

Denver Crime Lab Suicide Study

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Introduction

- Denver Crime Lab and coroner's offices in Las Vegas and Milwaukee have demographic data for suicide victims
- Exploratory analysis and power and sampling size planning was previously completed
- Drug panel data will now be added and combined with demographics for additional analysis
- Goal is to perform a Genome wide association study of suicide victims
- Observed study
- Population is United States citizens

Project Aims

Harmonize and clean the data sets

- With a focus on the drug panel data

Perform exploratory analysis

- Identify relationships between demographic data and drugs found in the suicide victims at the time of death(TOD)
- Understanding if drug class is associated with sex, city, race, or age

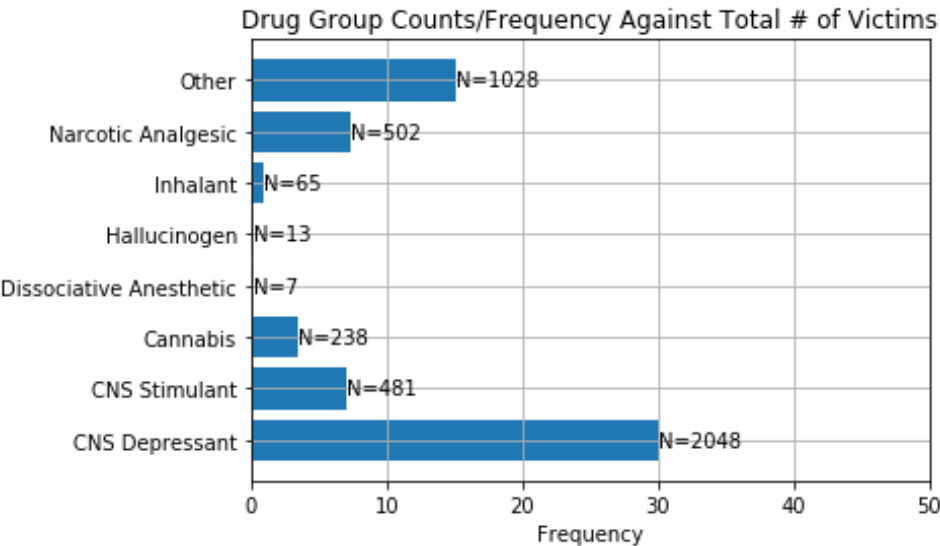
- Jupyter Notebooks
 - Pandas, Numpy, RegEx
- Clean columns such as Age, Marital Status, and Race
- Combine similar columns such as Location of Death and Place of Death, Cause of Death and Final Cause of Death
- Create dictionaries to replace drug codes with drug names and drug names with drug categories
- Create/Clean column with the drug data
- Create 8 new Boolean columns for each drug category

Methods for Harmonizing & Cleaning Data

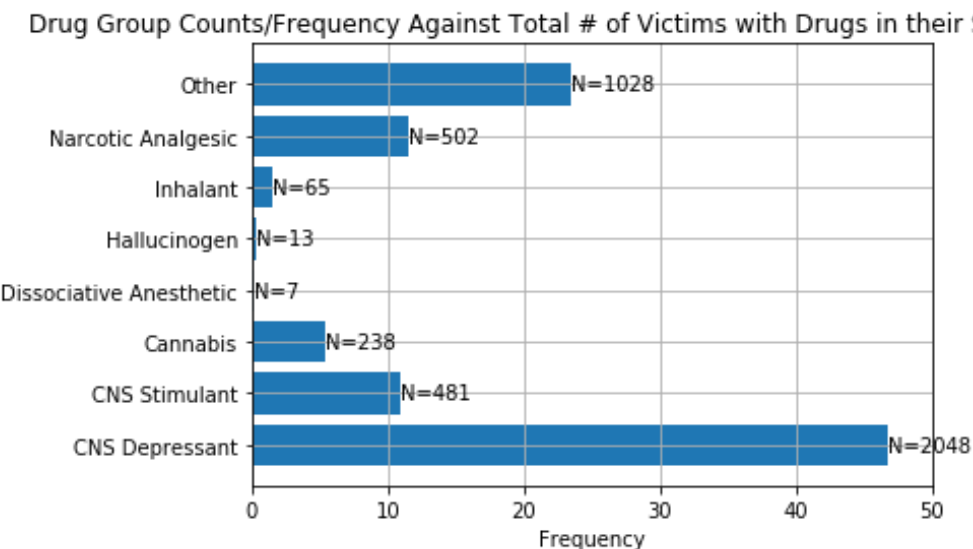
Data Analysis

- Total of 6827 suicide victims
 - Las Vegas has 3958
 - Denver has 1946
 - Milwaukee has 923
- Denver and Milwaukee's observations were collected from 1990-2014
- Las Vegas's observations were collected from 2003-2013
- Common Variables between Denver, Las Vegas, and Milwaukee : Case Number, Age, Race, and Cause of Death (COD)/Injury Type, and Toxic Substance
 - Common Variables between Denver and Las Vegas: Sex, Marital Status, Date of Death, and Location of Death
 - Variables for Denver: Case Number, Manner of Death, Date of Death, Age, Sex, Race, Marital Status, Place of Death, COD, Toxic Substance(s), Death Day of Week, HIV Positive
 - Variables for Las Vegas: Cause Number, Date of Death, Age, Sex, Race, Marital Status, Location of Death, COD, Toxic Substance(s)
 - Variables for Milwaukee: Case Number, Age, Race, Injury Type, COD, Toxic Substance(s)
- Variables addressed in exploratory analysis: Age, Sex, Race, City, Drug Group

