

EXAMINING ASSOCIATIONS BETWEEN THE TYPES OF
SUBSTANCES USED BY PEOPLE WHO INJECT DRUGS BY
GENDER, HOUSING STATUS, AND SOCIAL LIVING
ARRANGEMENT

by

ALEXA BRANNEN

A THESIS

Presented to the Department of Neuroscience
and the Robert D. Clark Honors College
in partial fulfillment of the requirements for the degree of
Bachelor of Science

May 2024

An Abstract of the Thesis of

Alexa Brannen for the degree of Bachelor of Science
in the Department of Neuroscience to be taken June 2024

Title: Examining Associations Between the Types of Substances Used by People Who Inject
Drugs Through Gender, Housing Status, and Social Living Arrangement

Approved: Camille Cioffi Ph.D.
Primary Thesis Advisor

Polysubstance use is a major public health concern, and individuals facing housing instability are at a higher risk of engaging in substance use. Traditional perceptions of homelessness often overlook the fact that individuals experiencing housing instability can engage in cohabitation or shared living arrangements. To address the unique needs of this population, it is crucial to explore how different aspects of interpersonal relationships, including gender, influence polysubstance use patterns. This study specifically investigates the use of legal substances among individuals who inject illegal drugs, providing insight into the complexities of legal and illegal substance interactions. Utilizing survey data collected from people who inject drugs throughout the COVID-19 pandemic, and analyses were conducted on gender, housing status, social living arrangement, and substance use. The findings highlight the importance of evidence-based interventions that address polysubstance use disorders among individuals facing housing instability and reveal potential underlying factors contributing to polysubstance use within this population. By addressing these factors, society can better prevent and manage polysubstance use. This study serves as an influential step toward creating long-term solutions that promote the well-being of this population.

Acknowledgments

I would like to express my deepest gratitude to my thesis committee members, who have provided invaluable support throughout the course of this project. Camille Cioffi, my primary thesis advisor, has been a constant source of guidance and inspiration. Her expertise and insight have greatly enriched this work. I am also profoundly thankful to Nicole Dudukovic and Elliot Berkman for their critical reviews and constructive suggestions that significantly shaped the final version of this thesis. I also extend my heartfelt thanks to my parents, James and Sherrie Brannen. Their endless love, encouragement, and patience have not only sustained me during the challenges of my academic journey but have also been my cornerstone of motivation and resilience. To my family and others who have surrounded me—thank you for believing in me and for being my unwavering support system. This journey would not have been possible without the collective support and encouragement from all who have been part of this process. Thank you.

Table of Contents

Introduction & Existing Literature.....	6
People Who Inject Drugs	7
Gender Disparities in Substance Use.....	9
Housing Status.....	10
Social Living Arrangement	13
Methods.....	14
Design, setting, and Participants	14
Demographics	14
Housing Status and Social Living Arrangement.....	14
Substance Use	15
Statistical Analysis	16
Results.....	17
Gender.....	17
Housing Status.....	17
Social Living Arrangements.....	17
Discussion.....	18
Gender and Substance Use.....	18
Housing Instability and Substance Use.....	19
Social Living Arrangement and Substance Use.....	21
Limitations	22
Conclusion	25
Implications	25
Further Research Directions	27
Tables.....	30
Bibliography	32

List of Tables

Table 1. Demographics Table (N= 482)	30
Table 2. Odds Ratios of Binge Drinking, Cannabis Use, and Prescription Drug Misuse Between Gender, Housing Status, and Social Living Arrangement.....	31

Introduction & Existing Literature

In 2019, nearly half of drug overdose deaths involved multiple drugs, (O'Donnell et al., 2020), highlighting the critical need in addressing the systemic issues linked to polysubstance use, particularly among people who inject drugs (PWID). Effective strategies should prioritize improved healthcare access, evidence-based prevention, reduction of socioeconomic inequalities, and promotion of a supportive and inclusive society. Polysubstance use among PWID often includes both legal (alcohol, cannabis, and prescription drugs) and illegal substances, introducing unique complexities due to the interplay between legal substance use and illegal drug injection. Furthermore, gender-specific differences in polysubstance use patterns and pathways to polysubstance use necessitate a tailored approach. The interrelation of polysubstance use with housing instability complicates these challenges, suggesting the necessity of integrated solutions that consider both substance use and living conditions. This paper aims to explore how gender influences the relationship between polysubstance use, housing status, and social living arrangements among PWID. It hypothesizes that men who inject drugs exhibit higher rates of polysubstance use than women who inject drugs; those facing housing instability have elevated rates of polysubstance use compared to those in permanent housing; and those living alone have elevated rates of polysubstance use than those living with others. This research will contribute to developing targeted interventions and informing policy, addressing the complex dynamics of polysubstance use and housing among this vulnerable group of individuals.

