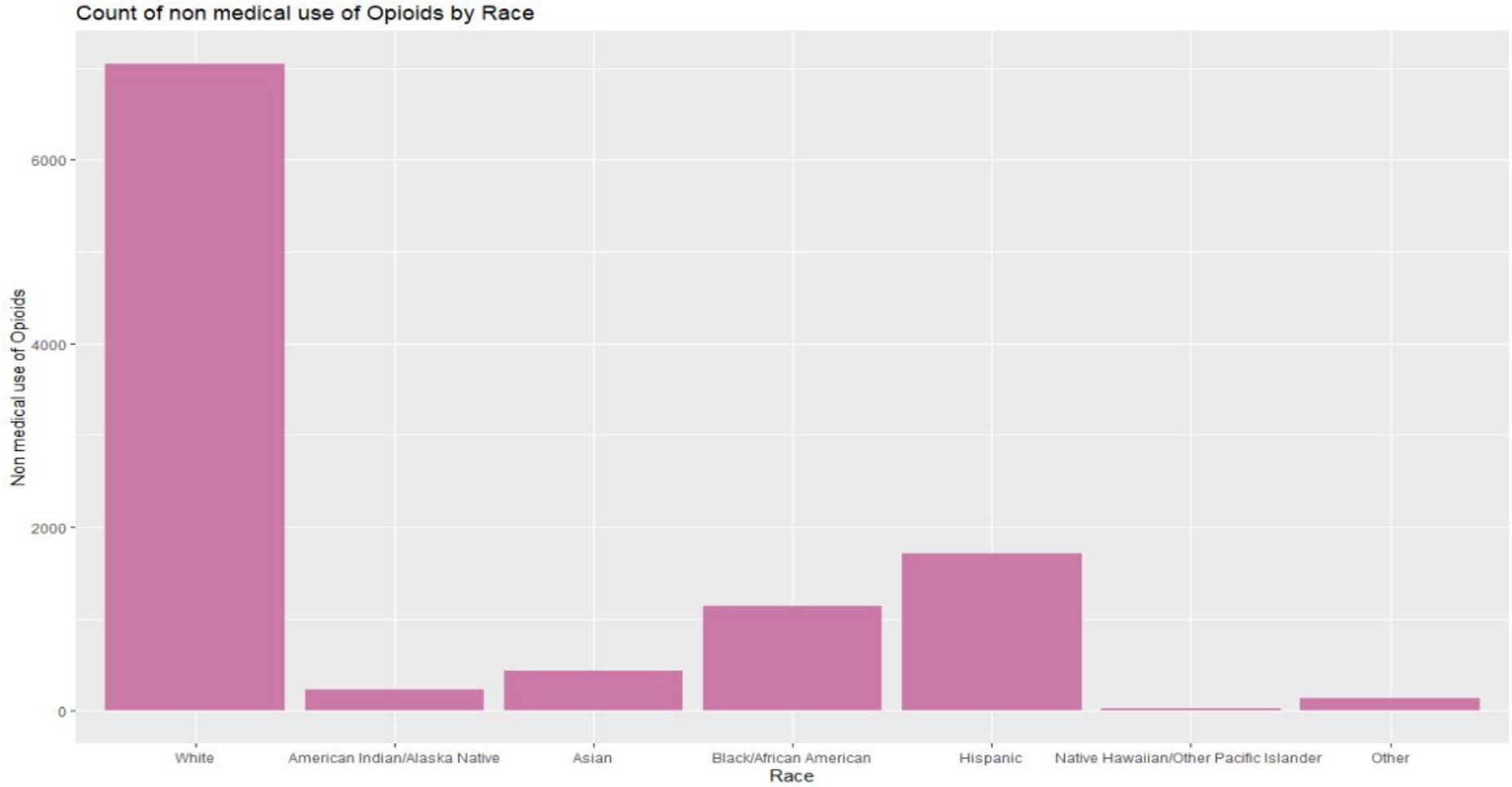
- Response variable: Count of Opioid Misuse
  - total number of non medical use of opioids