Drug Data



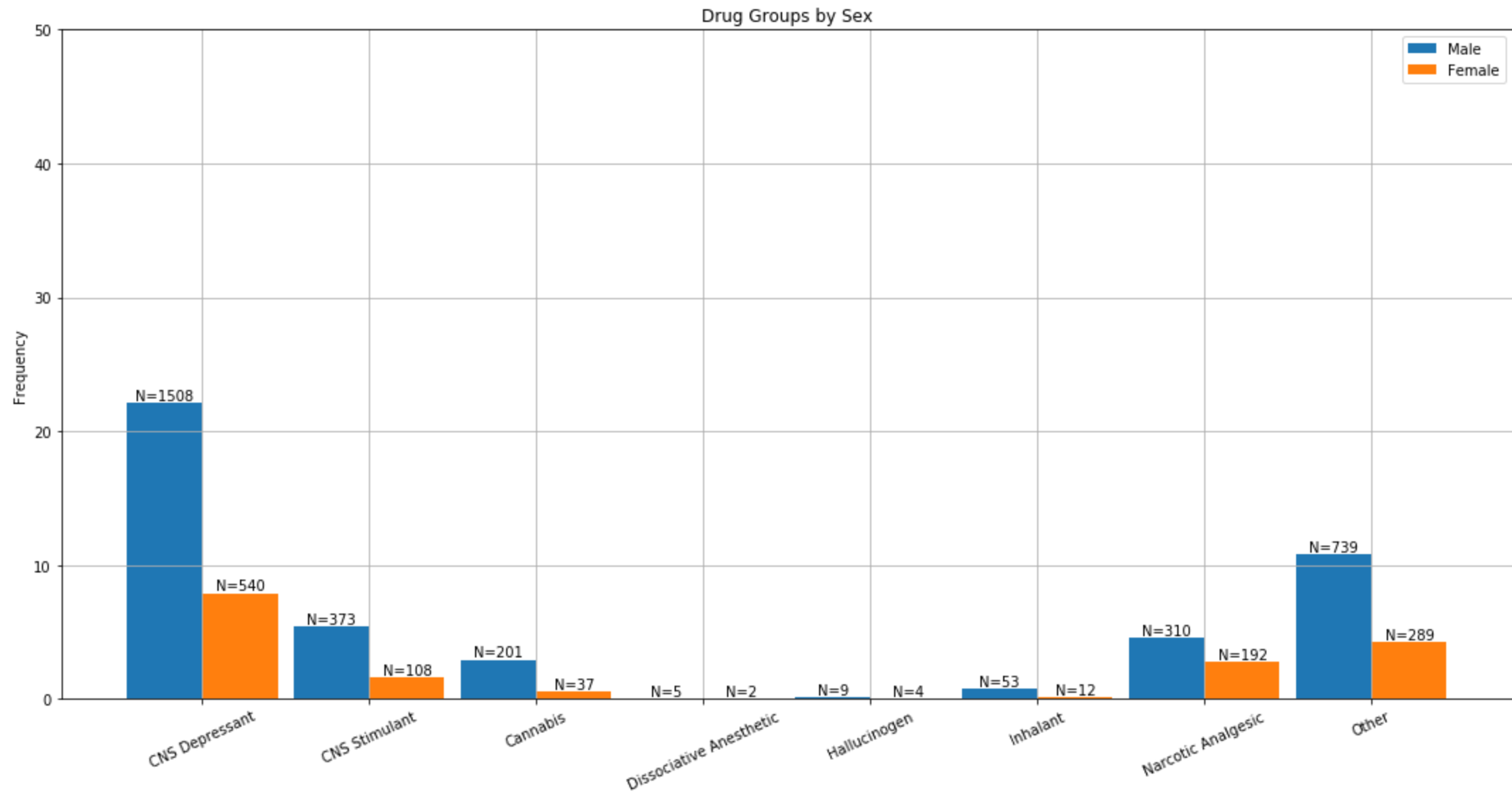
- 4019 victims w/out drugs in their system at TOD
- 2808 victims w/ dugs in their system at TOD
- 613 unique combinations of drugs
 - Victims can have multiple drugs in their system at the TOD (430)
 - Methadone, Fluoxetine, Diazepam
 - Acetaminophen, Trazodone, Bupropion, Diphenhydramine, Alcohol, and Sertraline

