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## Modelling the drug addictions and associated risk factors in California

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### Abstract

Drug addiction is a chronic medical condition marked by an individual's inability to suppress the need to use drugs despite knowing that doing so will have a severe impact on their health, their family, and society at large. A growing corpus of research demonstrates how the use of illegal drugs begins and persists as a result of interactions between the substance misuse phenomena and drug addiction propensity. The purpose of this study was to evaluate the relationship between socio demographic factors and other risk factors and the propensity for drug addiction. According to the results of the fitted logistic regression, there is a significant correlation between the likelihood of drug addiction in California and social demographic risk factors like sample respondents, family history, alcohol consumption, monthly income, age, and gender as well as other risk factors like tobacco smoking. The goodness of fit test shows that the model fits the data well and may be used to forecast the likelihood of drug addiction in the future. Based on the fact that California residents of all ages particularly adults and genders are a significant factor in the occurrence of drug addiction, the state should enforce rules and consistently raise public knowledge of potential penalties and fines.

**Keywords:** Drug addictions, Socio-demographic risk factors, logistic regression model, goodness of fit

### 1. Introduction

Drug addiction is a persistent medical condition marked by an individual's incapacity to regulate the compulsion to consume drugs, notwithstanding the adverse impact on the addicted person's health, daily functioning, familial relationships, and society at large (Charitonidi, Studer & Gaume *et al.*, 2016) <sup>[5]</sup>.

Based on data from the World Drug Report, it was found that around 5.5% of the global population, totaling an estimated 270 million individuals, engaged in drug consumption during the year 2017. Furthermore, within this group, a notable subset of 35 million individuals experienced the adverse consequences associated with drug addiction throughout the same time frame. There is an increasing amount of evidence indicating that there exists a reciprocal relationship between the phenomenon of substance abuse and the propensity for drug addiction. This interaction ultimately contributes to the initiation and persistent engagement in the consumption of illicit drugs (Russell *et al.*, 2008) <sup>[17]</sup>.

Gaining insight into the characteristics correlated with a proclivity towards drug addiction is a pivotal undertaking in mitigating this societal disaster. Based on existing scholarly literature, it is evident that these components can be classified into three overarching groups, namely individual, family, and environmental influences. There is a positive correlation between the number of characteristics present in an individual and the likelihood of developing a propensity towards drug addiction. Individual factors include several elements that contribute to the likelihood of drug misuse. These factors encompass a lack of self-assurance, experiences of child abuse, favourable views towards the consequences of drugs, namely psychotropic and chemical substances, inquisitiveness, as well as the presence of depression and mental disorders (Noury, 2015; Alhyas *et al.*, 2015; Korsgaard & Torgersen, 2016; Behzad, Mehrnaz & Shahram, 2015) <sup>[13, 2, 6, 3]</sup>.

The factors about family and environment encompass various elements such as family structure and function disorders, generation gap, social and ecological disorder within a neighbourhood characterized by criminal activities, low social status, poverty and class disparities, identity crisis, isolation and seclusion, pursuit of hedonistic pleasures,

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unemployment and limited social engagement, as well as the influence of family members' behaviour and the impact of friends and peer groups (Monacis & de Palo, 2017; Lee, Jones & Kosterman *et al.*, 2017) <sup>[12, 9]</sup>.

The rationale for undertaking this study can be attributed to several factors. Firstly, there is a significant prevalence and incidence of drug use both in California and worldwide. Secondly, substance abuse is often linked to social disorder in various regions across the globe. Thirdly, there is a particular emphasis on identifying preventable factors and targeted interventions that address the behavioural and social characteristics of drug users. Lastly, there is a concerning trend of individuals experiencing difficulties in successfully quitting drug use, leading to a growing resistance or failure to achieve abstinence (Menati *et al.*, 2017; Vonasch, Clark & Lau, 2017) <sup>[10, 20]</sup>. Hence, the objective of this study is to construct a model that captures the risk factors linked to the propensity or inclination towards drug addiction in the state of California.

