Examining Drug Use Profiles

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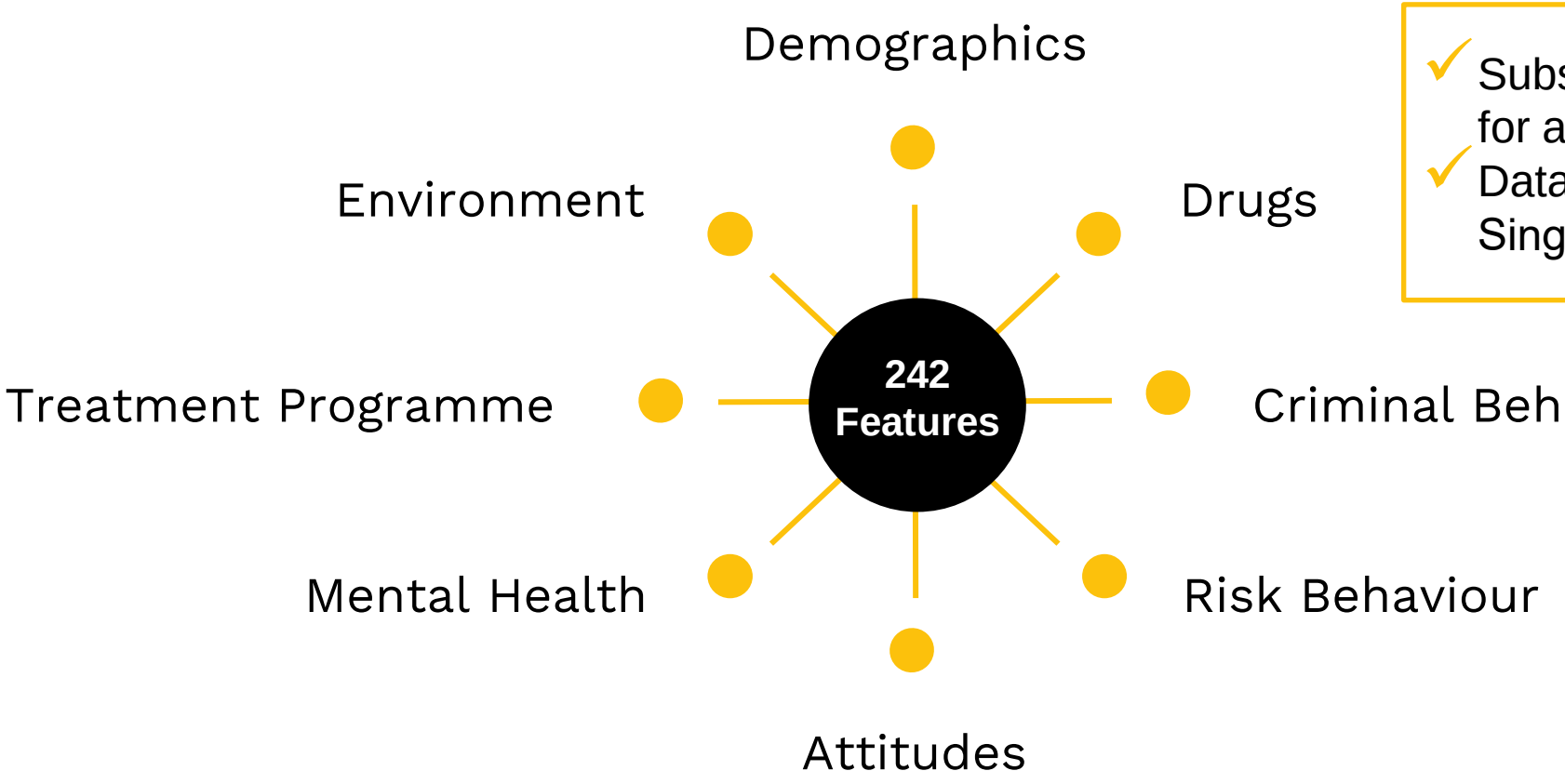
Background & Problem Statement

