NSF_KBG_Written_Full_Report

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Data Description

- The data that we will be using comes from the Health Evaluation and Linkage to Primary Care (HELP) study which was a clinical trial for adults receiving in-patient care at a detoxification unit. If patients did not have a primary care physician then they were randomized with the goal of linking to primary medical care. This clinical research data was approved by Institutional Review Board of Boston University Medical Center and is housed in the mosaic RStudio package. For our research focus we will be utilizing the explanatory variables a1 (gender represented by 1 = male and 2 = female), age, homeless (related to homeless status with 0 = no and 1 = yes), and ces_d (center for epidemiologic studies depression measure 0-60). Our chosen variables will help us determine the potential correlation between these factors and the chosen first drug of choice (prim_sub) for an individual in the detoxification unit.

Research Question

- Do age, gender, depression score, and homelessness predict primary substance type?
- Exposures: age, a1 (gender represented by 1 = male and 2 = female), homeless (related to homeless status with 0 = no and 1 = yes), and ces_d (center for epidemiologic studies depression measure 0-60)
- Outcomes: The first substance an individual at the detoxification center has taken (prim_sub).

Variable Descriptions

- Depression levels (ces_d)

  - Depression levels in patients in the detoxification center are measured using the Center for Epidemiological Studies depression measure which ranges from 0-60. Patients with higher scores are deemed to have more depressive symptoms.

- Primary substance (prim_sub)
  - The primary substance in this data set refers to the first drug of choice for the patient in the detoxification center. The drugs are categorized by levels with 0 = none, 1 = alcohol, 2 = cocaine, 3 = heroin, 4 = barbiturates, 5 = benzos, 6 = marijuana, 7 = methadone, and 8 = opiates.

Relevant Literature

1. Understanding drug use patterns among the homeless population: A systematic review of quantitative studies Coombs et al. (2024)
   - Summary: Researchers conducted a systematic review of quantitative studies from 2007 and 2020 to assess the trends associated with substance abuse among the global adult homeless population. They found that alcohol was a highly popular primary drug abuse substance, but overtime there was an emergence in psychoactive substance use as well. Substance abuse was also found to be more common among men due to mental health and trauma stressors.
2. Differences in Drug Use among Persons Experiencing Homelessness According to Gender and Nationality Parés-Bayerri et al. (2023)
   - Summary: This paper focuses on a cross sectional study observing whether there is a statistical difference in drug consumption between homeless men and women in Spanish shelters. They also assess whether there is higher drug usage present among homeless Spanish nationals or immigrants. After conducting the study they found that there was not a statistically significant difference between men and women in their observed population in terms of their drug use. However, they found that the reason behind initial drug use did differ. Women tended to initially use drugs due to partner influence or lack of family affectivity while men initiated drug use because of personality or social factors. We found the difference in initial drug use between men and women to be very interesting especially as we examine whether factors like depression score influence an individual's primary substance in the HELP data.
   - Additionally, their investigation into whether or not there was a difference in drug risk among homeless Spanish nationals and immigrants found that Spanish nationals were statistically at a higher tendency of drug use compared to immigrants. This section of the research paper seemed compelling for future investigation of whether primary substance differs among homeless populations across the U.S depending

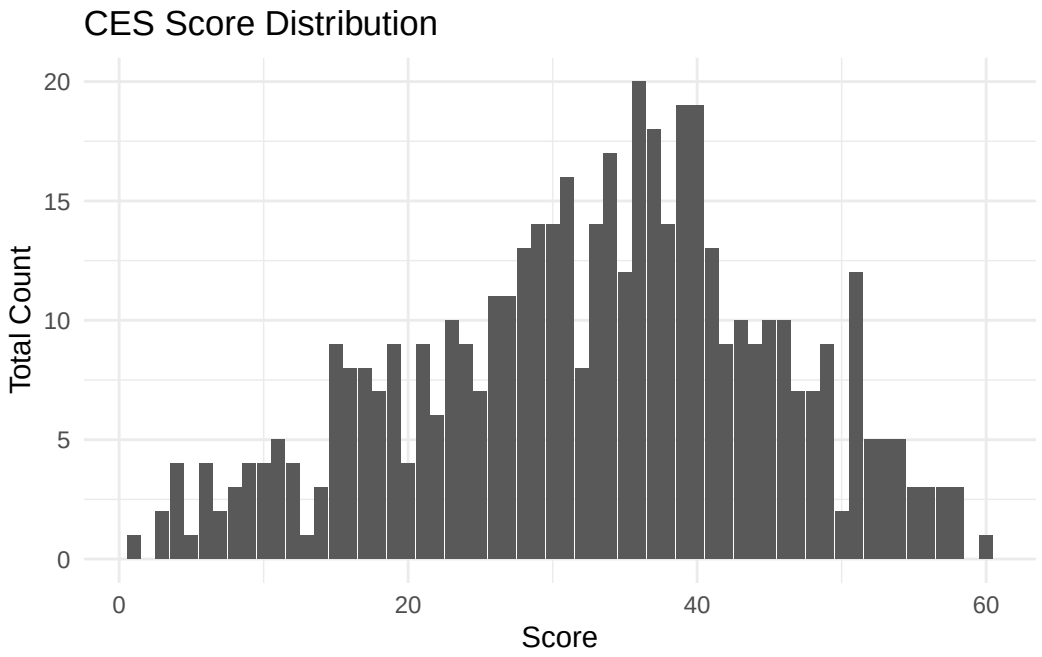
on their geographic location. The HELP data does not account for geographic information at this time so for now this is more of a future expansion of our research.