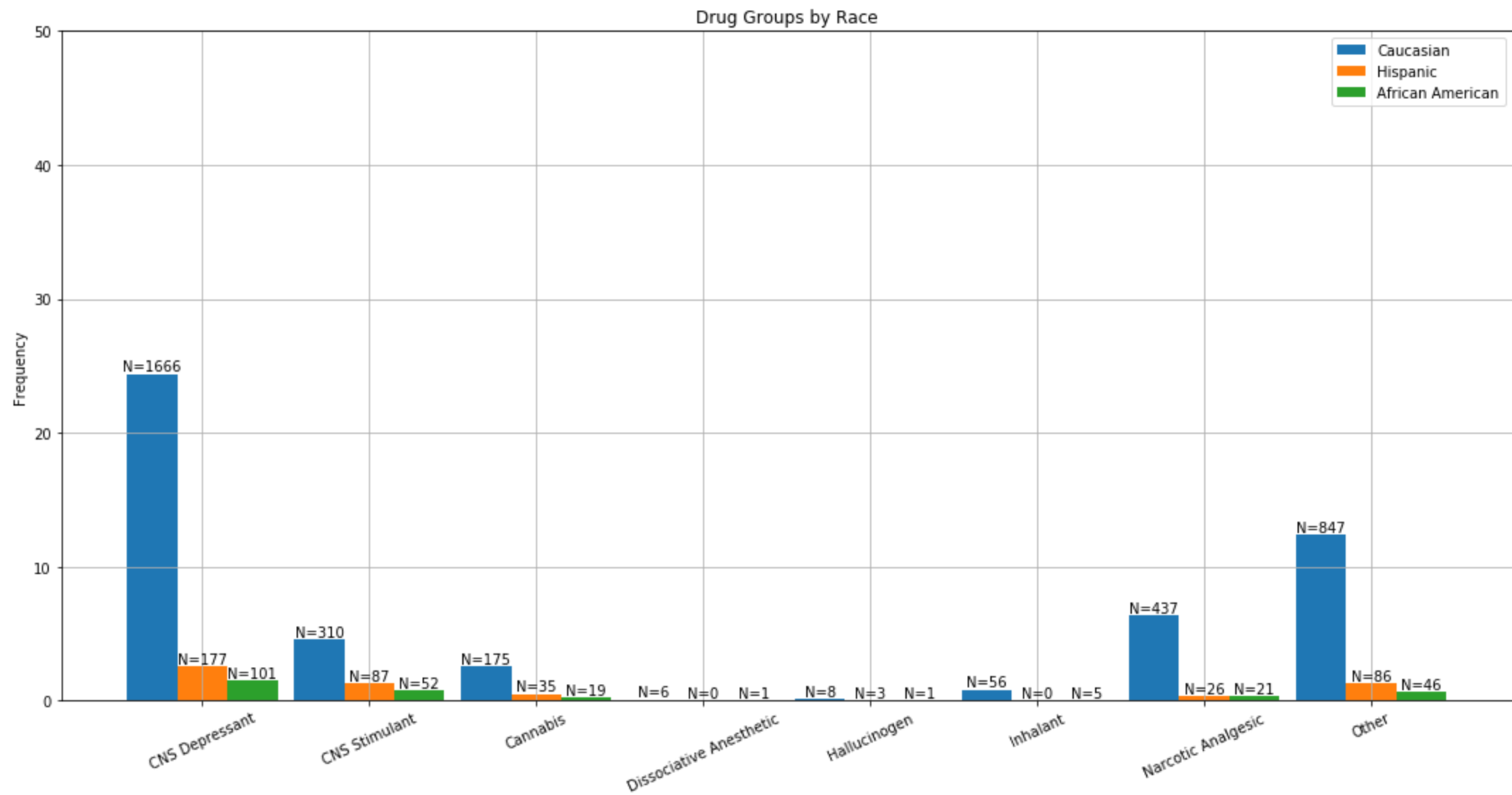


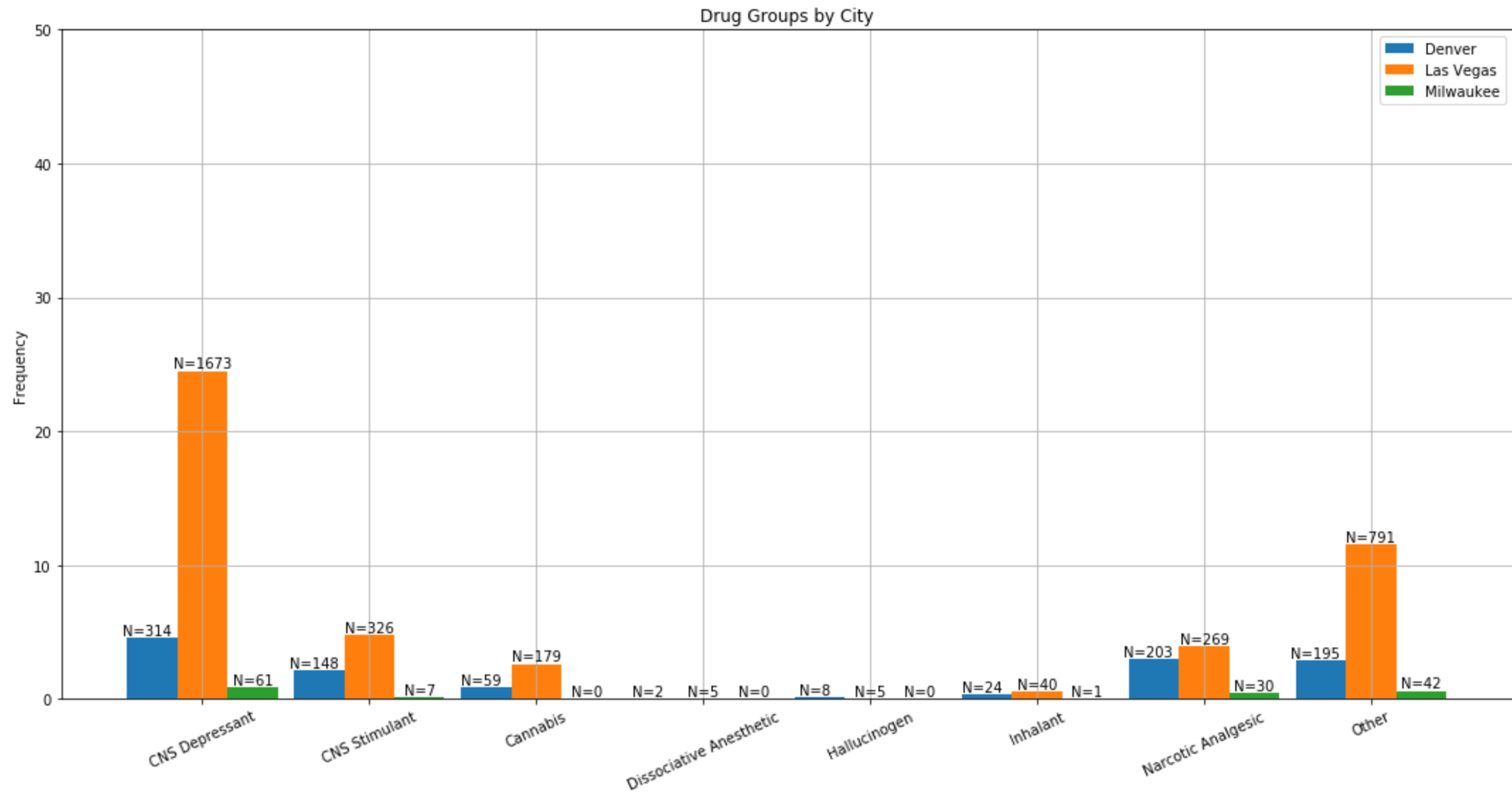
- Grouped into 8 Drug Categories
 - CNS Depressants: Alcohol, Anti-Depressants, Anti-Anxiety, Sleep Inducers
 - CNS Stimulants: Cocaine, Nicotine, Methamphetamine
 - Cannabis: THC, Cannabinoids, Synthetics
 - Dissociative Anesthetics: PCP, Ketamine
 - Hallucinogens: LSD, Ecstasy
 - Inhalants: Gasoline, Hair Spray, Paint Thinner, Anesthetic gases
 - Narcotic Analgesics: Opioids, Codeine, Morphine, Heroin
 - Other: Anticonvulsants, Antibiotics, Anticoagulants, Allergy Medications

- Samples larger than 5
- Permutation test for independence
- Chi-squared test statistic
- 99,999 permutations
- P-value from permutation distribution