## 2. Review of Related work

One of the elements that greatly increases a person's risk of addiction, according to a 2015 study (Ogunsola & Fatusi), is their environment. Interviews were conducted with 600 respondents, divided into urban and rural groups. (Sansgiry & Bhansali, 2017) <sup>[18]</sup> It was discovered that several risk factors, including being male, having friends who are a "bad influence," the parental norm, dads' and mothers' educational levels, and parental connectivity, were linked to poor outcomes in adults' lives.

Drug addiction is a severe issue that affects a wide range of countries around the world; it does not regard differences in gender, age, colour, or religious affiliation, suggesting that substance misuse is in some way related to human nature in general (Lander, Howsare, & Byrne, 2013) <sup>[8]</sup>. "In 2016, there were approximately 5.6% of people worldwide between the ages of 15 and 64 who had used drugs at least once in their lifetime." The problem of drug addiction has grown over the past ten years among teenagers and young adults, particularly among men between the ages of 15 and 30. The Global Burden of Disease Study from 2013 found that use of these substances peaked between the ages of 16 and 18, with the peak age of initiation, and that use of these substances also results in 14% of health issues in young men (Lee & Jones *et al.*, 2017) <sup>[9]</sup>.

Drug use and its effects vary by ethnicity and have long been reported; nonetheless, it is still unknown what impact genetic and cultural variables play. Racial healthcare disparities may be mistakenly linked to genetic variations, even though they are the outcome of social and historical circumstances. Drug use disorders are hereditary diseases that are influenced by a complex interplay of genetic and environmental factors (Richardson *et al.*, 2013) <sup>[16]</sup>.

Existing studies revealed that alcohol consumption results in the deaths of 11.8 million individuals each year. According to estimates of more than 200 million documented users, cannabis is the most commonly used illicit substance in the world (Benjet *et al.*, 2013) <sup>[4]</sup>.

In one study, substance abuse among medical students and doctors was explored about the influence of family history on a person's future risk of developing a drug addiction. According to the findings (Rahimian-Boogar *et al.*, 2014) <sup>[15]</sup>, one of the risk factors that made people more likely to misuse any subtype of substance was a family history of

drug addiction. In addition, a study on methadone maintenance therapy and positive parental history found that individuals with a positive family history had higher opioid dependence symptoms that were so severe that they may be labelled as seriously dependent (Tsering & Pal, 2009) <sup>[19]</sup>.

Age-related categories can be used to group a variety of individual risk factors for drug addiction. For instance, children and teenagers under the age of 18 experiment with substances for a variety of reasons, including interpersonal trauma, the desire for a novel experience or sense of adventure, as well as racial, gender, and socioeconomic factors. Academic stress, chronic prescription drug use following minor surgery, strained parent-child relationships, and minor surgery all contribute significantly to substance abuse among young adults between the ages of 18 and 25. Especially if they work in a high-stress industry like law, medicine, or the military, adults between the ages of 26 and 64 frequently confront significant life obstacles and must strike a balance between work and family obligations, which tends to raise the risk of substance misuse. Addiction to drugs or alcohol can result from grieving the loss of a close family member or friend. Last but not least, problems that older persons over 65 may experience include grief, chronic illnesses, a lack of care, and social isolation, all of which may encourage them to use medicines at improper dosages (Khazaie, Najafi, & Alavifar, 2013) <sup>[7]</sup>.

## 3. Methodology

Data used was cross-sectional data about drug addictions and risk factors including sociodemographic information extracted from the publication of California Health Care Foundation in 2022.