3. Homelessness and Gender: Differences in Characteristics and Comorbidity of Substance Use Disorders at Admission to Services Arnos and Acevedo (2022)

    1. Summary: Study focuses on examining the associations between homelessness, gender, the severity of substance use, and the presence of mental health comorbidity among individuals entering treatment for SUD. After conducting a logistic regression on the 2017 Treatment Episodes dataset they found that individuals experiencing homelessness that admit into services have a higher usage rate of cocaine and meth, have higher frequency of use, and have higher rates of mental health comorbidity. Among their population they also found that women experiencing homelessness were highly associated with having mental health comorbidities. This research study helped in answering a question that bubbled up from our reading of, "Differences in Drug Use among Persons Experiencing Homelessness According to Gender and Nationality" where they found different influential factors impact initial drug use between men and women. We believe that mental health could be a factor that influences primary substance use so finding a paper that observed higher mental health comorbidities among homeless women that use substances is helpful to our research.

Exploratory Data Analysis

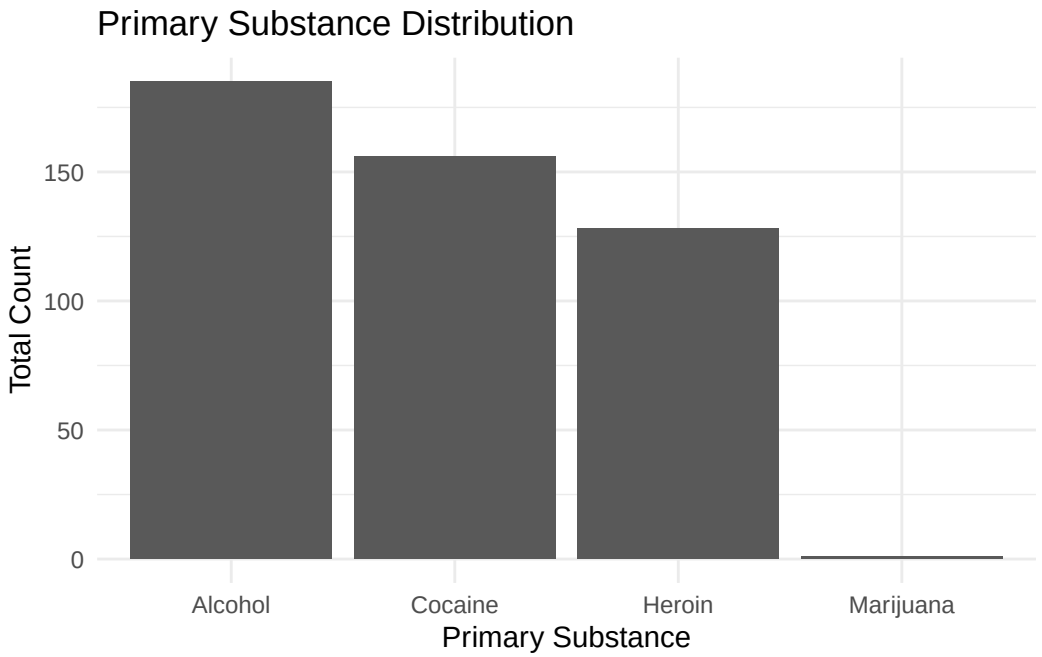
Depression levels (ces_d) general distribution count:




```
Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
1.00   25.00   34.00   32.86   41.00   60.00
```

- **Findings** The CES depression scores tend to peak towards the 30-40 score range. This indicates high frequency of mid-range depression symptoms among the population in the HELP data set. This mid-range score finding is also supported by the summary statistics for CES-D scores which indicate a mean of 32.86.

Primary substance (prim_sub) general distribution count:

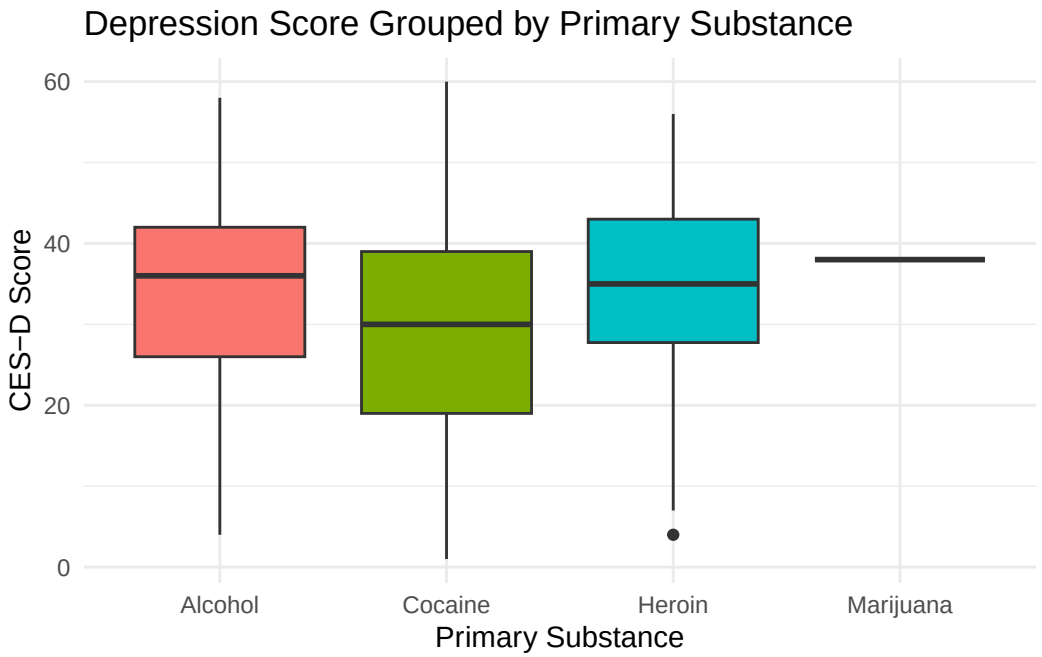



```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  1.000   1.000   2.000   1.887   3.000   6.000
```

```
# A tibble: 4 x 2
# Groups:   prim_sub [4]
  prim_sub     n
     <dbl> <int>
1        1   185
2        2   156
3        3   128
4        6     1
```