Method for Statistical Testing

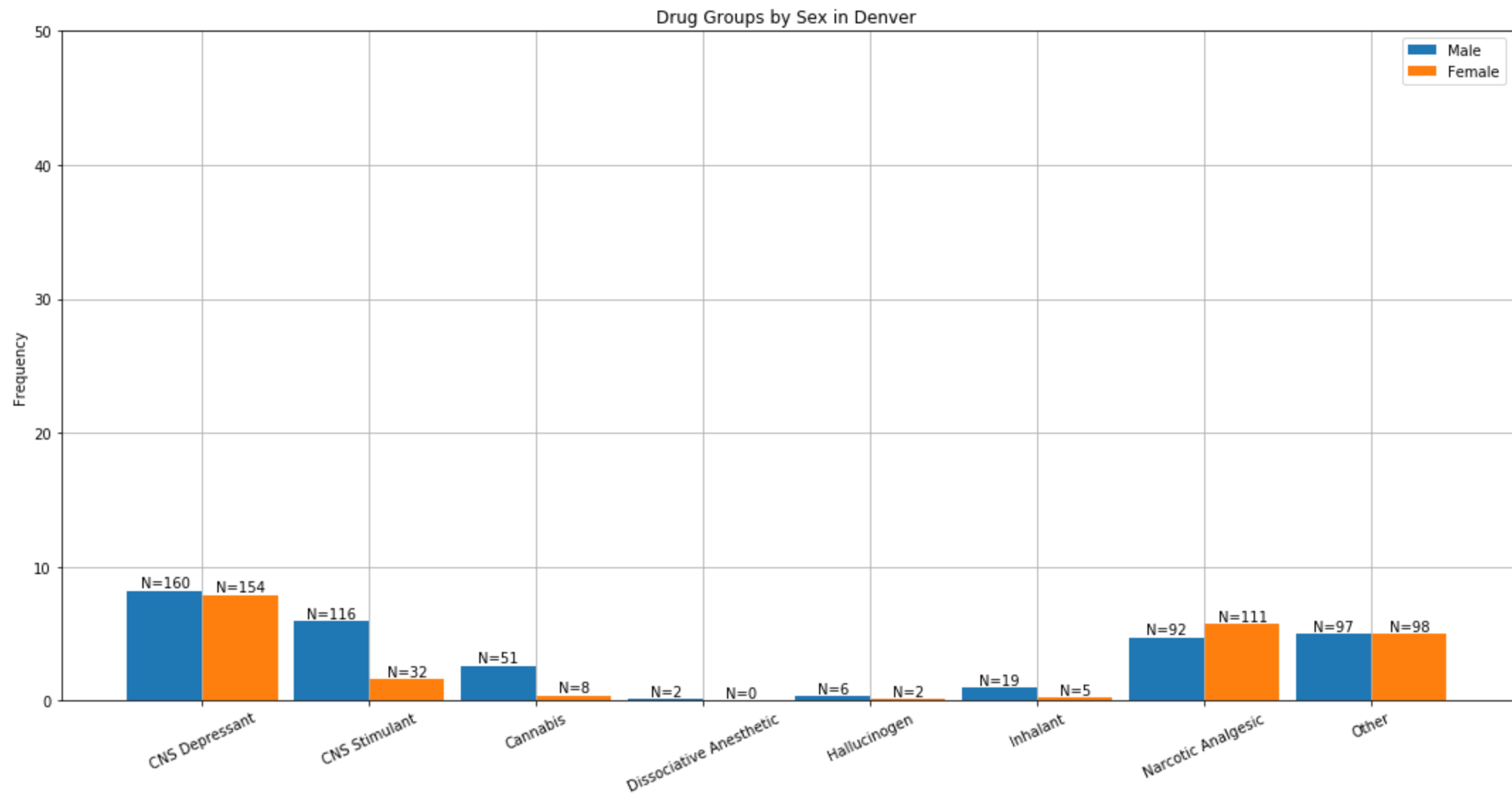


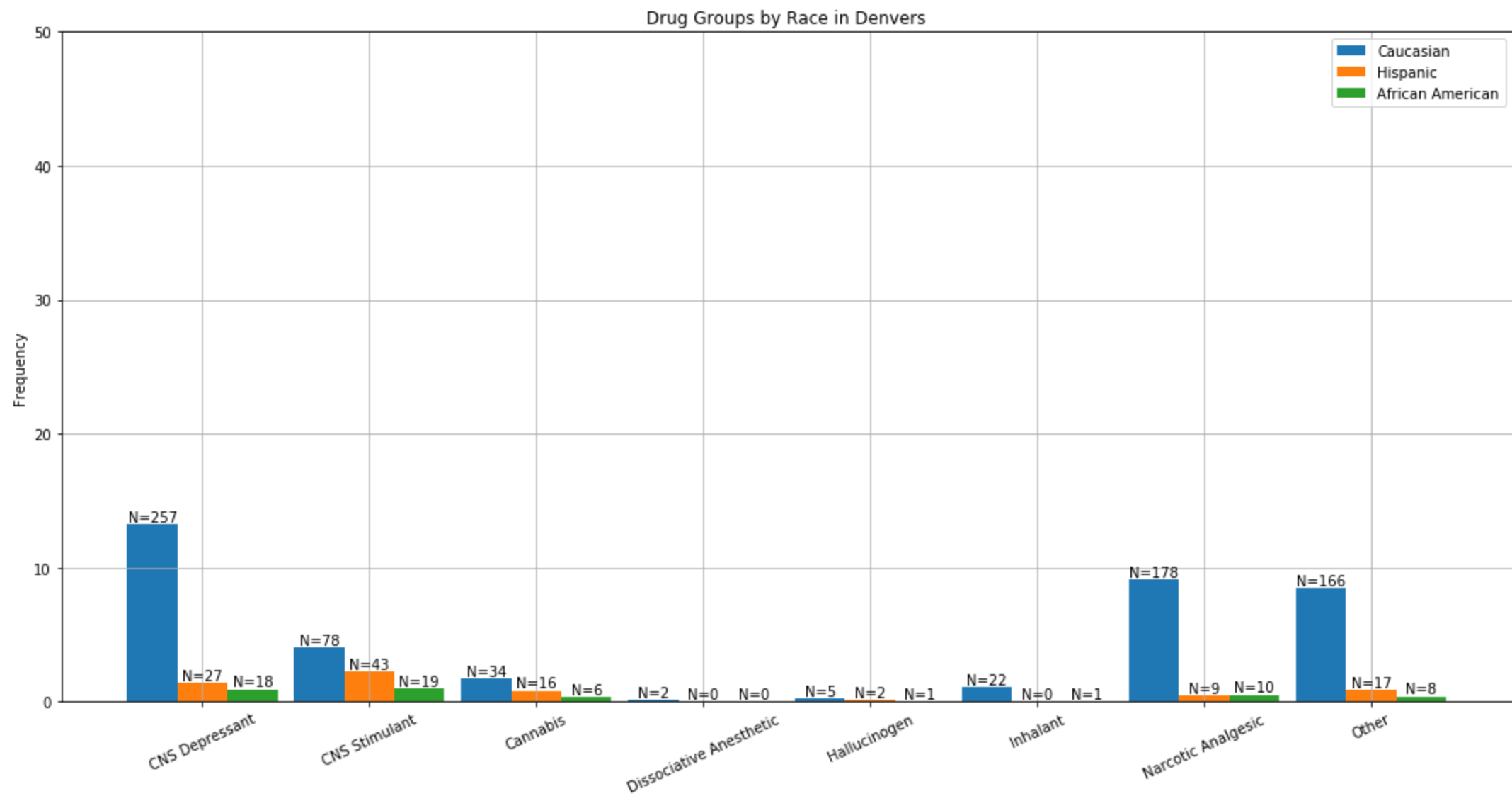




Exploratory Analysis

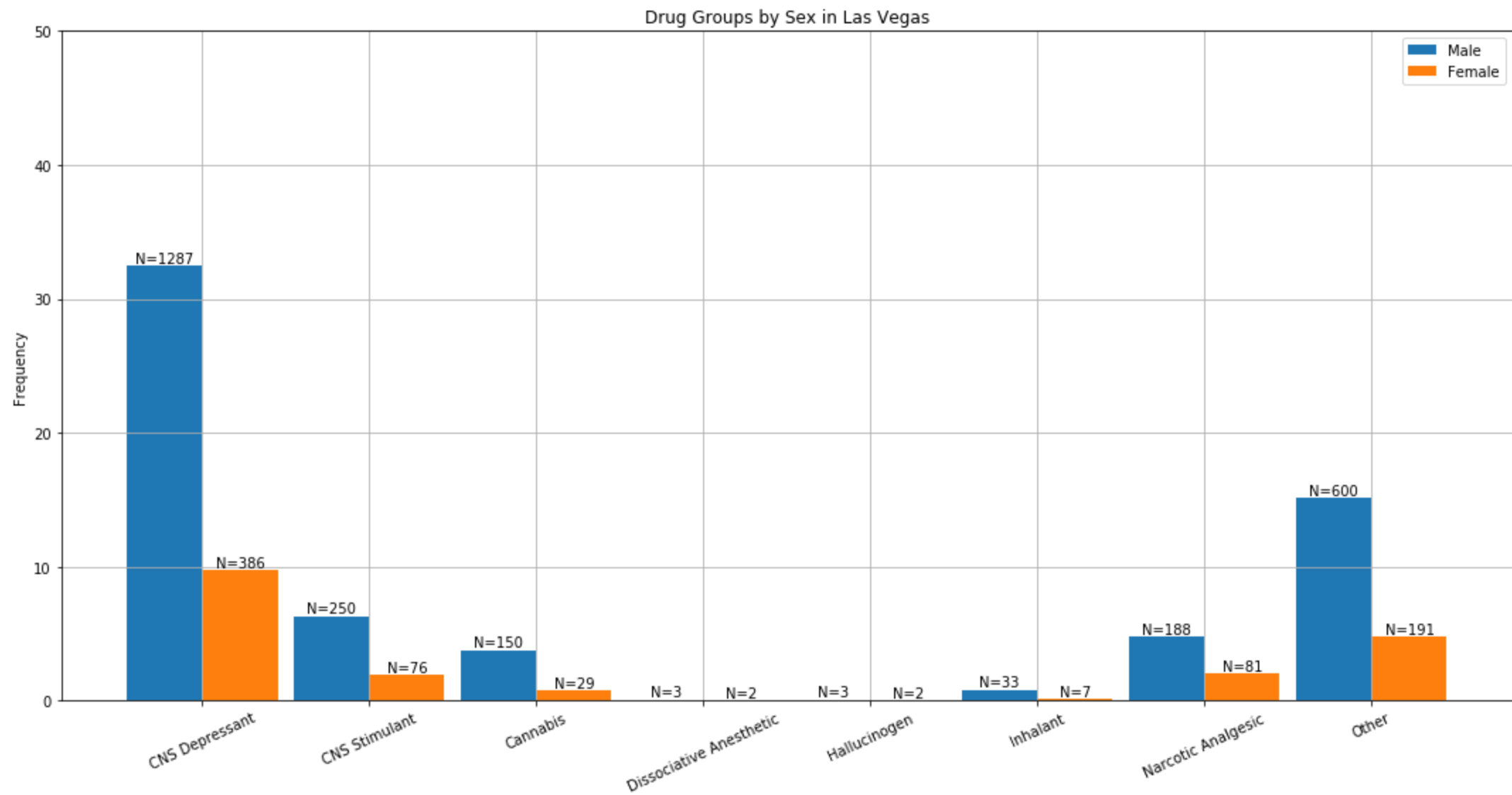
	Drug Groups	P-value
Sex	CNS Depressant, CNS Stimulant, Cannabis, Inhalant, Narcotic Analgesic, Other	.00001
City	CNS Depressant, CNS Stimulant, Narcotic Analgesic, Other	.00001
Race	CNS Depressant, CNS Stimulant, Cannabis, Narcotic Analgesic, Other	.00001