Count of non medical use of Opioids by State
Non medical use of Opioids
1250
1000
750
500
250
0
AK AL AR AZ CA CO CT DC DE FL GA HI IA ID IL IN KS KY LA MA MD ME MI MN MO MS MT NC ND NE NH NJ NM NV NY OH OK OR PA RI SC SD TN TX UT VA VT WA WI WV WY
State
Region
Midwest
Northeast
South
West


Count of non medical use of Opioids for Males vs Females based on Age
Female
Male
Non medical use of Opioids
0
500
1000
1500
18-24
25-34
35-44
45-54
55-64
65+
Age Range

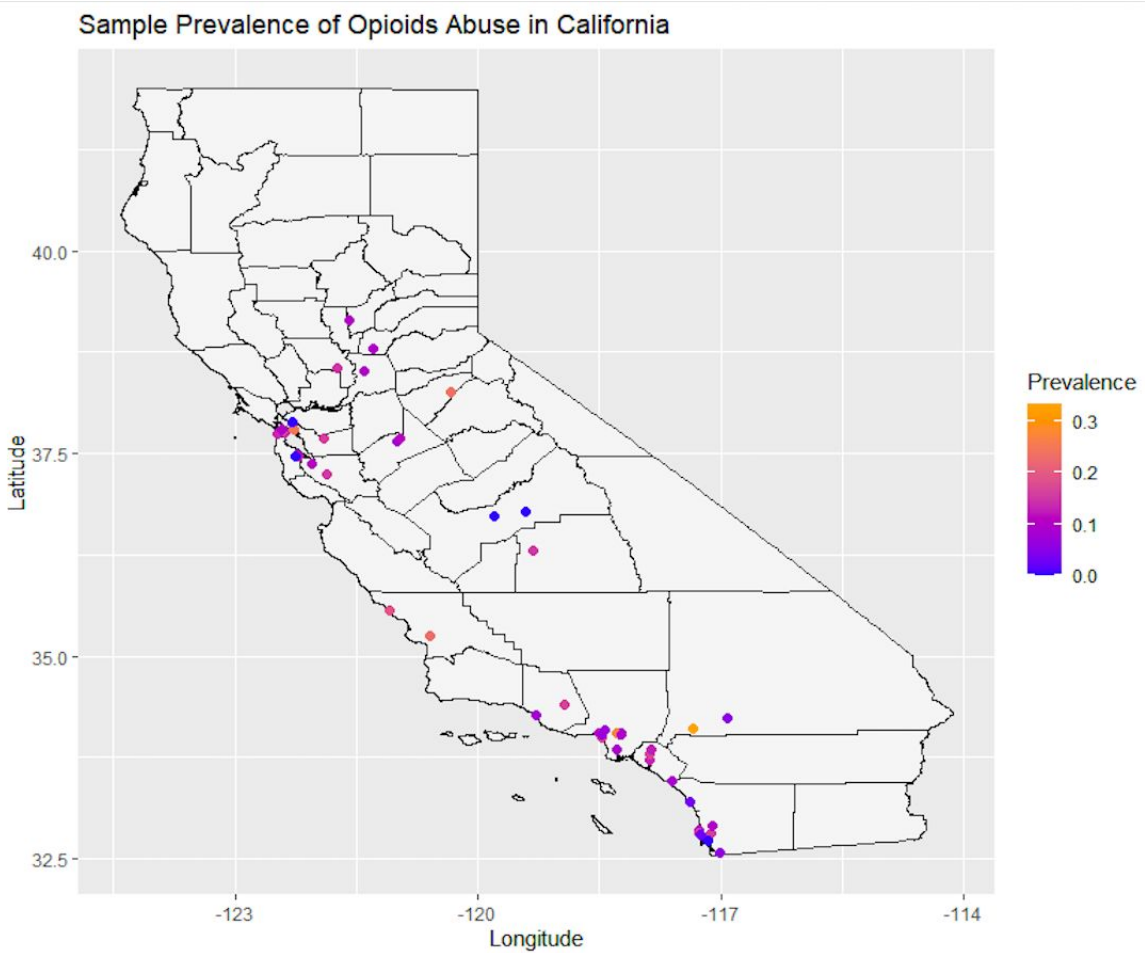

Count of non medical use of Opioids by Income
Non medical use of Opioids
0
1000
2000
3000
<$25,000
$25,000 ~ $49,999
$50,000 ~ $74,999
$75,000 ~ $99,999
$100,000 +
Income


Count of non medical use of Opioids by Marital Status
Non medical use of Opioids
0
1000
2000
3000
4000
5000
Never married
Divorced
Now Married
Separated
Widowed
Marital Status