People Who Inject Drugs

In recent years, the health community has become increasingly aware of the obscure challenges faced by people who inject drugs (PWID). These individuals are not only at the forefront of public health crises as the spread of HIV/AIDS and hepatitis C but also bear the burden of societal stigma and marginalization. The compounded risks associated with drug injection, including a significantly increased likelihood of overdose, demand a refined understanding and targeted intervention strategies, (Strathdee & Stockman, 2010; Degenhardt et al., 2017). Adding to the perplexities of health challenges faced by PWID is the phenomenon of polysubstance use. Research in polysubstance use between illegal and legal substances such as alcohol, cannabis, and prescription drugs is lacking among PWID. Despite the legality and relative ease of obtaining these substances, their use among people who also inject illegal drugs like opioids, methamphetamine, and cocaine, potentially introduces additional layers of risk and requires careful consideration in health interventions. Polysubstance use fundamentally alters brain circuits and structures, affecting decision-making, motivation, and self-control, (Heilig et al., 2021). At the heart of substance use lies the brain's reward system, primarily the nucleus accumbens, intertwined with regions such as the prefrontal cortex and amygdala. Addictive substances hijack this system, altering dopamine levels and leading to an increased propensity for drug-seeking behaviors, (Robinson & Berridge, 2008). Over time, the brain's reward circuitry becomes increasingly sensitized to substance-related cues, leading to an enhanced response to these cues while the response to natural rewards is diminished, (Volkow et al., 2013). Each substance carries distinct risks and potential harms, making it vital for strategies for substance use reduction to be tailored to the specific substances being used by this population, (Peacock et al., 2018; Jacka et al., 2019).

Alcohol use among PWID can exacerbate health risks, particularly liver damage. Given that PWID are already at a higher risk for liver diseases such as hepatitis C, combining alcohol with injectable drugs can lead to accelerated liver damage. While considered less harmful to the general population, cannabis use among PWID can contribute to mental health issues, such as anxiety and paranoia. It may also affect judgment and decision-making, potentially leading to riskier injection practices. Misuse of prescription medications, including opioids, benzodiazepines, and stimulants, is a significant concern. These substances can increase overdose risks, especially when combined with illicit drugs. Chronic substance use induces long-lasting changes in brain architecture and function, a phenomenon known as neural plasticity. These alterations contribute to the persistence of polysubstance use, affecting neural circuits related to reward, stress, and self-control, (Gipson et al., 2013; Lüscher & Malenka, 2011). Recognizing the significance of social pathways to concurrent substance use among PWID is crucial for developing targeted social interventions that address these complex behaviors.

Furthermore, the non-medical use of prescription drugs can lead to dependency and complicate polysubstance use reduction. The legal status and accessibility of alcohol, cannabis, and prescription drugs present a paradox for PWID. On one hand, these substances are legally obtained and socially accepted to varying degrees, potentially making them more easily accessible. On the other hand, their use alongside illegal injectable drugs significantly complicates the health landscape for PWID. This accessibility does not diminish the potential health risks; instead, it may contribute to the normalization of polysubstance use within this population, masking the need for targeted interventions. The inclusion of legal substances in discussions on polysubstance use among PWID emphasizes the need for comprehensive health interventions that encompass all aspects of substance use.

Gender Disparities in Substance Use

The relationship between gender and polysubstance use introduces an additional layer of complexity to the challenges faced by PWID. Women who inject drugs may navigate an environment that is marked by a heightened risk of sexual violence and exploitation, directly linked to their marginalized status within both the broader society and subcultures of drug use. Men who inject drugs face their own unique set of challenges that are often overlooked due to societal perceptions of masculinity and strength. Men may experience a heightened pressure to conform to traditional gender roles, leading to increased risk-taking behaviors and reluctance to seek help for fear of appearing weak or vulnerable. They are faced with risks such as an increased likelihood of involvement in violent activities and legal troubles related to substance use, (Zhang et al., 2009). Men may find their social networks less willing to acknowledge or discuss emotional vulnerabilities, reinforcing harmful patterns of polysubstance use as a form of coping. The stigma associated with substance use is magnified for women, intertwining with societal norms and expectations around femininity and morality, leading to profound consequences on their mental and physical health, (Pinkham et al., 2012). For many women, social networks may include individuals who are themselves engaged in substance use, complicating the dynamics of support and again, potentially reinforcing patterns of use. In contrast, supportive relationships that offer alternative coping mechanisms and models of behavior can be instrumental in reducing patterns of substance use.

Gender-responsive approaches to substance use reduction, which account for these unique challenges and needs, are lacking. The lack of targeted, effective care for women, men, and non-binary PWID, suggests an urgent need for interventions that are both accessible and sensitive to these disparities, (Greenfield et al., 2010; Kennedy et al., 2017).

Housing Status

In 2022, it was estimated around 582,000 Americans experienced homelessness, a significant social issue that intersects with numerous health disparities, including elevated rates of polysubstance use and other related concerns, (Sousa et al., 2022). This population is particularly vulnerable, not only due to the direct impacts of housing instability but also because of the myriad of stressors associated with unstable living conditions. Exposure to unsafe environments, the daily uncertainties of homelessness, and the overall lack of security can serve as potent catalysts for substance use, often adopted as a coping mechanism to navigate the harsh realities of life without stable housing, (Baggett et al., 2010; Henwood et al., 2015). The exacerbation of polysubstance use among the unhoused population highlights how substance use complicates the path to achieving stable housing, while the lack of a home aggravates substance use issues, (Tsai et al., 2018; Upshur et al., 2019).