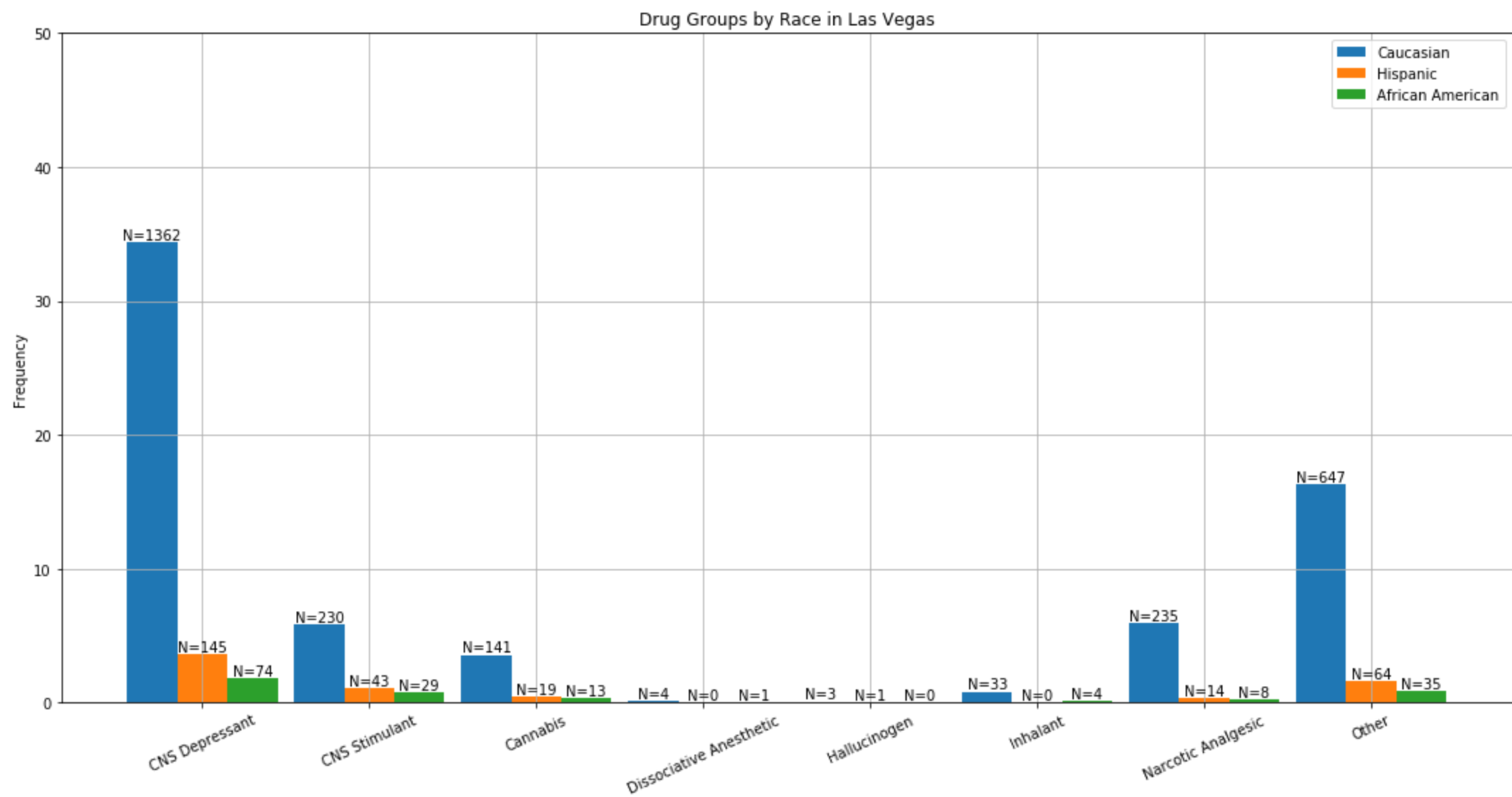




Exploratory Analysis

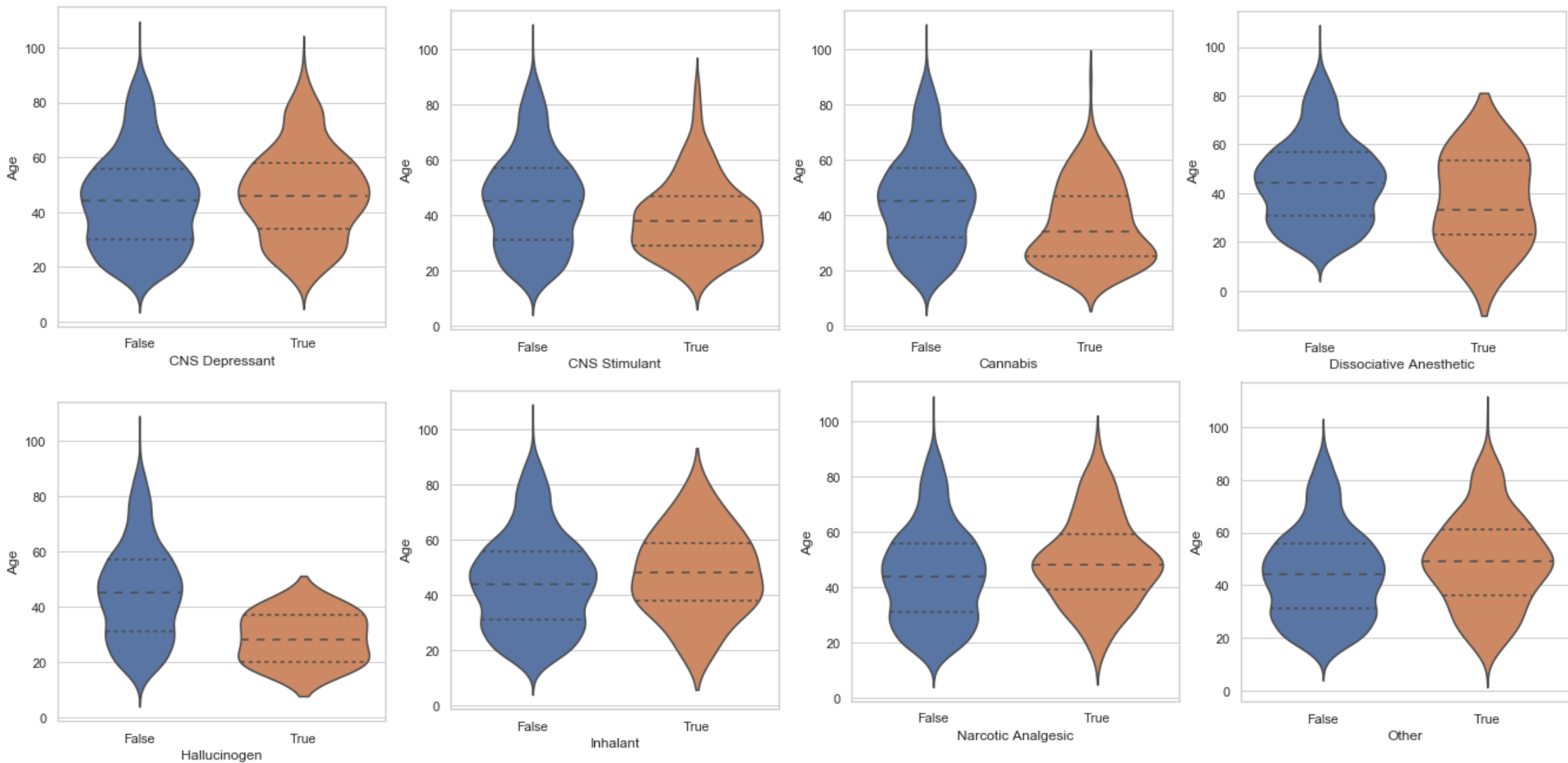
Denver	Drug Groups	P-value
Sex	CNS Depressant, CNS Stimulant, Cannabis, Narcotic Analgesic, Other	.00001
Race	CNS Depressant, CNS Stimulant, Cannabis, Narcotic Analgesic, Other	.00001





Exploratory Analysis

Las Vegas	Drug Groups	P-value
Sex	CNS Depressant, CNS Stimulant, Cannabis, Inhalant, Narcotic Analgesic, Other	.02294
Race	CNS Depressant, CNS Stimulant, Cannabis, Narcotic Analgesic, Other	.00006



Distribution of Age related to each Drug Category

Average Age

Total	45 yrs.
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Drug in system at TOD	46 yrs.
No Drug in system at TOD	44 yrs.

CNS Depressant	50 yrs.
CNS Stimulant	40 yrs.
Cannabis	37 yrs.
Dissociative Anesthetic	36 yrs.
Hallucinogen	29 yrs.
Inhalant	48 yrs.
Narcotic Analgesic	49 yrs.
Other	49 yrs.

Discussion

Extremely small
p-values

Enough evidence
to reject the null
hypothesis of no
association

Recommendations Moving Forward

Uniform data set

- Data sets having similar variables in common (e.g., Sex, Marital Status)
- Formal method of entering/receiving data

Different methods for grouping drugs

Other methods for forming the data where we avoid non-mutually exclusive variables

Looking at the relationship between drug data and cause of death, marriage, HIV Positive, etc.

Deliverables



WRITTEN PAPER



PYTHON & R CODE



CLEAN DATA SET



Questions

References & Acknowledgments

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http://rasbt.github.io/mlxtend/user_guide/evaluate/permutation_test/

<https://docs.scipy.org/doc/>

<https://www.theiacp.org/7-drug-categories>

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