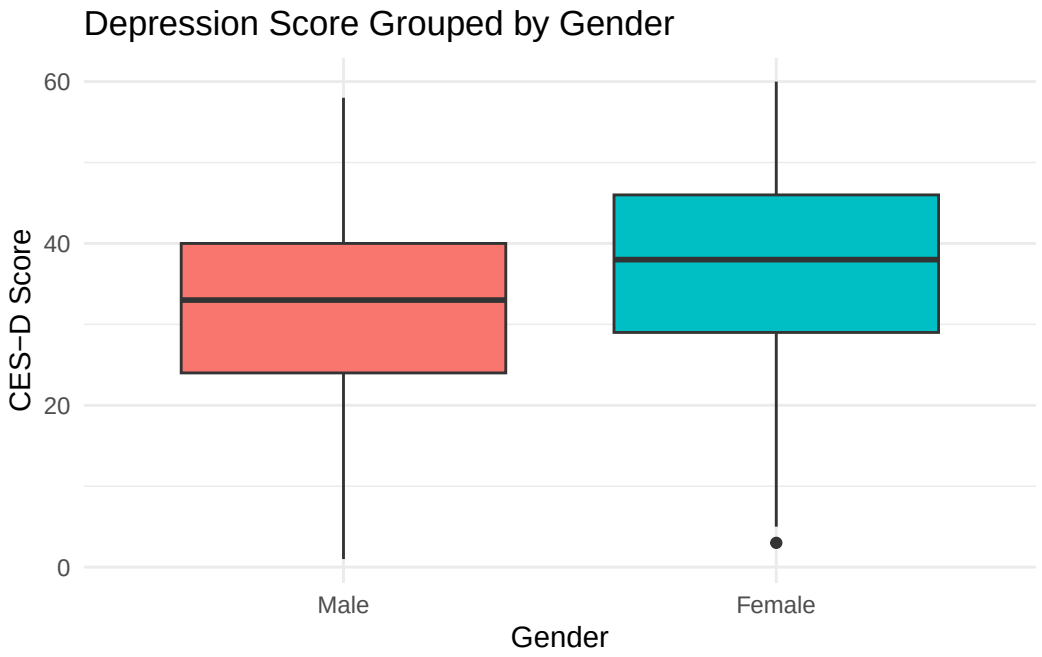
- **Findings:** The primary substance with high usage rates among the HELP population is alcohol with the lowest being marijuana. Further information on the exact distribution counts can be found in the summary count of each primary substance group with alcohol having 185 users and marijuana only having 1. It should also be noted that responses to "None", "Barbiturates", "Benzos", "Methadone", and "Opiates" were left off because no patients in the detoxification center responded to those options as their primary substance.

Depression Score in association with Primary Substance:



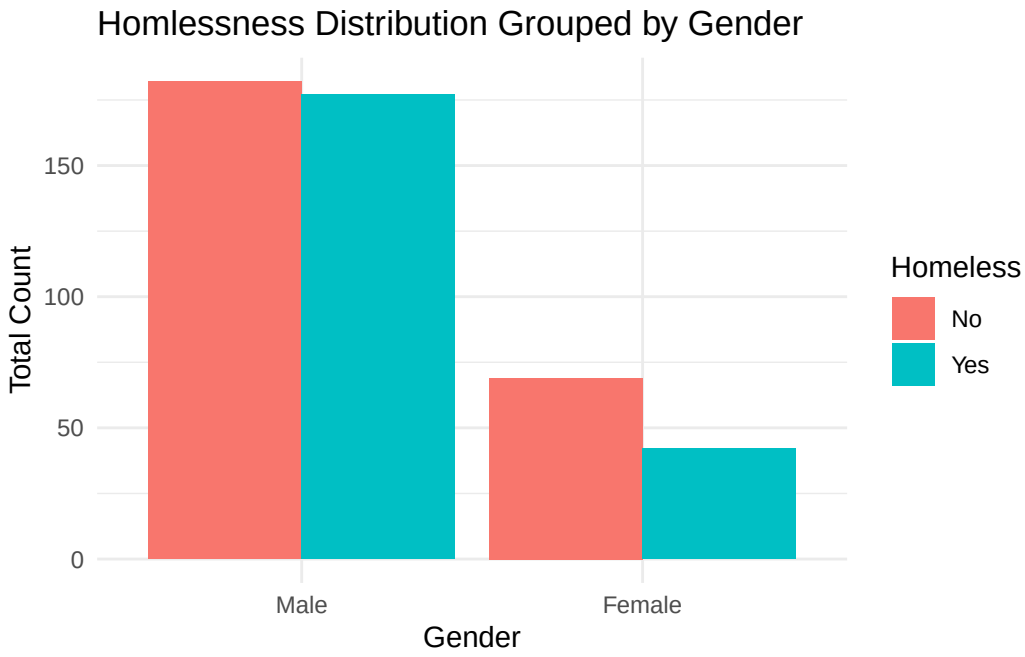
- **Findings:** After grouping depression score by the different primary substances used by the detoxification patients we found that alcohol tended to have a higher mean depression score (>35) compared to cocaine and heroine. We also saw that in terms of variance cocaine had a wider range of variance extending to the highest score of 60 indicating a high instance of depression symptoms.