Count of non medical use of Opioids by Race
Non medical use of Opioids
6000
4000
2000
0
White
American Indian/Alaska Native
Asian
Black/African American
Hispanic
Native Hawaiian/Other Pacific Islander
Other
Race

SPDE Approach: Data Preparation

- Find the unique postal code within the data set
- Sample prevalence computed for each postal code
- Longitudes and Latitudes of the postal codes found using Google's geocoding API
- GADM geospatial data set is used to find the county that each postal code belongs to
- Demographic data for each county are obtained from US Bureau of Statistics


Sample Prevalence of Opioids Abuse in California
Latitude
40.0
37.5
35.0
32.5
-123
-120
-117
-114
Longitude
Prevalence
0.3
0.2
0.1
0.0

SPDE Approach: The Model

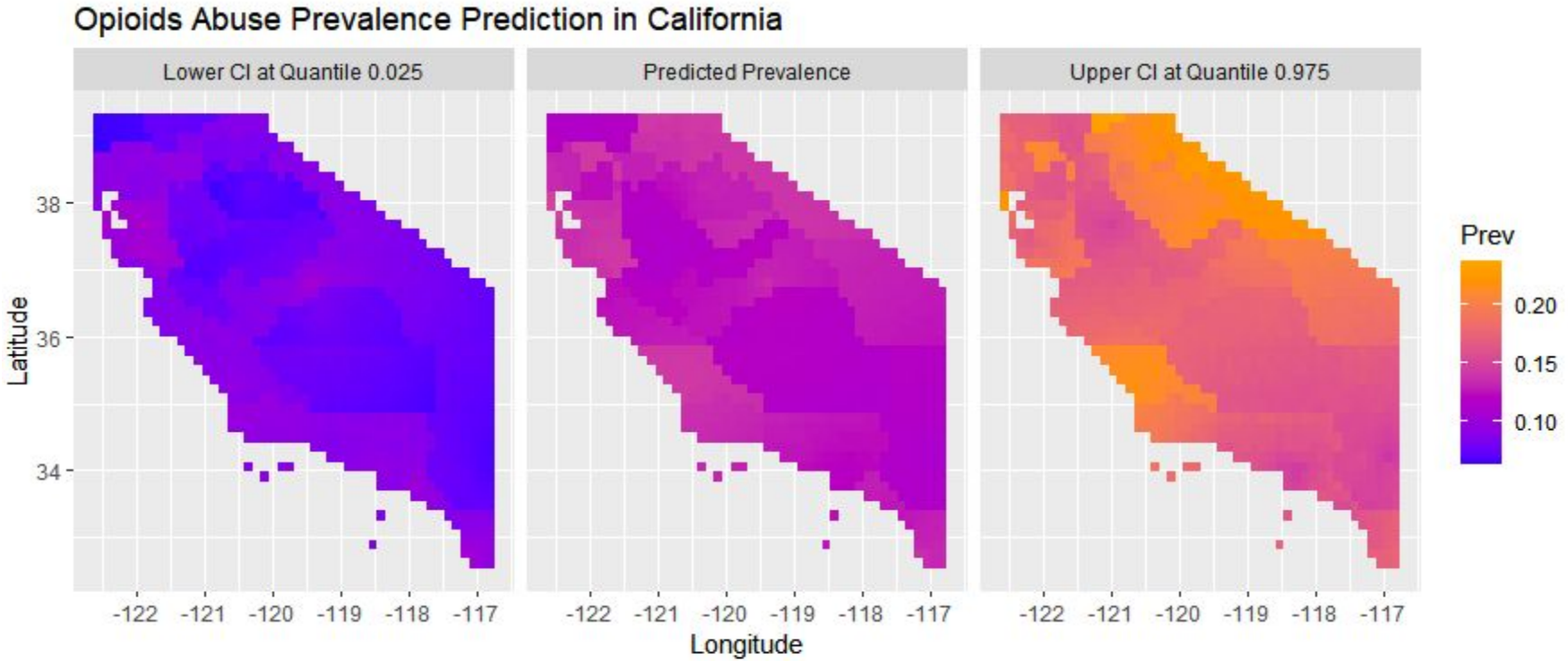
$$\text{logit}(P(\mathbf{s}_i)) = d(\mathbf{s}_i)'\beta + Z(\mathbf{s}_i)$$