- The prevention of drug abuse is of key concern to Singapore. We take a tough but rehabilitative stance towards drug abuse.
- Need to understand **who** are the people abusing drugs and **what** are their needs so as so inform:
  1. **Policymakers** on appropriate measures to take to prevent new/repeat drug abuse cases
  2. **Prison officers & practitioners** on suitable ways to approach the rehabilitation of drug abusers

Thus, this project examines what are the different drug user profiles and their distinguishing features

Dataset Sourcing & Preparation

- USA National Survey on Drug Use and Health (NSDUH) by the Substance Abuse and Mental Health Services Administration (SAMHSA)
- Cohort survey data from 2015-2019 (*N* = 280K)



- ✓ Substantial data available for analysis (<10% missing)
- ✓ Data is generalisable to Singapore's context

Analysis Outline

01 Data Cleaning & Preparation

Missing values analysis & imputation,
Data transformation

02 EDA & Feature Engineering

Examined variable distributions,
Correlations within & between domains,
Created new features based on domain knowledge

03 Principal Components Analysis

Reduce dimensions/ no. of variables

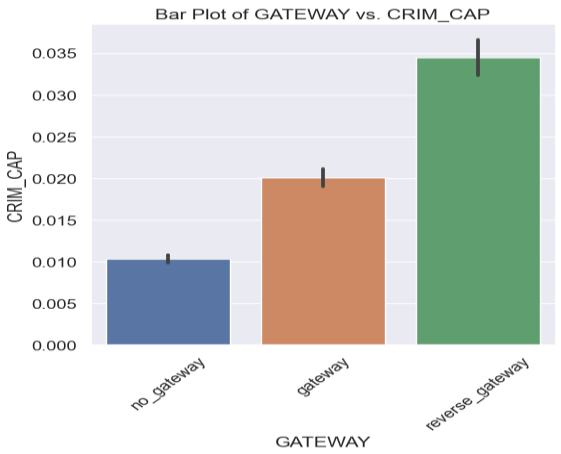
04 Cluster Analysis

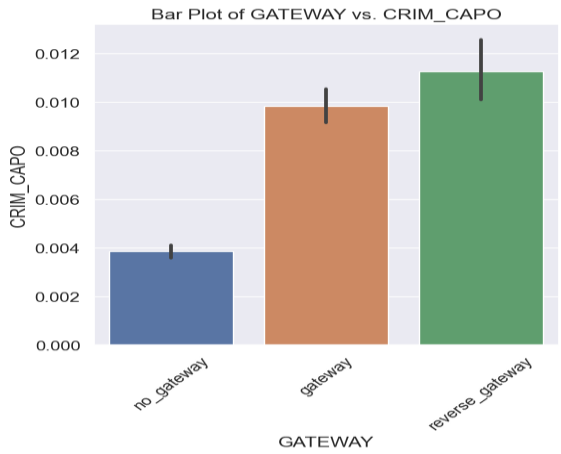
Kmeans,
DBSCAN,
Hierarchical Clustering

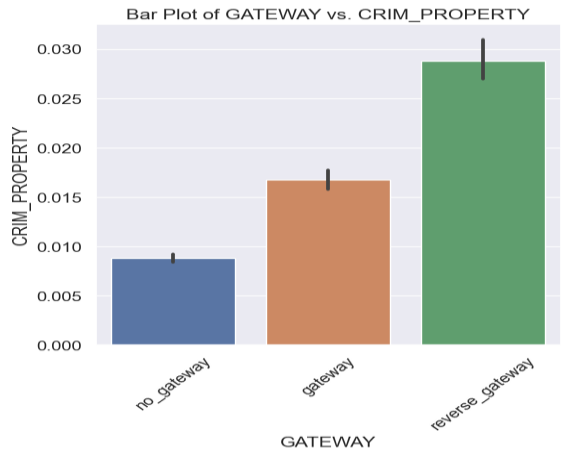
05 Predictive Modelling

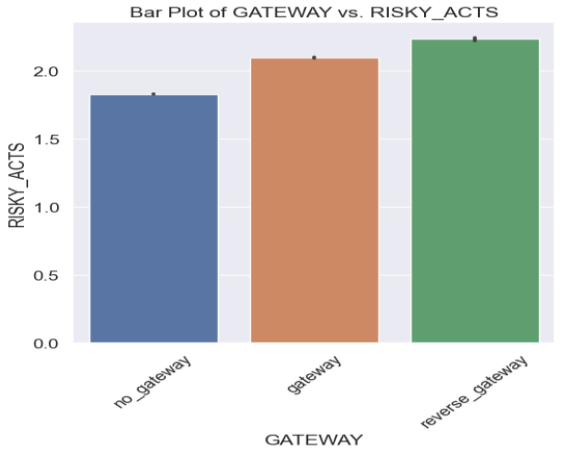
Random Forest,
SHAP analysis

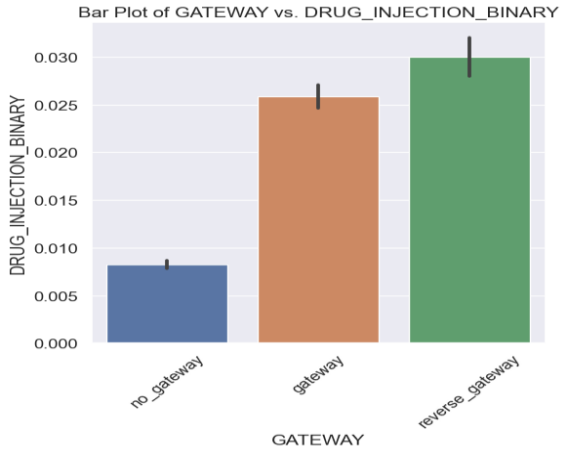
EDA Finding 1: People with reverse gateway drug use were more likely to have criminal history, engage in risky behaviour, and perceive less risk with drug use.