Depression Score in association with Gender:



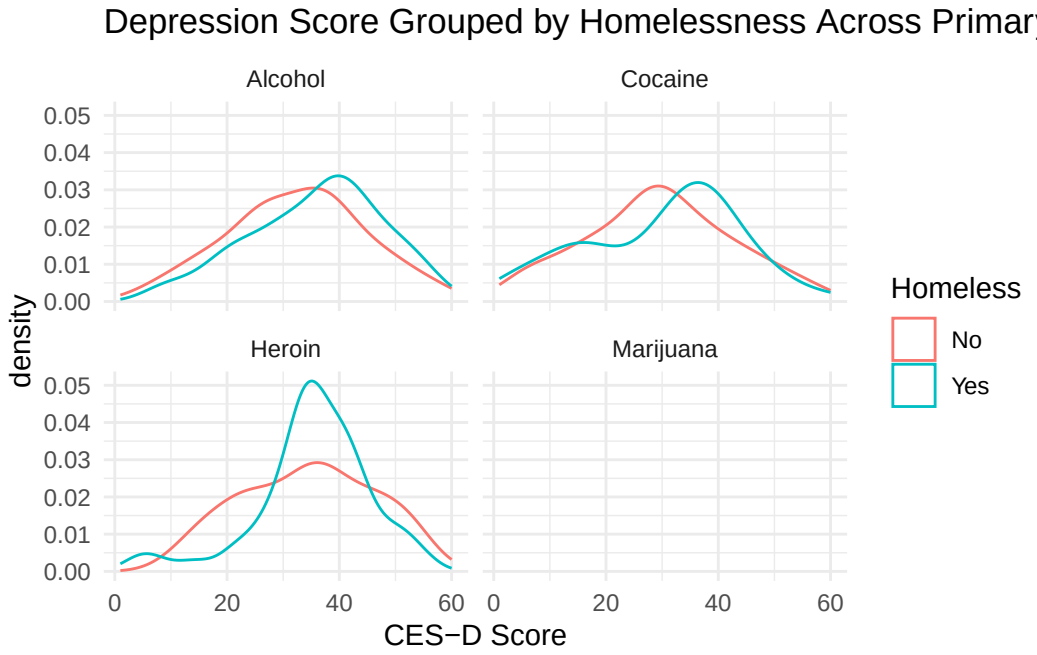
- **Findings:** When evaluating the depression levels of men versus women in the detoxification center we found that women had a higher depression scores overall. Women had a mean score of >35 compared to men who scored ~30.

Homelessness in association with Gender:



- **Findings:** From this bar plot we can see that for both categories of homelessness men tend to be more represented overall in the HELP data set. However, within the male population there is a close tie between those that are homeless and those that are not. For women this is not the case. Women who are not homeless are at a higher proportion than those that are in the detoxification center.

Depression Score and Homelessness grouped by Primary Substance:



- **Findings** This density chart shows the interaction between homelessness and depression score across different primary substances. From the plot we found an interesting relationship among the heroin drug use group. Detoxification patients who use heroin and are homeless tend to have a higher population representation in scoring a mid-high range depression score (30-40). Meanwhile, those that used heroin and were not homeless were more spread across 20-60.

Introduction

Substance abuse and use disorders have been a major public health concern in the United States especially among those that have faced homelessness and mental health challenges. Prior research has found patterns associated with an individuals substance choice, though the research can be mixed in results. A systemic review focused on understanding drug use patterns from 2007 and 2020 found that alcohol still remains the most commonly used substance among individuals experiencing homelessness with psychoactive drug use increasing overtime (Coombs et al., 2024). They also found that substance abuse was generally more common among men due to mental health and trauma stressors (Coombs et al., 2024). In relation to gender, studies have mixed results on whether gender as a significant association with drug use. A study conducted in a Spanish shelter assessed whether there was a statistical difference in drug consumption between homeless men and women. They found that there was not a statistically significant difference between men and women in their observed population in terms of their drug use. However, they did find that reason for inital drug use did differ with women starting

due to partner influence or lack of family affectivity while men initiated drug use because of personality or social factors (Parés-Bayerri et al., 2023). Following the new thread of mental health comorbitity with drug use among those facing homelessness, a third and final study found that individuals experiencing homelessness that admit into services have higher frequency of drug use, and have higher rates of mental health comorbidity. Women in this population were also found to be highly associated with having mental health comorbidities tied with their drug use (Arnos & Acevedo, 2023).

Based on this prior research our primary question then becomes:

Does age, gender, depressive symptom scores, and homelessness predict primary substance type among adults receiving inpatient detoxification care?

To address this question, we will utilize multinominal logistic regression which is an extension of binary logisitc regression due to our outcome of primary substance choice being nominal and non-ordinal (Bilder, 2015). The data that will be used in this analysis comes from the Health Evaluation and Linkage to Primary Care (HELP) study which was a clinical trial for adults receiving in-patient care at a detoxification unit. If patients did not have a primary care physician then they were randomized with the goal of linking to primary medical care. This clinical research data was approved by Institutional Review Board of Boston University Medical Center and is housed in the mosaic RStudio package. For our research focus we will be utilizing the explanatory variables a1 (gender represented by 1 = male and 2 = female), age, homeless (related to homeless status with 0 = no and 1 = yes), and ces_d (center for epidemiologic studies depression measure 0-60). Our chosen variables will help us determine the potential correlation between these factors and the chosen first drug of choice (prim_sub) for an individual in the detoxification unit. Note that age and ces-d scores were treated as continuous variables while gender and homelessness were treated as categorical variables.