Temporary housing arrangements, such as shelters or transitional housing, introduce a different set of dynamics, often characterized by transience and uncertainty. The stress associated with these living conditions can lead to increased substance use, as well as polysubstance use as a coping mechanism, highlighting the need for interventions that provide stability and support in these environments, (Aidala et al., 2016; Watson et al., 2017). Furthermore, the interaction between individuals in these settings can either facilitate access to recovery resources or, conversely, increase exposure to substance use through shared behaviors and social networks, (Palepu et al., 2013; Tucker et al., 2021).

The experiences of unhoused individuals without any shelter at all, reveal another dimension of how social living arrangements impact polysubstance use. In these settings, the lack of formal housing does not equate to a lack of social interaction; rather, it creates unique

communal environments where norms and behavior, including substance, are collectively shaped and shared. These individuals often rely on one another for various forms of support, from sharing resources to providing emotional support amidst adversity. However, these street-based communities also face heightened exposure to substance use, where the collective experience of homelessness can influence patterns of use and the types of substances consumed. The solidarity found in these communities can lead to both protective and risk-enhancing dynamics regarding substance use, illustrating the complex role of social networks among the unhoused, (Bardwell et al., 2018).

The intricate relationship between housing instability and polysubstance use, particularly involving legal substances, necessitates a multifaceted approach to intervention. Stable and supportive housing is critical as a foundational element that may directly impact the outcomes of substance use. Research indicates that stable housing conditions can significantly mitigate the risks associated with the use of legal substances among individuals engaging in polysubstance use. For instance, permanent housing has been associated with reduced substance use and improved overall well-being, (Padgett et al., 2016; Tsemberis, 2011). This correlation suggests that the security and stability provided by consistent housing can reduce the reliance on substances as coping mechanisms.

Furthermore, the availability of stable living environments is linked to increased motivation for maintaining health and engaging in health-promoting behaviors. The literature states that when individuals have access to permanent housing, there is a notable decrease in the use of both alcohol and legal drugs, suggesting the potential of stable housing to serve as a platform for reduced substance use, (Polcin & Korcha, 2015; Henwood et al., 2018). The integration of supportive services within these housing settings can further enhance these

outcomes by providing continuous access to care and support, thereby facilitating a comprehensive approach to managing polysubstance use. Despite these positive correlations, the challenge remains to ensure equitable access to such housing solutions, especially considering the variability in program availability and effectiveness influenced by factors like geographic location and funding, (Kertesz et al., 2009; Culhane et al., 2013). Thus, continued research and policy efforts are essential to adapt and expand housing interventions to better meet the diverse needs of individuals affected by housing instability and polysubstance use involving both legal and illegal substances.

Social Living Arrangement

The phrase social living arrangement refers to the living situation between individuals, both unhoused and housed, choosing to cohabitate with each other. This relationship plays an exigent role in the development and perpetuation of polysubstance use, especially in those experiencing housing instability. This concept extends beyond mere physical aspects of living arrangements to encompass the complex web of social interactions and influences within these spaces. The dynamics within group homes, where communal living can foster both supportive and problematic environments for substance use, represent the importance of the social context in influencing substance use behaviors. Studies indicate that norms among who an individual is cohabitating with can significantly impact individuals' substance use patterns, either encouraging recovery-oriented behaviors or exacerbating substance use depending on the dominant culture within the home, (Polcin et al., 2010; Jason et al., 2016).

Social living arrangements (i.e. whether an individual lives with others) influence patterns of substance use and vary depending on whether cohabitants are people who use substances or not, and which substances they use. Living with people who use substances can create an environment where substance use is normalized and potentially encouraged, presenting significant challenges for individuals seeking to reduce their use. The presence of substances in the home, combined with societal pressures, can lead to problematic substance use patterns, (Moos & Moos, 2006; Polcin et al., 2010). Conversely, cohabitants who do not use substances can offer major social support, serving as role models for substance-free living, highlighting the potential protective effects of living among people who do not use substances, in promoting reducing substance use, (Jason et al., 2016; Mericle et al., 2018). Yet, the literature minimally addresses the nuances of social living arrangements and their implications for polysubstance use.

Methods

Design, setting, and Participants

This study was a part of a larger project to understand factors that may influence COVID-19 testing and vaccination among people who inject drugs (PWID) during the pandemic. The study investigators partnered with HIV Alliance, an Oregon-based non-profit, to reach PWID at syringe services programs across Oregon. The participants of the study were individuals who utilized the services programs and participated in the SARS-CoV-2 testing program between March 14, 2022 and June 9, 2023 (N = 482 unique individuals).

Participants were required to be over the age of 18 to take the survey. Individuals who were not syringe services participants were excluded from analyses. Each participant provided consent prior to taking the survey and were given a \$10 gift card upon completion of the survey. The survey included demographic information as well as elements required by the funding agency on vaccine status and vaccine deliberation. This study was approved by the University of Oregon Institutional Review Board.