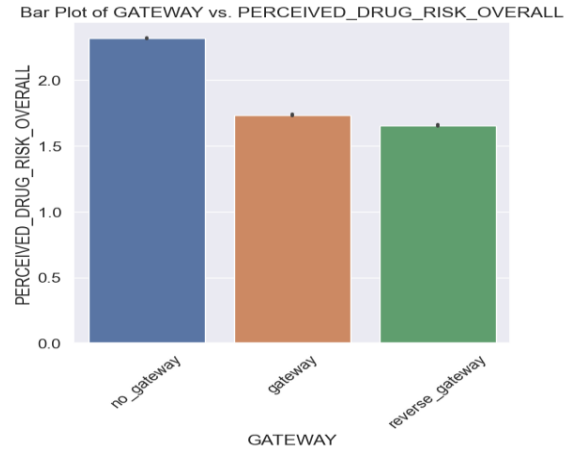








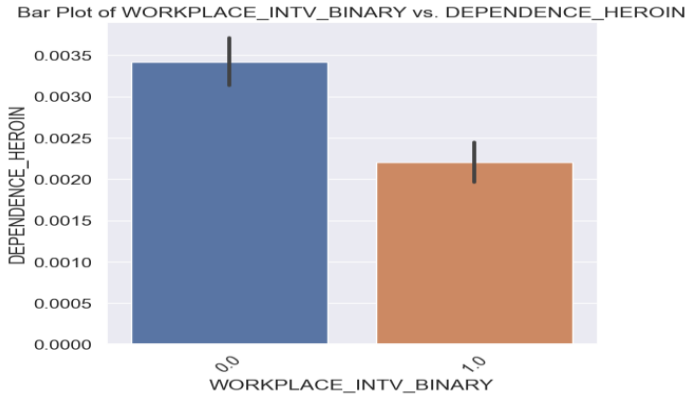


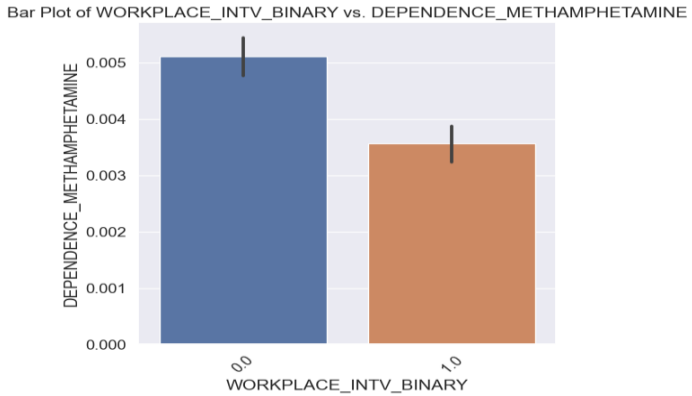


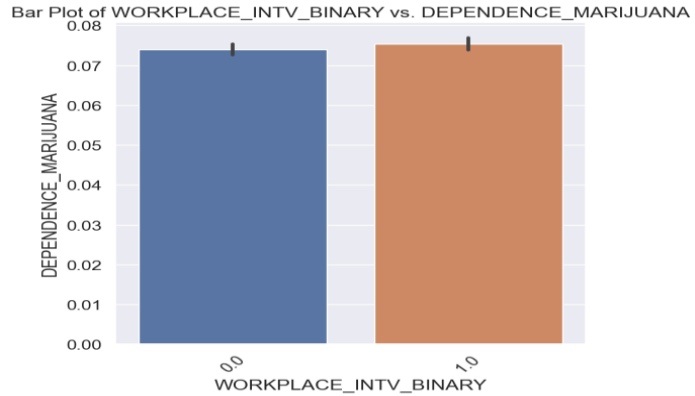
Gateway:
Progressive use from legal drugs to less severe illegal drugs to more severe illegal drugs