Methodological Extension: Multinominal Logistic Regression

After conducting our exploratory analysis we found that alcohol was the most frequently reported primary substance followed by cocaine and heroin. The other substance response options of none, barbituates, benzos, methadone, and opiates were not reported (n = 0). Marijuana was also only reported once among the detoxification center population. Due to this sparsity the analysis was restricted to individuals that reported alcohol, cocaine, and heroin as their primary substance. Given the non-ordinal and multi-category nature of the primary substance outcome, a multinominal logistic regression model was therefore selected for our analysis (Bilder, 2015). Additionally, if binary logistic regression had been used in this instance it would have caused all substances to be collapsed into a single category which would prevent a deeper understanding of the substance-specific relationships between the explanatory variables.

In a multinominal logistic regression model, a base-line category must be assigned to compare the association between age, gender, ces-d depression score, and homelessness status with choice of primary substance use. Our model utilizes alcohol as the base-line reference category due to its high response prevalence (n = 185) among individuals in the detoxification center compared to cocaine (n = 156) and heroin (n = 128).

To account for only alcohol, cocaine, and heroin in the regression the HELP data was cleaned by dropping all unnecessary category outcomes from the primary substance variable:

```
[1] "Alcohol" "Cocaine" "Heroin"
```

```
Alcohol Cocaine  Heroin
    185     156     128
```

The final cleaned dataset now only includes individuals with the primary substances of alcohol (n = 185), cocaine (n = 156), and heroin (n = 128), for a total sample size of N = 469.

Next, the multinominal logistic regression model can be set up to examine the association between age, gender, homelessness status, and ces-d depression score with primary substance while using alcohol as the reference. Let Y_i denote the primary substance for detoxification patient i. Since alcohol is being treated as the reference category each remaining substance $j \in \{\text{cocaine, heroin}\}$ will be modeled as:

$$log(\frac{P(Y_i = j)}{P(Y_i = alcohol)}) = \beta_{0j} + \beta_{1j}(age_i) + \beta_{2j}(gender_i) + \beta_{3j}(homeless_i) + \beta_{4j}(ces - d_i)$$

This model creates an odds ratio comparison between alcohol and cocaine or heroin as it relates to the explanatory variables to test associations.

To conduct multinominal logistic regression the `multinom()` function was used from the `nnet` package (Bruin, 2011).

```
# weights:  18 (10 variable)
initial  value 515.249163
iter  10 value 477.910750
final  value 475.046601
converged
```

```
Call:
multinom(formula = prim_sub_label ~ gender_label + age + home_label +
    ces_d, data = filtered_rehab)
```

```
Coefficients:
        (Intercept) gender_labelFemale         age home_labelYes        ces_d
Cocaine    3.482882          0.5151278 -0.06541351    -0.6770641 -0.033279411
Heroin     2.809829          0.2613825 -0.08280411    -0.7872552  0.003195923

Std. Errors:
        (Intercept) gender_labelFemale        age home_labelYes       ces_d
Cocaine   0.6634623          0.2789489 0.01552075     0.2318375 0.009526877
Heroin    0.6985494          0.2942801 0.01668220     0.2450201 0.010339152

Residual Deviance: 950.0932
AIC: 970.0932
```

The resulting fitted log-odds equations were: Cocaine vs Alcohol

$$log(\frac{\hat{\pi}_{cocaine}}{\hat{\pi}_{alcohol}}) = 2.967828+0.5151615(gender)-0.06541560(age)-0.6770603(homeless)-0.03327985(ces-d)$$

Heroin vs Alcohol

$$log(\frac{\hat{\pi}_{heroin}}{\hat{\pi}_{alcohol}}) = 2.548504+0.2613997(gender)-0.08280548(age)-0.7872547(homeless)+0.00319592(ces-d)$$

These resulting coefficients are the changes in the log odds of choosing cocaine or heroin versus alcohol while holding all explanatory variables constant. The negative age coefficients in both models indicate that for each additional year there is an associated lower log odds of choosing cocaine versus alcohol and heroin versus alcohol. Homelessness shows a similar relationship with a "yes" response to being homeless is associated with lower log odds of cocaine and heroin use versus alcohol. However, CES-D is only negative for cocaine and not heroin indicating that depressive symptom scores are more strongly associated with decreased odds of cocaine use.