The multiple logistic regression model and summary statistics (mean and standard deviation) was employed in this study's analysis to look into the main risk factors connected to the likely inclination towards drug addiction in California. Whether anything is hooked or not, whether it is yes or no, and so forth, everything occurs in pairs according to the dynamics of the worldwide globe. According to Mohammed & Raheem's work (2020) <sup>[11]</sup>, when determining a dichotomous dependent variable, this tends to follow the logic of the logistic regression model. When there are many independent variables, which can be either continuous or categorical, it is possible to predict a dichotomous dependent variable (that is, a variable that falls into two categories) using a multiple logistic regression model. Even though the multiple logistic regression model is nonparametric and does not adhere to the assumptions of the parametric regression model (OLS), post-estimate measures including the goodness of fit, sensitivity and specificity, and receiver operating characteristic curve (ROC) are still used.

### 3.1 Model specification

The multiple regression model adopted for this study can be adequately specified as:

$$\text{Iny} = \text{Log} (P/1-P) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \beta_6x_6 + \beta_7x_7 + \varepsilon$$

Where  $\beta_1$  to  $\beta_7$  are the coefficient estimates of the factors that affect the likelihood of drug addiction  $\varepsilon$  is the stochastic random error and the other components of the model are described below:

Iny: Likelihood of drug addiction (1 = yes, 0 = Otherwise)

x<sub>1</sub>: Sample examined daily  
 x<sub>2</sub>: Tobacco smoking (in percentage)  
 x<sub>3</sub>: Family history (1 = those addicted, 0 = otherwise)  
 x<sub>4</sub>: Daily Alcohol Intake (in percentage)  
 x<sub>5</sub>: Monthly Income (In thousand dollars)  
 x<sub>6</sub>: Age (in years)  
 x<sub>7</sub>: Gender (1= Male, 0 = Female)  
 The odd ratio = Exp (B) = e<sup>B</sup> which will help us determine the most critical out of the seven factors that influence the likelihood of drug addiction.

Hosmer & Lemeshow test is a diagnostic test for goodness of fit for logistic regression model using Chi-square statistic.  
 Hypothesis for goodness of fit  
**H<sub>0</sub>**: The fit is good  
**H<sub>a</sub>**: The fit is not good  
 Decision rule: Reject the null hypothesis if P-value is less than the significant level and do not reject if otherwise. The generally acceptable significant level in practice are 1% and 5% respectively (Adebanjo *et al*, 2022) <sup>[1]</sup>.

**3.2 Goodness of fit diagnostic for Logistic regression**

**4. Results and Discussion**

**Table 1:** Summary statistics

|                                | N     | Mean   | Std. Deviation |
|--------------------------------|-------|--------|----------------|
| Sample                         | 600   | 120.14 | 32.658         |
| Tobacco smoking                | 600   | 68.68  | 19.360         |
| Alcohol Intake                 | 600   | 20.56  | 16.005         |
| Monthly Income                 | 600   | 31.91  | 8.009          |
| Age                            | 600   | 33.28  | 11.822         |
| Percentage                     | %     |        |                |
| <b>Gender</b>                  |       |        |                |
| Male                           | 63.8  |        |                |
| Female                         | 36.2  |        |                |
| <b>Likelihood of Addiction</b> |       |        |                |
| Yes                            | 34.70 |        |                |
| Otherwise                      | 65.30 |        |                |
| Family history                 | %     |        |                |
| Yes                            | 49.20 |        |                |
| Otherwise                      | 50.80 |        |                |

**Source:** Author’s computation using Stata Software

Table 1 shows that the average of the respondents sampled daily is about 120 people with a variability of about 33 people, the average number of respondents smoking Tobacco is about 69% with a variability of about 19%, the average number of respondents with Alcohol intake is about 21% with the variability of about 16%, the average monthly income of the respondents is about 32 thousand dollars with the variability of about 8 thousand dollars. The average age

of the respondents is about 33years with the variability of about 12 years. The gender/sex of the respondents indicates that 63.8% are male while 36.2% are female which suggest that male are more addicted than female, those addicted represent 34.7% while those not addicted represent 65.3% and those with a family history are 49.2% while those without a family history are 50.8%.