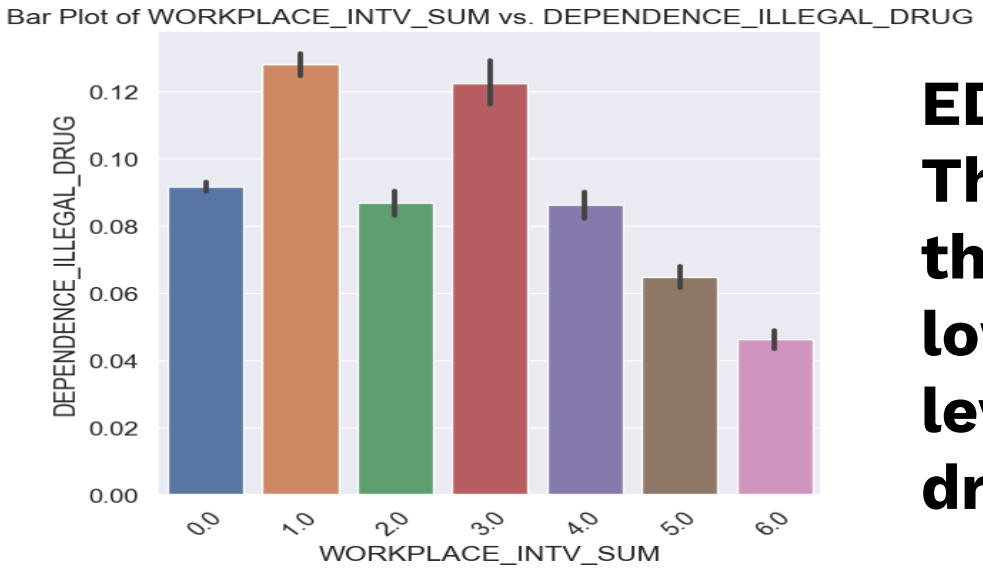
Reverse gateway:
Starting off with more severe drug use

EDA Finding 2a: Presence of workplace alcohol/drug use prevention and management policies was associated with lower drug dependence on heroin and methamphetamine, though not marijuana.