An ANOVA Type II test was then used to assess whether each explanatory variable is associated with each primary substance.

```
Analysis of Deviance Table (Type II tests)

Response: prim_sub_label
             LR Chisq Df Pr(>Chisq)
gender_label    3.437  2  0.1793288
age            33.112  2  6.453e-08 ***
home_label     13.270  2  0.0013139 **
ces_d          17.450  2  0.0001625 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

From the resulting deviance table it can be noted that age ($LR_{\chi^2} = 33.112$, $p = 6.453e-08$), homelessness ($LR_{\chi^2} = 13.270$, $p = 0.0013139$), and CES-D ($LR_{\chi^2} = 17.450$, $p = 0.0001625$) are significantly associated with primary substance choice. However, gender was not statistically significant ($LR_{\chi^2} = 3.437$, $p = 0.1793288$). This suggests that even if there is a difference in gender distribution among each primary substance of choice there is not enough evidence to conclude that this difference is significant for this research population.

Results

To further assess the probability of choosing cocaine and heroin versus alcohol relative risk ratios were calculated.

Table 1: Odds ratios and 95 percent CI intervals for multinominal logisitc regression (alcohol as reference).

y.level	term	estimate	std.error	statistic	p.value	conf.low	conf.high
Cocaine	Intercept	32.553	0.663	5.250	0.000	8.869	119.491
Cocaine	gender_labelFemale	1.674	0.279	1.847	0.065	0.969	2.892
Cocaine	Age	0.937	0.016	-4.215	0.000	0.909	0.966
Cocaine	home_labelYes	0.508	0.232	-2.920	0.003	0.323	0.800
Cocaine	CES-D score	0.967	0.010	-3.493	0.000	0.949	0.985
Heroin	Intercept	16.607	0.699	4.022	0.000	4.224	65.298
Heroin	gender_labelFemale	1.299	0.294	0.888	0.374	0.729	2.312
Heroin	Age	0.921	0.017	-4.964	0.000	0.891	0.951
Heroin	home_labelYes	0.455	0.245	-3.213	0.001	0.282	0.736
Heroin	CES-D score	1.003	0.010	0.309	0.757	0.983	1.024

From the relative risk ratio table, age showed a strong association with both cocaine and heroin relative to alcohol while holding gender, homelessness, and CES-D score constant. For every additional year of age, there was an associated 6.3% decrease in the relative risk of cocaine versus alcohol and we are 95% confident that the true decrease lies between 3.4% and 9.1%. There was also a 7.9% decrease in relative risk of heroin versus alcohol and we are 95% confident that the true decrease lies between 4.9% and 10.9%. This suggests that younger patients in the detoxification center are relatively more likely to report cocaine or heroine use compared to alcohol.

CES-D score also had a high association with choice of substance. For every additional 1 point score increase there is an associated 3.3% decrease in relative risk of cocaine versus alcohol with a 95% confidence interval where the true decrease lies between 1.5% and 5.1%. On the other hand, there was not a significant association between heroin versus alcohol since the risk ratio was close to one (1.003) and the confidence interval included 1 (-2.4% to 1.7%).

Homelessness status also had an association with choice of primary substance. Patients that experienced homelessness had a 49.2% lower relative risk of choosing cocaine over alcohol when compared to those that were not homeless. They also had a 95% confidence interval of 32.3% to 67.7%. When it came to heroin versus alcohol, homelessness was associated with a 54.5% lower relative risk and a 95% confidence interval of 26.4% to 71.8%.

These relative risk ratios indicate that characteristics like age, CES-D score, and homelessness status shift the relative likelihood of choosing any of the primary substance outcomes. Within the context of the detoxification center population this means that older patients and those facing homelessness are more likely to choose alcohol as their primary substance than cocaine or heroin.

Predicted probabilities were then conducted to observe the absolute likelihood of choosing any of the primary substance outcomes (Bilder, 2015).