Demographics

Participants self-reported their demographic characteristics which included gender, race, and ethnicity. Participants could select multiple options for gender identity. Due to the small counts, those who identified as something other than man or woman were excluded from analyses. Participants could select multiple options for race and ethnicity.

Housing Status and Social Living Arrangement

Participants were asked, “What best describes the people at your home?” Response options were: *family including kids, family with 3 generations (parents, children, grandchildren),*

family with 4 generations, just me, living with roommates, living with spouse with no kids, none of these, and prefer not to answer. Due to small counts, those who responded with *none of these* or *prefer not to answer* were excluded from analyses. Those who responded with an answer choice other than *alone* were combined for analyses. Participants were then asked, “Are you currently living in transitional housing, staying in a shelter, or experiencing homelessness?” Response options that were included in data analyses were: *no* and *yes*.

Substance Use

To determine substance use, participants were asked, “Have you used cannabis in the past 12 months?” with the answer choices being: *yes, no, or prefer not to answer*. Due to small counts, those who chose *prefer not to answer* were excluded from analyses. To follow up, participants had the opportunity to record the number of alcoholic drinks and frequency of drinking by answering the question, “How often do you have a drink containing alcohol?” with answer options being: *never, monthly or less, 2-4 times per month, 2-3 times per week, 4 or more times per week, and don't know or refuse to answer*. As well as, “How many drinks containing alcohol do you have on a typical day when you are drinking?”. They had the opportunity to respond with *1 or 2, 3 or 4, 5 or 6, 7,8, or 9, 10 or more, and prefer not to answer*. Binge drinking was defined for women as 4 or more alcoholic drinks, 4 or more times a week and 5 or more alcoholic drinks, 4 or more times a week for men. Finally, they also reported their misuse of prescription drugs through the question, “In the past 12 months, how often have you used prescription drugs just for the feeling, more than prescribed, or that were not prescribed for you?”. Response options were *daily or almost daily, about once or twice per week, about once per month, rarely (less than once per month), never, or prefer not to answer*. Due to small

counts, those who chose *prefer not to answer* were excluded from analyses. Those who chose an answer other than *never* were combined for analyses.

Statistical Analysis

Odds ratios (ORs) were employed to quantify the strength of association between various factors—such as gender, housing status, and social living arrangements—and the prevalence of polysubstance use among PWID. Odds ratios are a measure of association between an exposure and an outcome, providing a figure that indicates whether the probability of a specific event is high or lower in one group compared to another. An odds ratio greater than 1 indicates higher odds of the outcome occurring in the exposure group compared to the control group, while an odds ratio less than 1 suggests lower odds. In this study, the control group was women living in permanent housing among others. The significance of the odds ratios was determined based on their 95% confidence intervals. Importantly, for an odds ratio to be considered statistically significant, its 95% confidence interval should not include the value of 1.

Results

Gender

Being a man was associated with decreased odds of binge drinking [OR 0.34 (95% CI 0.14, 0.83)] compared to being a woman. Gender was not associated with cannabis use or prescription drug misuse. (See Table 2)

Housing Status

Housing instability was associated with increased odds of cannabis use [OR 2.49 (95% CI 1.28, 4.83)] and prescription drug misuse [OR 4.02 (95% CI 1.4, 11.58)] compared to permanent housing. Housing status was not associated with binge drinking. (See Table 2)

Social Living Arrangements

Living alone was associated with decreased odds of binge drinking [OR 0.26 (95% CI 0.07, 0.97)] compared to those living with others. Social living arrangements were not associated with cannabis use or prescription drug misuse. (See Table 2)

Discussion

This study sought to understand associations between polysubstance use, gender, housing instability, and social living arrangements. The findings contribute to a growing body of literature that situates polysubstance use within a broader social and environmental context and carries significant implications for the development of targeted interventions.

Gender and Substance Use

The finding that men have decreased odds of binge drinking compared to women may seem counterintuitive against the grain of traditional beliefs that typically associate higher rates of binge drinking with men. However, recent studies, such as Keyes et al. (2011), have begun to highlight the narrowing gender gap in alcohol consumption, suggesting shifts in societal norms and possibly increased reporting accuracy among women. Traditionally, alcohol consumption, particularly binge drinking, has been more socially acceptable for men, often seen as a rite of passage or a sign of masculinity. However, as societal views on gender and alcohol evolve, women's drinking behaviors may be becoming more visible and socially acceptable, contributing to the observed shift in binge drinking patterns. Studies have shown that exposure to alcohol-related content in media is associated with increased alcohol consumption, (Smith & Foxcroft, 2009). As media representations of women increasingly depict alcohol use, this could contribute to changing norms and behaviors around women and drinking.

The use of alcohol as a coping mechanism, particularly among women, warrants further exploration. Nash et al. (2015) suggest that women may turn to alcohol to cope with stressors more frequently than men. This could be related to differences in stress response and coping strategies between genders. Women are more likely to report using emotion-focused coping strategies, such as drinking, to manage stress, whereas men may be more likely to use problem-

focused strategies, (Matud, 2004). This difference in coping mechanisms may partly explain the gender disparities observed in binge drinking behaviors among PWID. Additionally, the role of mental health in influencing substance use behaviors cannot be overlooked. Women are at a higher risk for certain mental health conditions, such as anxiety and depression, which are often comorbid with substance use, (Kessler, 2003). The self-medication hypothesis suggests that individuals may use substances like alcohol to alleviate symptoms of mental health disorders, potentially contributing to higher rates of binge drinking among women who inject drugs.