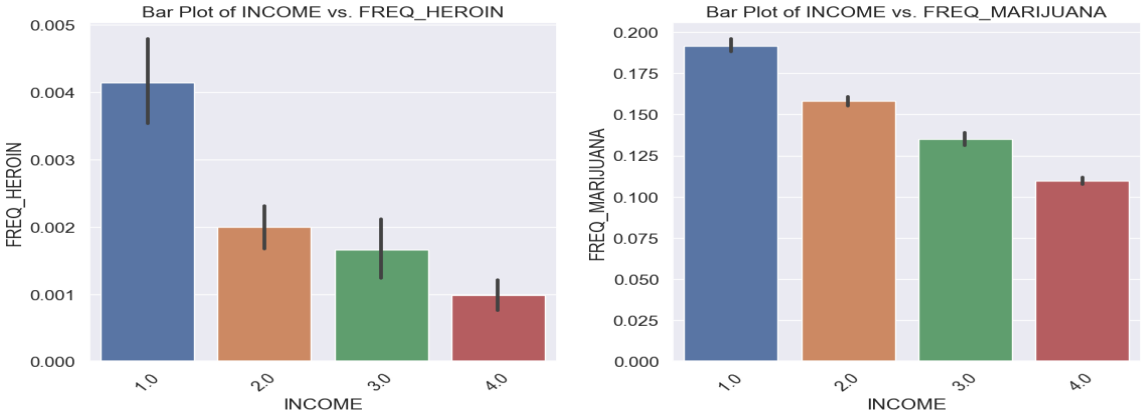


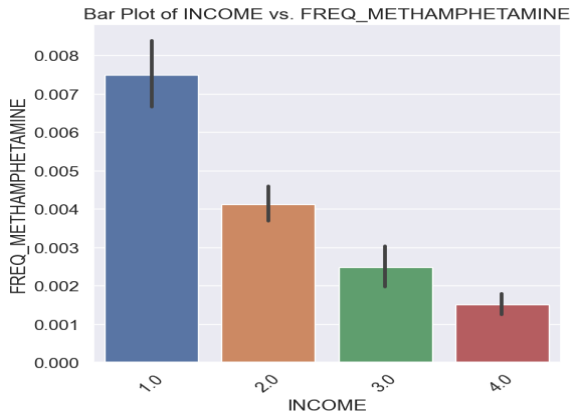




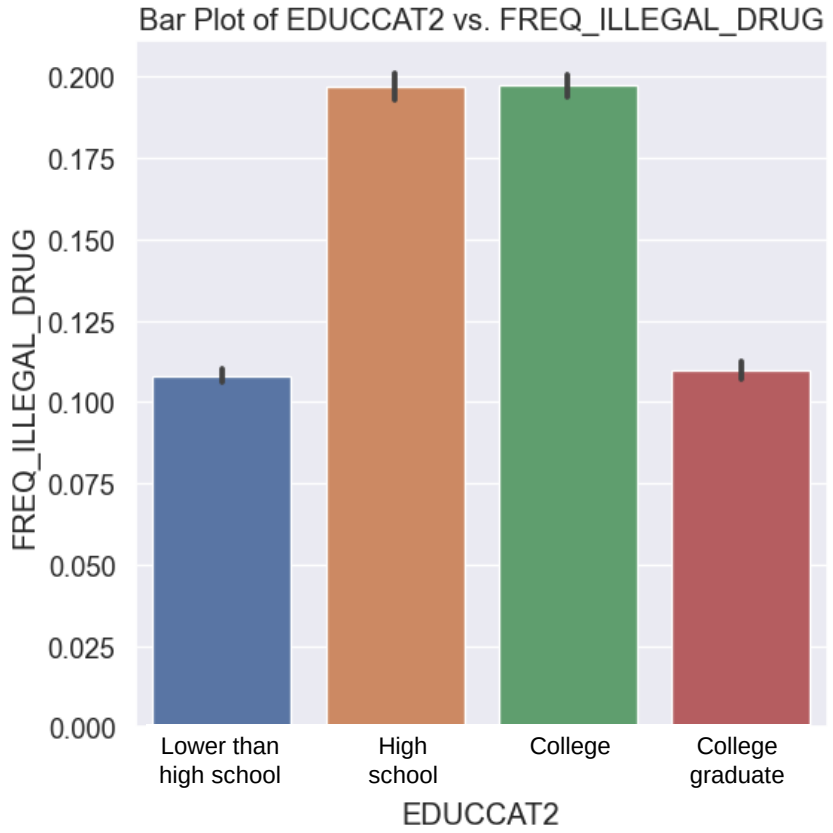
EDA Finding 2b:
The more interventions the workplace had, the lower the reported level of overall illegal drug dependence.