```
    Alcohol   Cocaine    Heroin
1 0.4042268 0.2290331 0.3667400
2 0.5180383 0.2806713 0.2012904
3 0.2079947 0.3375608 0.4544444
4 0.2234441 0.5764291 0.2001268
5 0.4625479 0.2576078 0.2798443
6 0.2848067 0.5874013 0.1277920
```

Table 2: Summary of the predicted probabilites by subtance

Substance	mean_prob	min_prob	max_prob
Alcohol	0.394	0.085	0.868
Cocaine	0.333	0.063	0.717
Heroin	0.273	0.043	0.549

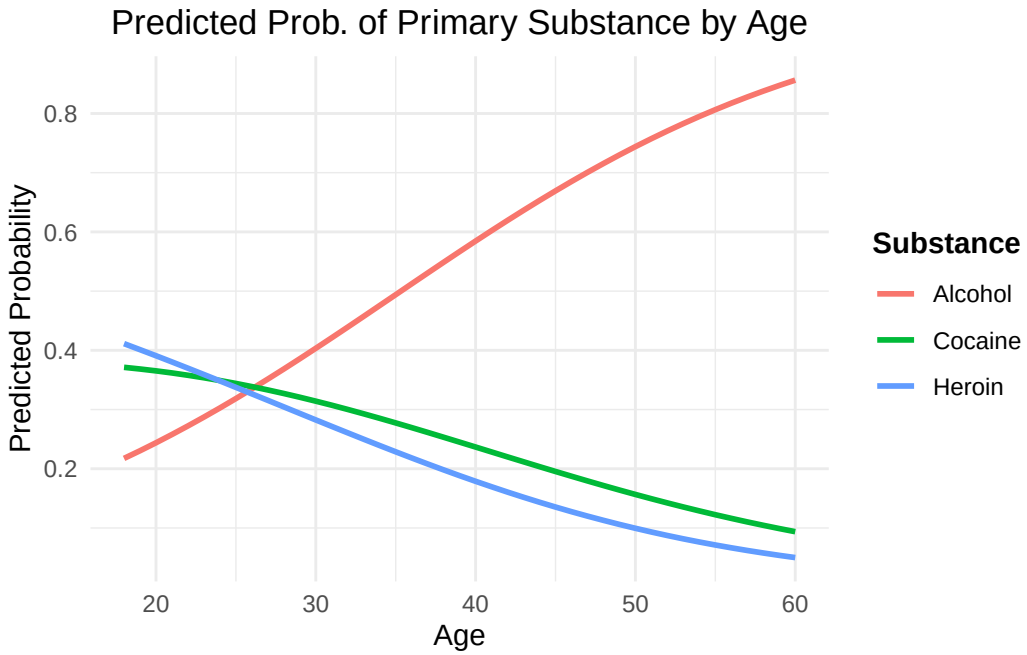
The table above summarizes the distribution of the predicted probabilities for each primary substance across all the patients that entered into the detoxification center. On average, alcohol had the highest average predicted probability (mean = 0.394) compared to cocaine (mean = 0.333) and heroin (mean = 0.273). Alcohol is therefore the most common primary substance to be chosen among the detoxification center population.

The ranges of predicted probabilities for each primary substance also reveals how individual characteristics influence the substance choice. The range for alcohol was 0.085 to 0.868 which indicates that some individuals based on their characteristics (age, gender, homelessness, and CES-D) where predicted to have a lower or higher likelihood of choosing alcohol. Similarly, the predicted probabilities for cocaine and heroin ranged from 0.063 to 0.717 and 0.043 to 0.549 respectively. Essentially, the predicted probabilities ranges show that the explanatory

variables do not affect all individuals the same. They are shown to shift the relative likelihood of each substance based on an individual's combined characteristics.

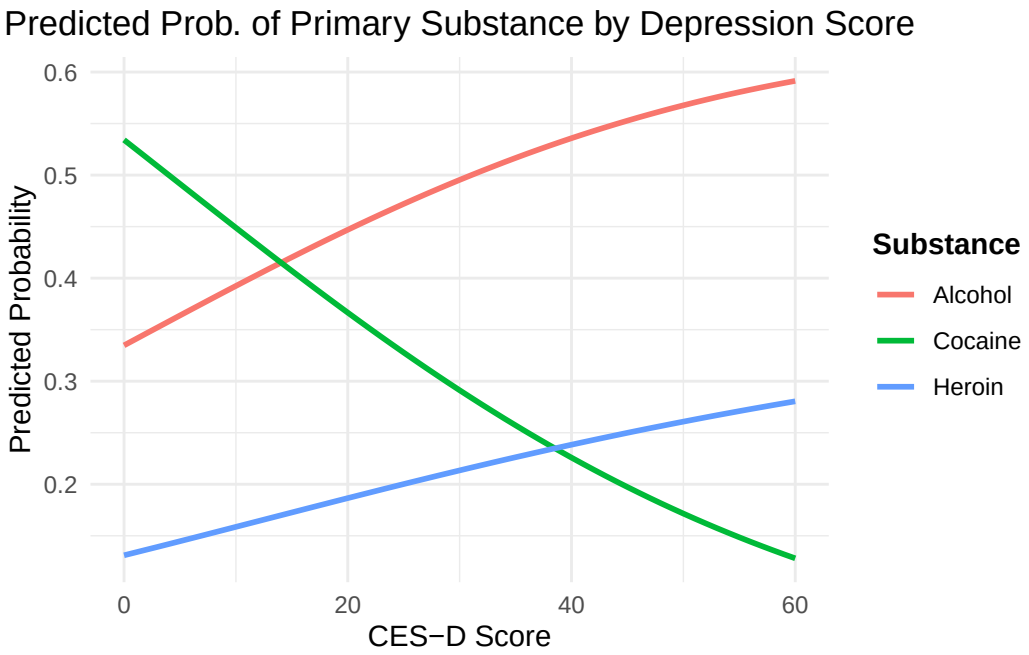
Predicted Probabilities

Predicted Probability Plot for Age



- **Findings** Figure 1 shows a model-predicted probabilities of primary substance choice across age. When holding depression, gender, and homelessness constant, older individuals are substantially more likely to report alcohol as their primary substance.Younger individuals are more likely to report cocaine as their primary substance, whereas cocaine use declines with increasing age.Heroin use as a primary substance is concentrated among younger individuals and becomes increasingly unlikely at older ages. (Add some kind of visualization)

Predicted Probability of Primary Substance by Depression Score



- **Findings** Figure 2 visuaizes the model-predicted probabilities of primary substance choice across levels of depressive symptom scores, while holding age, gender, and homelessness constant. As CES-D scores increase, the predicted probability of alcohol as the primary substance rises, while the probability of cocaine declines more rapidly. This is in contrast to the probability of heroin where it increases somewhat steadily but remains lower than alcohol throughout the range of depression scores. These results indicate that higher depressive symptom severity is associated with having alcohol as a primary substance which may show that depression as an important predictor of substance choice for this study's population.

Discussion

The purpose of this study was to examine whether age, gender, depression score (CES-D), and homelessness would predict primary substance type (alcohol, heroin, cocaine) among adults receiving inpatient detoxification services in the HELP study. Using multinomial logistic regression, we assessed how these factors were associated with the likelihood of selecting alcohol, cocaine, or heroin as a primary substance, while adjusting for all other variables. These findings partially answer our research question, suggesting that some demographic and psychosocial factors play an important role in substance choice, but that gender differences observed descriptively may be explained by other variables. The results are as follows

- **Age:** One of the strongest predictors for primary substance type was age. In the multinomial regression, increasing age was associated with a 6.3% decrease in the relative risk of cocaine versus alcohol and a 7.9% decrease in the relative risk of heroin versus alcohol, holding gender, homelessness, and CES-D constant. We can see that this pattern is further illustrated in Figure 2, which displays model-predicted probabilities across age. When depression (in this case, the `cs_d` variable‘, a measure of depressive symptoms), gender, and homelessness were held constant, older individuals were substantially more likely to report alcohol as their primary substance, while younger individuals were more likely to report cocaine or heroin. These findings suggest a pattern where cocaine and heroin drug use more prevalent at younger ages and alcohol use predominating at older ages. Perhaps there are more
- **Depression score (CES-D):** Depression score was another significant predictor for primary substance type. Higher CES-D scores had an association with a lower relative risk of cocaine versus alcohol, however there was no significant association was observed for heroin versus alcohol. This is also supported by the predicted probability plot shown in Figure 1 demonstrating that as depressive symptom severity increases, alcohol becomes increasingly more likely to be the primary substance, while cocaine use declines sharply. Heroin probabilities remain relatively stable across the range of depression scores. In conjuction, these results suggest that alcohol use may be more strongly associated with higher depressive symptom burden than cocaine or heroin in this detoxification population.
- **Gender:** Though we explored gender differences in the exploratory data analysis, gender was not determined to be a statistically significant predictor of primary substance type in the multinominal regression. Perhaps, gender differences observed could be due to or mediated by other factors such as age, depression or homeless rather than gender in itself. This is in tandem with previous literature, where Parés-Bayerri et al (Parés-Bayerri et al, 2023), found that there were no strong difference in drug type use between men and women in the homeless population but there were differences in the path towards addictive behaviors.