The findings and supporting literature highlight the need for gender-sensitive approaches in addressing substance use. Interventions should consider the unique sociocultural and psychological factors influencing substance use behaviors among men and women. For instance, programs targeting women might focus on developing healthy coping strategies for stress and addressing comorbid mental health conditions. Additionally, public health policies could benefit from addressing the portrayal of gender and alcohol consumption in media to influence societal norms and behaviors. In conclusion, the observed gender differences in binge drinking behaviors reflect a complex relationship between sociocultural, psychological, and behavioral factors. Continued research into these factors will be essential for advancing our understanding of gender disparities in polysubstance use among PWID for informing targeted public health strategies.

Housing Instability and Substance Use

The intricate relationship between housing instability and the elevated incidence of substance use, particularly regarding cannabis and prescription drug misuse, aligns with broader patterns identified within public health research. The findings resonate with the work of Fazel et al. (2014), who established a pronounced link between the precariousness of homelessness and a predisposition towards substance misuse. This connection not only highlights the acute stress and

vulnerability of individuals grappling with housing insecurity but also suggests that substances may serve as a response to the adversities associated with such instability. The preference for cannabis and prescription drugs, as opposed to alcohol, in contexts of housing instability may be attributed to several factors that distinguish these substances. For instance, cannabis and certain prescription medications might be perceived as more benign or have a more manageable risk profile compared to the potential for overt intoxication and dependency associated with alcohol, (Lucas et al., 2019). This perception could influence the choice of substances among individuals seeking to mitigate the psychological and physical discomforts of their circumstances without attracting undue attention or exacerbating their precarious situation.

The specific vulnerability of individuals experiencing housing instability to cannabis use and prescription drug misuse outlines the necessity of addressing the root causes of housing instability as part of comprehensive substance use prevention. It suggests that effective interventions must not only focus on polysubstance use itself but also the broader social determinants of health, including stable housing, access to healthcare, and social support systems. By tackling these foundational issues, public health initiatives can better support individuals in overcoming the challenges posed by housing instability and substance use, facilitating pathways to recovery and stability. Integral to these strategies is the Housing First model, which provides immediate, unconditional housing without requiring sobriety or treatment engagement as prerequisites. This approach has demonstrated promising outcomes in securing permanent housing, enhancing well-being, and reducing substance use among those engaged in polysubstance use, (Padgett et al., 2016; Tsemberis, 2011). By departing from traditional conditional housing models, Housing First offers a solid platform, emphasizing the critical role of stable housing in effective substance use reduction.

In sum, the dynamics of housing instability and polysubstance use highlight the dire importance of a holistic approach to public health policy and intervention design. Understanding and addressing the underlying social and environmental factors that contribute to substance misuse among populations facing housing challenges are paramount in developing effective, empathetic, and sustainable solutions.

Social Living Arrangement and Substance Use

The observation that individuals living alone have a reduced likelihood of engaging in binge drinking compared to those in shared living arrangements invites a deeper exploration into the social mechanisms that influence substance use behaviors. The counterintuitive nature of these findings represents the complex role that social environments and cohabitation play in shaping individual behaviors, especially regarding substance use. The relationship between social environments and individual behaviors is a key area of interest in understanding substance use patterns. The Social Control Theory provides a framework for understanding how social structures, including family and shared living situations, can exert a regulatory effect on individuals, guiding their behaviors to align with societal norms and expectations. This theory posits that the presence of close, interconnected relationships and the inherent desire for social approval can deter individuals from engaging in behaviors deemed socially unacceptable, such as binge drinking, (Hirschi, 1969). This regulatory effect could be diminished in the absence of immediate social networks, such as in the case of living alone, suggesting that social surveillance and the pressure to conform play significant roles in mitigating risk behaviors.

Living with others often involves a complex negotiation of shared spaces (e.g. apartment, trailer, tent, shelter space) and communal life, where social norms and behaviors are continually observed and, to some extent, internalized. According to Leonard et al. (2015), the dynamics of

social influence in these settings can impact individual behaviors, including alcohol consumption patterns. The desire to belong and the fear of social ostracization may drive individuals to participate in or abstain from certain behaviors, including binge drinking, based on the prevailing norms within their immediate social circle.

The concept of surveillance and accountability in shared living situations, as highlighted by Tucker et al. (2013), further elucidates the potential for social living arrangements to act as a deterrent against binge drinking. The awareness of being observed by others and the potential for immediate social feedback can foster a sense of accountability, prompting individuals to regulate their behaviors more closely. This phenomenon suggests that the social visibility inherent in cohabitation scenarios can act as a form of informal social control, encouraging behaviors that are in line with collective norms and expectations.

In conclusion, the role of social living arrangements in terms of binge drinking highlights the intricate ways in which social environments, peer influence, and mechanisms of social control interact to influence individual behaviors. These insights reveal the value of incorporating social and environmental considerations into public health strategies, aiming to create supportive, cohesive communities that can contribute to the reduction of polysubstance use and the promotion of healthier lifestyle choices.