**Table 2:** Logistic regression model

| <b>Logistic regression</b>  |            |                |                                     |         |
|---|------------|----------------|-------------------------------------|---------|
| <b>Accuracy of the logistic regression classifier = 0.77</b>      |            |                | <b>Number of observations = 600</b> |         |
| <b>Log likelihood = -291.526</b>                                  |            |                | <b>LR chi2(7) = 191.38</b>          |         |
|   |            |                | <b>Prob &gt; chi2 = 0.0000</b>      |         |
|   |            |                | <b>Pseudo R2 = 0.2471</b>           |         |
| Likelihood of drug addiction (Yes or otherwise)                   | Odds ratio | Standard error | Test Statistic                      | P-value |
| Sample  | 1.032      | 0.004          | 8.43                                | 0.000** |
| Tobacco smoking   | 0.990      | 0.006          | -1.73                               | 0.004** |
| Family history  | 0.822      | 0.008          | -0.77                               | 0.443   |
| Alcohol Intake  | 1.002      | 0.019          | 0.22                                | 0.826   |
| Monthly Income  | 1.104      | 0.009          | 5.77                                | 0.000** |
| Age   | 1.025      | 0.710          | 2.67                                | 0.008** |
| Gender  | 1.675      | 0.366          | 2.36                                | 0.018*  |
| Constant  | 0.000      | 0.000          | -10.18                              | 0.000   |
| Pearson or Hosmer-Lemeshow goodness of fit (Prob > chi2) = 0.1082 |            |                |                                     |         |

**Source:** Author’s computation using Stata Software

Where Asterisk \*\* and \* are 1% and 5% level of significance respectively

Table 2 show that health risk factor such as tobacco smoking contributes statistically significantly to the likelihood of drug addiction while the socio-demographic factors such as sampled respondents, monthly income, age

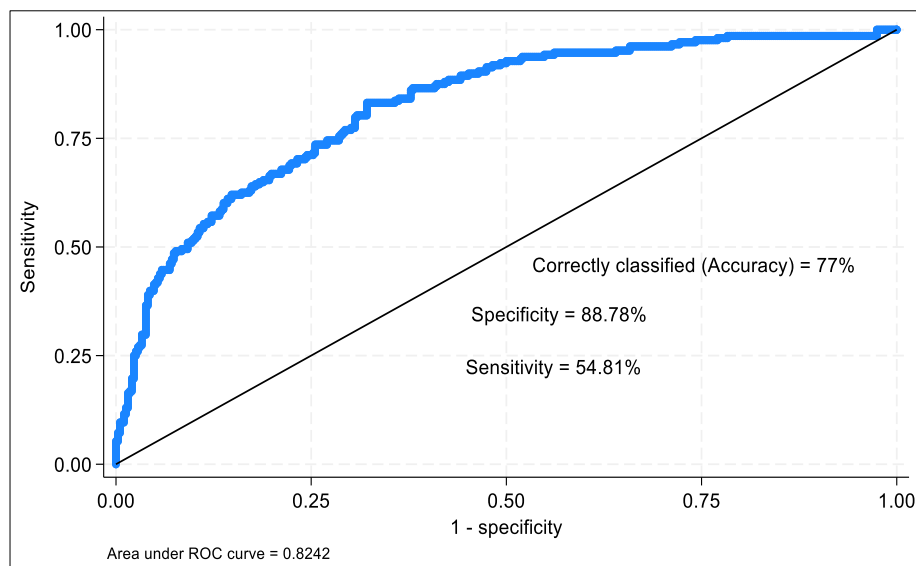
and gender also contribute significantly to the tendency of drug addiction in California. Meanwhile, gender has the highest odd ratio among the other risk factors which implies that it is the most critical

out of the other risk factors that influence the likelihood of drug addiction.