EDA Finding 3a: Higher income was associated with lower frequency of use for a given drug (heroin, methamphetamine, and marijuana).

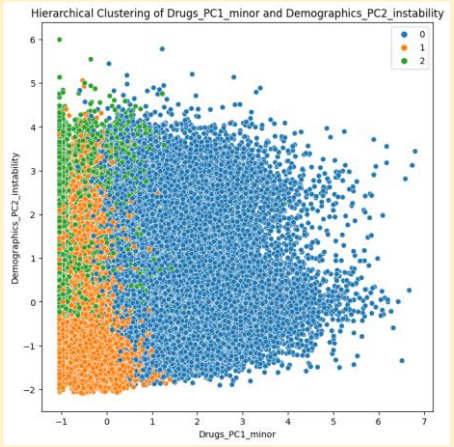
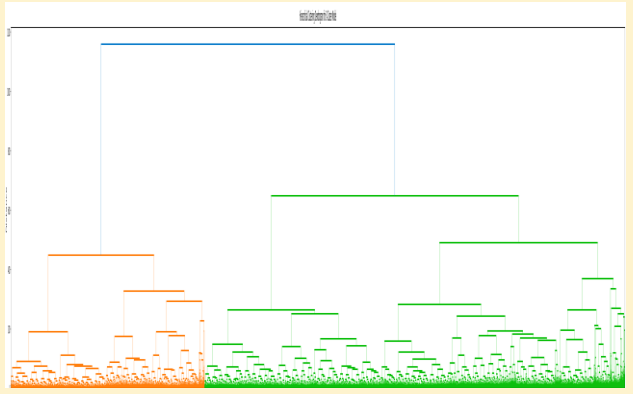




EDA Finding 3b: Higher frequencies of drug use were observed amongst those with high-school or college education levels.