Limitations

This study, while providing important insight into the associational relationship between gender, housing status, social living arrangement, and polysubstance use, has several limitations that must be acknowledged and carefully considered when interpreting the findings.

A primary limitation is the reliance on self-reported data, which inherently carries potential biases such as social desirability or recall bias. Participants may underreport behaviors

perceived as socially undesirable, such as binge drinking, or overreport behaviors seen as more socially acceptable or victimized, such as using prescription drugs for legitimate health issues. This could lead to inaccuracies in estimating the true prevalence and patterns of polysubstance use among the study population. Additionally, self-reported data on sensitive issues like substance use are subject to recall errors, particularly if participants are asked to remember their usage over extended periods.

The use of odds ratios as a measure of association in this study also presents limitations. While odds ratios provide a useful estimate of the strength of the association between exposure and outcome, they can sometimes overestimate the risk, especially in studies where the outcome of interest is not rare. Furthermore, odds ratios do not imply causation and must be interpreted within the context of potential confounding factors and the study design. This limitation is particularly pertinent given the cross-sectional nature of the data, which restricts the ability to determine causal relationships between the variables studied.

Another significant limitation stems from the fact that this study utilized a subset of data extracted from a larger project. This secondary use of data implies that the current study was confined to the scope, scale, and data collection methods originally employed in the primary project. Consequently, there might have been relevant variables or data points that were not collected but could have influenced the findings significantly. The inability to collect additional data to address these gaps or to tailor the data collection specifically to the hypotheses of the current study restricts the depth and scope of the analyses. The use of a dataset that is a subset of another project also poses limitations on the generalizability of the findings. The original data collection's context, population, and geographical location may limit the applicability of the results to other settings or populations. Without the ability to adapt the data collection to

potentially overlook demographics or regions in the initial project, the findings might not accurately reflect the experiences of broader or different populations.

Despite these limitations, the study provides valuable insights that contribute to the understanding of complex interactions between social, environmental, and personal factors in polysubstance use behaviors.

Conclusion

This thesis has explored the intricate associations between gender, housing status, social living arrangement, and substance use, shedding light on how these are associated with binge drinking, cannabis use, and prescription drug misuse in people who inject drugs.

The unexpected gender differences in binge drinking behaviors suggest a shift in traditional roles or perhaps underline the influence of evolving social norms on polysubstance use patterns. This aspect highlights the necessity for continuous monitoring of trends and the implementation of gender-sensitive approaches in substance use prevention. The strong link between housing instability and increased use of cannabis and prescription drugs reinforces the intense role of stable housing as a determinant of health. This association underscores the need for comprehensive strategies that integrate substance use interventions with housing support services, emphasizing that addressing socio-environmental factors is crucial in mitigating substance misuse. Furthermore, the study's insights into the role of social living arrangements relating to binge drinking illuminate the importance of social relationships and community environments in influencing health behaviors. These findings advocate for the development of social interventions that leverage social networks and amplify social support as preventative measures against polysubstance use. Additionally, these interventions should consider gender, housing instability, and social living arrangements as critical factors in addressing polysubstance use effectively.

Implications

For public health practitioners, the insights gained about the effects of social living arrangements and the risks associated with housing instability and gender differences in substance use provide a basis for designing targeted interventions. Health promotion programs

could benefit from incorporating strategies that strengthen community ties and enrich social support networks, especially for individuals who are at risk of social isolation. Moreover, recognizing the importance of stable housing as a determinant of health suggests that public health initiatives could effectively reduce polysubstance use by advocating for and implementing housing-first approaches and integrating these with support services tailored to address polysubstance use.

From a policy perspective, the findings highlight the need for policies that consider the broader social determinants of health, such as housing and gender-specific factors, in the formation of substance use prevention strategies. Policies aimed at reducing homelessness or improving housing stability should be viewed as potential levers for decreasing the prevalence of polysubstance use. Additionally, gender-responsive policies that recognize and address the unique needs and experiences of men and women in relation to substance use are indispensable. This may involve funding gender-specific programs or adjusting existing policies to better support women, who appear to be at a higher risk of binge drinking.

Engaging communities in the development and implementation of polysubstance use interventions could amplify their effectiveness. Community-based approaches ensure that programs are culturally relevant and tailored to meet the specific needs of the population. Educational campaigns that raise awareness about the risks associated with unstable housing and the benefits of social support can empower communities to take proactive steps in supporting vulnerable populations. The intersection of housing, social relationships, and polysubstance use emphasizes the need for interdisciplinary collaboration among public health professionals, social workers, housing authorities, and community organizations. Such collaborations can foster

integrated approaches that address multiple aspects of substance use simultaneously, enhancing the overall well-being of individuals and communities.

Further Research Directions

While this thesis only looked at the independent associations between polysubstance use, housing status, and social living arrangements between genders, future research should examine their interacting contributions to potentially produce different patterns of polysubstance use. Addressing these areas can help to refine intervention strategies and improve the effectiveness of public health policies.