The overall model  $P = 0.000$  indicate that the fitted logistic regression model is statistically significant which means that the social demographic risk factors such as the sample respondents, family history, alcohol intake, monthly income, age and gender as well as the other risk factor such as the

tobacco smoking are significantly associated the likelihood or tendency to drug addiction in California.

Besides, the Pearson or Hosmer-Lemeshow goodness of fit shows that the P-value is greater than 0.05 significant level indicating that the model is a good fit for the data and can be used for the future prediction of the Likelihood of drug addiction. The accuracy of the logistic regression classifier is 0.77 which implies that the model prediction is accurate.



**Fig 1:** Area under the curve that demonstrate the precision and accuracy of the model

Figure 1 shows the area under the curve with a precision level of about 82.4%, a specificity is 88.78%, a sensitivity is about 54.81% and the accuracy of the model classifier is 77% indicating that the model prediction is accurate.

#### 4.1 Discussion of findings

Table 1 presents the findings of the study, indicating that the mean number of individuals surveyed daily is approximately 120, with a standard deviation of approximately 33. Moreover, the average proportion of respondents who reported smoking tobacco is approximately 69%, with a standard deviation of approximately 19%. Similarly, the average proportion of respondents who reported consuming alcohol is approximately 21%, with a standard deviation of approximately 16%. Lastly, the average monthly income of the respondents is approximately \$32,000, with a standard deviation of approximately \$8,000. The average age of the respondents is about 33 years with the standard deviation of about 12 years. The data about the gender/sex of the respondents reveals that 63.8% of the participants identify as male, while 36.2% identify as female. This distribution suggests that males exhibit a higher prevalence of addiction compared to females. Specifically, individuals classified as addicted comprise 34.7% of the sample, while those classified as non-addicted constitute 65.3%. Furthermore, respondents with a family history of addiction account for 49.2%, whereas those without such a history make up 50.8% of the sample.

Table 2 demonstrates a statistically significant association between health risk factors, specifically tobacco smoking, and the likelihood of drug addiction. Additionally, socio-demographic factors such as sampled respondents, monthly income, age, and gender also exhibit a significant contribution to the propensity for drug addiction in

California. These findings align with previous research conducted by Lander, Howsare, & Byrne (2013) [8] and Lee & Jones *et al.* (2017) [9], which identified age as a contributing factor to drug addiction. However, these findings contradict the perspective of Rahimian-Boogar *et al.* (2014) [15], who assert that family history is the primary factor influencing drug addiction.

In the context of drug addiction, gender exhibits the largest odds ratio compared to other risk factors, indicating its paramount significance in influencing the probability of drug addiction.

The logistic regression model with an overall model P-value of 0.000 demonstrates statistical significance. This indicates that various social demographic risk factors, including sample respondents, family history, alcohol intake, monthly income, age, gender, and tobacco smoking, are significantly associated with the likelihood or tendency of drug addiction in California.

Additionally, the goodness of fit test demonstrates that the model is suitable for the data and can be utilised for future predictions regarding the likelihood of drug addiction.

#### 5. Conclusion and Policy recommendation

Drug addiction is a persistent medical condition marked by an individual's incapacity to regulate the compulsion to consume drugs, notwithstanding the adverse effects on the physical well-being and daily functioning of the afflicted individual, their familial unit, and the broader community.

The purpose of this study is to construct a model that examines the risk factors linked to the propensity or inclination towards drug addiction in the state of California. The findings of the logistic regression analysis indicate that various social demographic risk factors, including the characteristics of the sample respondents, family history,



alcohol consumption, monthly income, age, and gender, along with the presence of another risk factor, namely tobacco smoking, are significantly linked to the propensity for drug addiction in the state of California. The goodness of fit test suggests that the model adequately fits the data and can be employed for future predictions regarding the likelihood of drug addiction.

Therefore, the California government must implement measures that promote discipline and ensure continual awareness of potential penalties or fines. This will serve as a corrective approach for residents of California, regardless of age or gender, who significantly contribute to the occurrence of drug addiction.

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