- Aim to fit a spatially dependent prevalence for any arbitrary point within California

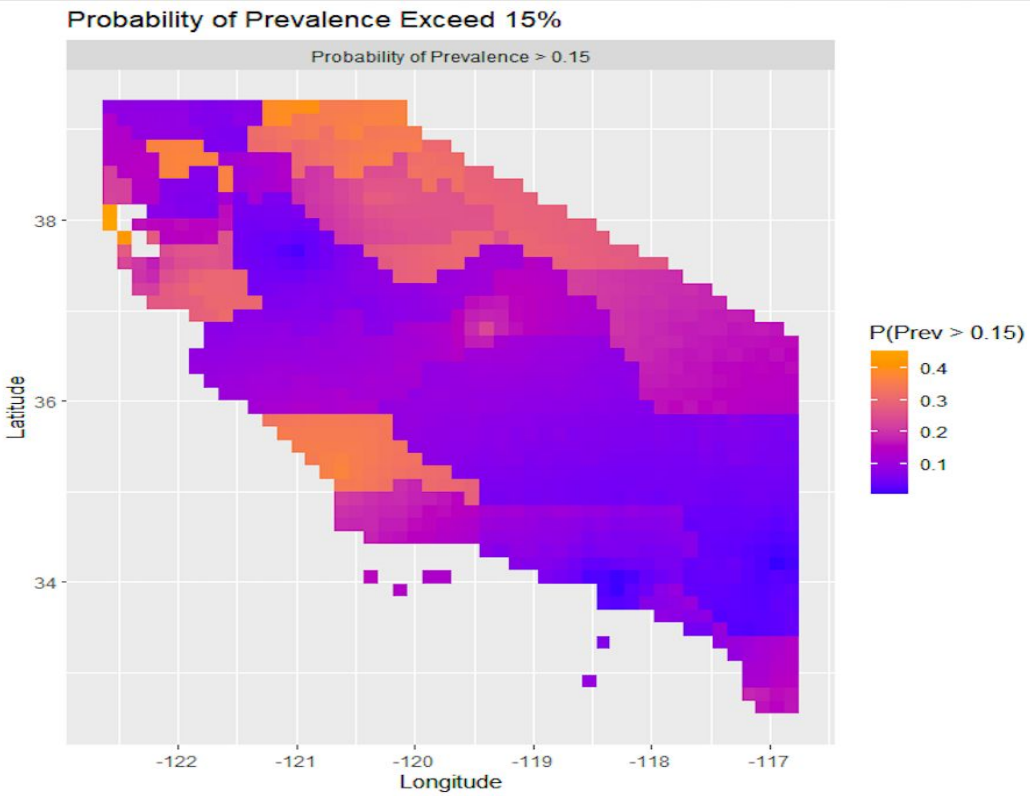
$\mathbf{s}_i$ is an arbitrary point within California
$d(\mathbf{s}_i) = (1, d_1, ..., d_p)'$ is the vector of covariates with values basing on county the points belong to
β is the parameter of the fixed effect
$Z(\cdot)$ is the spatially structured random effect which follows a zero-mean Gaussian random field with Matérn covariance function