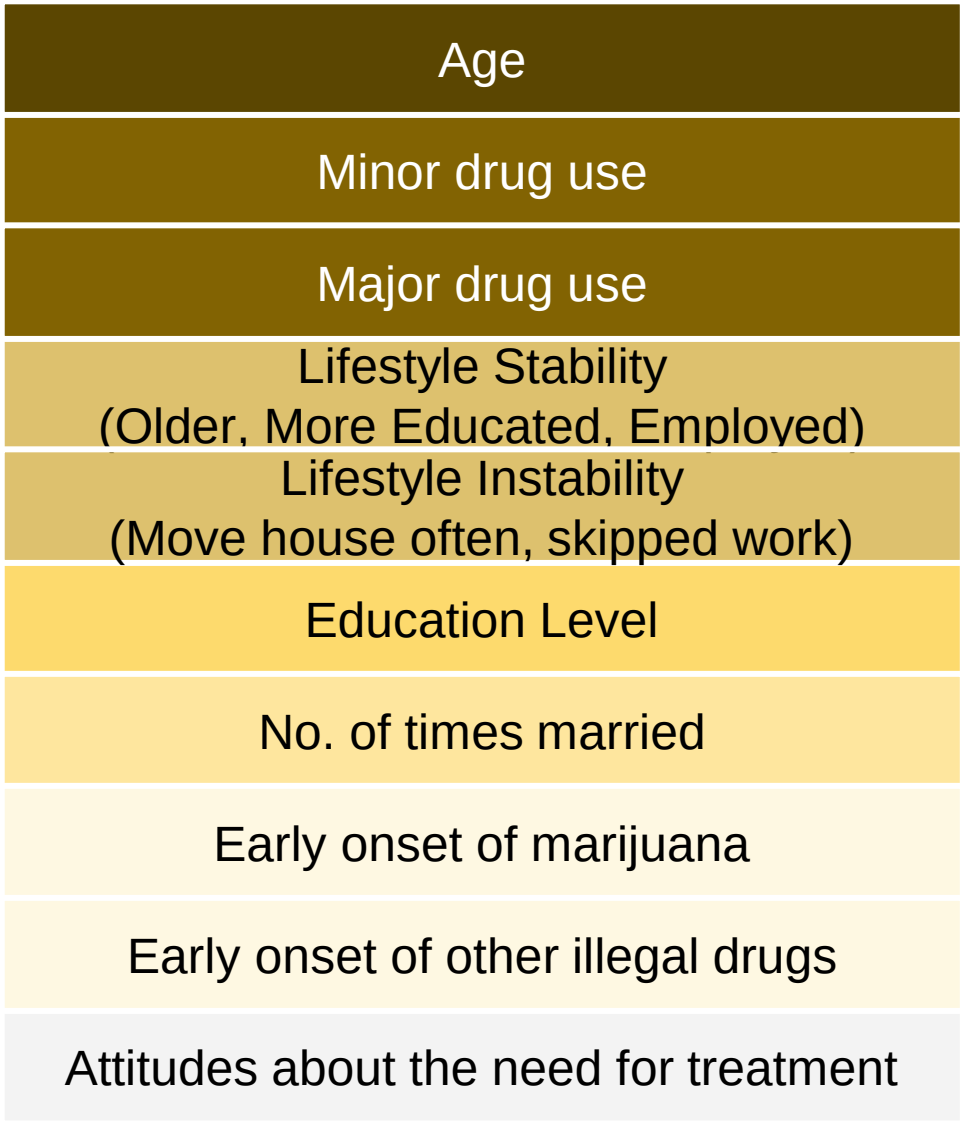


Cluster Analysis & Evaluation

	Kmeans	DBSCAN	Hierarchical
Parameters tested	• Distance (Euclidean, Manhattan) • No. of clusters to extract	• Epsilon • Minimum sample	• Threshold distance at which clusters should be merged
Silhouette Score	0.19 (3 clusters) 0.14 (4 clusters)	0.80 (2 clusters)	0.12 (3 clusters) 0.11 (4 clusters)
Visual Inspection of Clusters		All but one participant was grouped into the same group	

SHAP Analysis* showed that the following were important for the prediction of clusters overall

*After running random forest analysis to predict the 3 clusters derived from kmeans clustering



Cluster 1

- Minor drug use
- Age
- Early onset of marijuana
- Early onset of other illegal drugs
- Education Level
- Attitudes about the need for treatment
- Major drug use
- Lifestyle Stability (Older, More Educated, Employed)
- No. of times married
- Lifestyle Instability (Move house often, skipped work)

Cluster 2

- Age
- Education Level
- Lifestyle Stability (Older, More Educated, Employed)
- Minor drug use
- No. of times married
- Lifestyle Instability (Move house often, skipped work)
- Major drug use
- Early onset of other illegal drugs
- Early onset of marijuana
- Attitudes about the need for treatment

Cluster 3

- Age
- Minor drug use
- No. of times married
- Education Level
- Lifestyle Instability (Move house often, skipped work)
- Attitudes about the need for treatment
- Early onset of other illegal drugs
- Early onset of marijuana
- Major drug use
- Lifestyle Stability (Older, More Educated, Employed)

Conclusion & Recommendations

- This project highlighted some **potential drug use profiles to explore** further comprising the interactions between drug use patterns, criminal behaviour, risk behaviour, demographic profiles, and the impact of environment (e.g., workplace interventions).
- More in-depth work (e.g., literature review) can be done to **uncover/create new features** that can **better distinguish the clusters** and reduce the overlaps.
- **Local data** could be examined to determine if similar drug use patterns can be found in Singapore.

Thank you!