- **Homelessness:** Homelessness has a significant association with primary substance type in the adjusted model. Participants experiencing homelessness had lower relative risks of cocaine and heroin compared to alcohol, indicating that alcohol was disproportionately common among homeless participants. This finding aligns with prior literature suggesting that alcohol use disorders are highly prevalent among homeless populations.

Limitations

One glaring issue is the recency of the HELP study, which should beconsidered when interpreting the findings of this study. According to Schlunberg et al., 2022

First, the HELP study data were collected in the early 2000s, and drug use patterns have changed substantially (partly due to the decriminalization and recreational legalization use of some drugs such as marijuana). National data released in 2025 from the Monitoring the Future (MTF) Panel Study indicate major shifts in substance use prevalence and ways of consumption among young adults, including historically low levels of alcohol use and historically high levels of cannabis use, vaping, and nicotine products in 2024 (Patrick et al. (2025)). In contrast, alcohol was the dominant primary substance in the HELP dataset, suggesting that the observed patterns may reflect substance use norms at the time of data collection rather than current trends.

Second, newer substances and methods of using drugs such as vaping cannabis, nicotine pouches, delta-8 THC, and hallucinogens are not captured/noted in the HELP study. National data show sharp increases in these substances among young, early midlife, and late midlife adults between 2014 and 2024 (Patrick et al. (2025)). As a result, the generalizability of our findings to today's substance use behaviors is limited, more specifcally for younger cohorts whose substance use behaviors now differ substantially from those observed in the HELP population (who tended to be older).

Third, the HELP study population consists of adults entering inpatient detoxification services, which represents a clinically severe and highly selected group, which is inherit to this study. Substance use behaviors in this population may differ from those in the general population sampled by national surveys such as MTF, which could explain the differences in drug use behaviors. For example, while alcohol use has reached historic lows nationally across multiple age groups, it may still remain highly prevalent among individuals entering treatment, which may partially explain the strong association between age, depression, and alcohol observed in this study.

Finally, predicted probability plots are based on data generated on the model we created, where some variables are held constant. Though these plots are useful for interpretation and visualization, they may not represent actual individuals and should be interpreted as adjusted estimates rather than observed prevalences

Future Directions

Several extensions of this analysis could further strengthen our understanding of substance use patterns in the HELP study. Future analyses using datasets that include individuals who report no primary substance could extend this approach which could prove useful in modeling both substance reporting (whethere they had a primary substance) and substance choice Another next step would be to model the probability of reporting a specific primary substance versus not reporting that substance by potentially using a series of binary logistic regression models. Another distinction could be between type of drug in terms of classes, such as depressants, stimulants, psychedelics etc.

Additionally, future analyses could examine interactions between key predictors, such as age by depression score or homelessness by gender, to investigate whether associations differ may across/within subgroups. Given prior literature noting gender and mental health differences in how different groups reach substance use addictive behaviors, interaction effects may reveal patterns not captured by these main effects alone.

Finally, there could be a more recent replication of this analysis using more recent datasets would be valuable given substantial shifts in substance use patterns over time. Applying similar modeling approaches to contemporary national surveys, such as the Monitoring the Future study, would allow for direct comparison and improve the external validity of the findings.

Conclusion

This study examined whether age, gender, depression score, and homelessness predict primary substance type among adults entering inpatient detoxification services using the HELP study. By using multinomial logistic regression, we found that age, depression severity, and homelessness were significant predictors of primary substance choice, while gender was not associated after adjustment. Older individuals were more likely to report alcohol as their primary substance, whereas cocaine and heroin use were more common among younger individuals. Participants who had higher depression symptoms scores were associated with an increased likelihood of alcohol use when compared to cocaine, and homelessness was associated with a greater probability of alcohol use compared to other substances.

Predicted probability analyses further supported these relationships by visualizing how substance choice may shift across age and depressiive symptom scores while holding other factors constant. By combining these findings both mental health and other factors such as homelessness should be considered when examining substance use patterns in treatment-seeking populations. Although the HELP data reflect substance use patterns from the early 2000s, the statisticl analyses used in this study may help with understanding how demographic and psychosocial factors shape primary substance choice rehab treatement.

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