To overcome the limitations of cross-sectional data and better establish causality between housing status, social living arrangements, gender, and substance use, future research should employ longitudinal designs. These studies can track changes over time, providing insights into the temporal sequence of events and how long-term exposure to certain conditions affects substance use behaviors. Longitudinal data can also help identify critical periods for intervention and the long-term impacts of stable housing and social support systems on reducing polysubstance use. There are several challenges posed by longitudinal studies in this population, as many of them do not have fixed addresses or reliable tools for communication. These challenges make it very difficult to continuously keep up with participants to receive the necessary data.

There is a need to explore the mechanisms through which social cohabitation may exert protective effects against substance use. Future studies could investigate whether these effects are mediated by psychological factors such as increased feelings of belonging and decreased feelings of isolation, or if they are due to more tangible benefits such as shared responsibilities

that distract from substance use. Understanding these mechanisms can inform more targeted interventions that enhance the protective factors within cohabitative settings.

The gender differences observed in substance use behaviors, especially the higher odds of binge drinking among women, suggest a need for further investigation into gender-specific factors influencing these patterns. Future research should explore the sociocultural, psychological, and biological factors contributing to these differences. Studies could also examine how interventions can be tailored to meet the specific needs of men and women, potentially addressing underlying issues such as gender-related stress, coping mechanisms, and societal expectations.

Investigating the effects of policy interventions on substance use among populations experiencing housing instability or living in various social settings would provide valuable insights. Research could evaluate the effectiveness of policies such as housing-first initiatives, changes in healthcare access, or the decriminalization of certain substances. These studies can help to determine which policies are most effective in reducing substance use and improving the overall health of vulnerable populations.

Incorporating qualitative methodologies can enrich the quantitative findings of this study. Interviews, focus groups, and ethnographic research can provide deeper insights into the personal experiences and social contexts that influence substance use behaviors. This approach can uncover nuanced details that are not captured through quantitative measures alone, providing a richer understanding of the complex dynamics at play.

The promise of further research lies in its potential to unveil fresh therapeutic targets, thereby enriching the toolkit against polysubstance use with more precise and individualized approaches. Pharmacological approaches have the potential to not only alleviate withdrawal

symptoms and cravings but also aim to restore the brain's neurochemical balance disrupted by substance use. Behavioral interventions, including cognitive-behavioral therapy (CBT) and contingency management, remain cornerstones of polysubstance use reduction, addressing the psychological and social factors contributing to substance use. Additionally, integrating neuroimaging and other biomarkers could further refine treatment personalization, optimizing outcomes by matching patients with the most effective therapies based on their unique neurobiological profiles, (Volkow & Boyle, 2018). This research emphasizes the necessity for innovative therapeutic strategies that can address the unique neurobiological changes associated with polysubstance use, thereby enhancing recovery outcomes.

Finally, future research should embrace interdisciplinary approaches that integrate insights from psychology, sociology, public health, urban planning, and other fields. Such collaborative efforts can offer a more holistic view of the factors influencing substance use and lead to more comprehensive solutions. By pursuing these future research directions, scholars can build upon the findings of this study to develop a more detailed and significant understanding of the factors that influence substance use, thereby contributing to more effective and targeted public health interventions.

Tables

Table 1. Demographics Table (N= 482)

	n (%)
<i>Race</i>	
American Indian or Alaska Native	22 (4.56)
Asian	1 (0.21)
Black or African American	12 (2.49)
Native Hawaiian or Pacific Islander	3 (0.62)
Other/ Prefer Not to Answer	31 (6.43)
Two or More Races	41 (8.51)
White	372 (77.18)
<i>Ethnicity</i>	
Hispanic, Latino, or Spanish	55 (11.41)
Not Hispanic, Latino, or Spanish	404 (83.82)
Prefer Not to Answer	23 (4.77)
<i>Gender</i>	
Bigender	1 (0.21)
Gender Non-binary/Genderqueer/Gender Nonconforming	5 (1.04)
Man	318 (65.98)
Non-Binary	1 (0.21)
None of these describe me	8 (1.66)
Prefer not to answer	7 (1.45)
Woman	142 (29.46)
<i>Housing Status</i>	
Unhoused or Temporary Housing	412 (85.48)
Permanent Housing	41 (8.51)
No Answer Given	27 (5.60)
Prefer Not to Answer	2 (0.41)
<i>Social Living Arrangement</i>	
Just Me	157 (32.57)
Living with Spouse, No Kids	69 (14.32)
Living with Roommates	41 (8.51)
Family Including Kids	24 (4.96)
Family with 3 Generations	8 (1.66)
Family with 4 Generations	2 (0.41)
None of These	162 (33.61)
Prefer Not to Answer	2 (0.41)

Table 2. Odds Ratios of Binge Drinking, Cannabis Use, and Prescription Drug Misuse Between Gender, Housing Status, and Social Living Arrangement