- The final demographic variables chosen are mean income, proportion of the county's population of being white and proportion of the county's population having a bachelor's degree.
- Will be done use the bayesian R package INLA

SPDE Approach: Result & Prediction



SPDE Approach: Conclusion & Limitation



- The spatial model predicts most locations within California has prevalence roughly to be about 0.15
- Coastal areas tend to have a higher prevalence, which is where the Californian cities are concentrated at.
- The ethnicity parameter are founded to be statistically insignificant.
- This model completely ignores health related variable, potentially more useful, but such information is hard to find due to time constraint.

Logistic Regression

- **Covariates:**

  DEM_AGE10, DEM_INCOME, DEM_GENDER, DEM_GENHEALTH, DEM_MARITAL, DEM_EDU, DEM_HOME, race, DEM_LIMIT, PAIN_CHRONICYR_RX, MENT_NONE, TRT_USEYR, TOB_LIFE, ALC_USE, OTH_RX_DRUG_USE, DAST_CAT, illegalUse.

- **Response variable:** opioid_binary
  - 1 for existence of non medical use of opioids
  - 0 for non-existence of non medical use of opioids

Table 1: Estimates of baseline odds and odds ratios, with 95% confidence intervals

	est	2.5 %	97.5 %
Baseline	0.027	0.008	0.082
Age 18 - 24	1.045	0.532	2.014
Age 34 - 44	0.922	0.568	1.495
Age 45 - 54	0.728	0.420	1.249
Age 55 - 64	0.637	0.362	1.112
Age 65 +	0.346	0.164	0.698
income of more than $100,000	0.629	0.358	1.093
Income between $25,000 ~ $49,999	1.045	0.645	1.696
Income between $75,000 ~ $99,999	1.272	0.760	2.129
Income less than $25,000	0.789	0.442	1.396
Male	1.345	0.944	1.925
Excellent health	0.622	0.287	1.330
Good health	0.976	0.568	1.710
Poor health	0.422	0.097	1.556
Very good health	0.886	0.502	1.596
Divorced	0.723	0.377	1.348
Now Married	0.933	0.620	1.410
Separated	1.050	0.323	3.012
Widowed	1.952	0.814	4.431
Education level	1.010	0.911	1.119
Currently living with other individuals	1.007	0.902	1.091
American Indian/Alaska Native	3.818	1.011	12.851
Asian	1.060	0.601	1.820
Black/African American	1.522	0.723	3.029
Hispanic	1.668	1.099	2.525
Native Hawaiian/Other Pacific Islander	0.590	0.028	4.435
Other race	0.602	0.087	2.461
Currently limited in activity due to medical reasons	1.871	1.238	2.816
Received a prescription for a pain reliever in the last 12 months	1.267	0.790	2.009
Have been diagnoised with mental health disorder before	1.595	1.107	2.291
Have received treatment for use of any drugs (not including cigarettes)	0.541	0.265	1.090
Smoke cigarettes everyday	2.234	1.486	3.346
Smoke cigarettes on some days	1.820	1.159	2.833
Alcohol consumption	1.380	1.131	1.680
Have used other prescription drugs for non medical purposes	0.377	0.242	0.590
Involvement with drugs	1.965	1.574	2.470
Have used illegal drugs before	2.128	1.481	3.053

Conclusion & Limitations

- Opioids misuse is more likely to occur for those who are already familiar with legal/illegal drugs as well as those who have pre-existing health conditions
- Limitations include:
  - lack of consideration for interactions/random effects
  - possibility of an overfit