	Binge Drinking OR (95% CI)	Cannabis Use OR (95% CI)	Prescription Drug Misuse OR (95% CI)
<i>Gender</i>			
Men	0.34 (0.14, 0.82)	1.5 (0.97, 2.36)	1.10 (0.70, 1.71)
Women	REF	REF	REF
<i>Housing Status</i>			
Facing Housing Instability	1.93 (0.25, 14.83)	2.49 (1.28, 4.83)	4.02 (1.40, 11.58)
Permanently Housed	REF	REF	REF
<i>Social Living Arrangement</i>			
Living Alone	0.26 (0.07, 0.97)	1.22 (0.72, 2.05)	1.45 (0.87, 2.42)
Living With Other	REF	REF	REF

Bibliography

- O'Donnell J, Gladden RM, Mattson CL, Hunter CT, Davis NL. *Vital Signs: Characteristics of Drug Overdose Deaths Involving Opioids and Stimulants — 24 States and the District of Columbia, January–June 2019*. *MMWR Morb Mortal Wkly Rep* 2020;69:1189–1197. DOI: <http://dx.doi.org/10.15585/mmwr.mm6935a1>
- Strathdee, Steffanie A, and Jamila K Stockman. “Epidemiology of HIV among injecting and non-injecting drug users: current trends and implications for interventions.” *Current HIV/AIDS reports* vol. 7,2 (2010): 99-106. doi:10.1007/s11904-010-0043-7
- Degenhardt, Louisa et al. “Global prevalence of injecting drug use and sociodemographic characteristics and prevalence of HIV, HBV, and HCV in people who inject drugs: a multistage systematic review.” *The Lancet. Global health* vol. 5,12 (2017): e1192-e1207. doi:10.1016/S2214-109X(17)30375-3
- Heilig, Markus, et al. “Addiction as a Brain Disease Revised: Why It Still Matters, and the Need for Consilience.” *Neuropsychopharmacology*, vol. 46, no. 10, Sept. 2021, pp. 1715–23. *PubMed Central*, <https://doi.org/10.1038/s41386-020-00950-y>.
- Robinson, Terry E, and Kent C Berridge. “Review. The incentive sensitization theory of addiction: some current issues.” *Philosophical Transactions of the Royal Society of London. Series B, Biological sciences* vol. 363,1507 (2008): 3137-46. doi:10.1098/rstb.2008.0093
- Volkow, N D et al. “Obesity and addiction: neurobiological overlaps.” *Obesity Reviews: an official journal of the International Association for the Study of Obesity* vol. 14,1 (2013): 2-18. doi:10.1111/j.1467-789X.2012.01031.x
- Peacock, Amy et al. “Global statistics on alcohol, tobacco, and illicit drug use: 2017 status report.” *Addiction (Abingdon, England)* vol. 113,10 (2018): 1905-1926. doi:10.1111/add.14234
- Jacka, Brendan et al. “Prevalence of Injecting Drug Use and Coverage of Interventions to Prevent HIV and Hepatitis C Virus Infection Among People Who Inject Drugs in Canada.” *American Journal of public health* vol. 110,1 (2020): 45-50. doi:10.2105/AJPH.2019.305379
- Gipson, Cassandra D et al. “Relapse induced by cues predicting cocaine depends on rapid, transient synaptic potentiation.” *Neuron* vol. 77,5 (2013): 867-72. doi:10.1016/j.neuron.2013.01.005
- Lüscher, Christian, and Robert C Malenka. “Drug-evoked synaptic plasticity in addiction: from molecular changes to circuit remodeling.” *Neuron* vol. 69,4 (2011): 650-63. doi:10.1016/j.neuron.2011.01.017

- Zhang, Lanlan et al. "Gender Biases in Estimation of Others' Pain." *The journal of pain* vol. 22,9 (2021): 1048-1059. doi:10.1016/j.jpain.2021.03.001
- Pinkham, Sophie et al. "Developing effective health interventions for women who inject drugs: key areas and recommendations for program development and policy." *Advances in preventive medicine* vol. 2012 (2012): 269123. doi:10.1155/2012/269123
- Greenfield, Shelly F et al. "Substance abuse in women." *The Psychiatric clinics of North America* vol. 33,2 (2010): 339-55. doi:10.1016/j.psc.2010.01.004
- Kennedy-Hendricks, Alene et al. "Social Stigma Toward Persons With Prescription Opioid Use Disorder: Associations With Public Support for Punitive and Public Health-Oriented Policies." *Psychiatric services (Washington, D.C.)* vol. 68,5 (2017): 462-469. doi:10.1176/appi.ps.201600056
- "The 2022 Annual Homelessness Assessment Report (AHAR) to Congress." 2022, <https://www.huduser.gov/portal/sites/default/files/pdf/2022-AHAR-Part-1.pdf>. Accessed 2023.
- Baggett, Travis P et al. "The unmet health care needs of homeless adults: a national study." *American journal of public health* vol. 100,7 (2010): 1326-33. doi:10.2105/AJPH.2009.180109
- Henwood, Benjamin F et al. "Maslow and mental health recovery: a comparative study of homeless programs for adults with serious mental illness." *Administration and policy in mental health* vol. 42,2 (2015): 220-8. doi:10.1007/s10488-014-0542-8
- Tsai, Jack et al. "Public exposure and attitudes about homelessness." *Journal of community psychology* vol. 47,1 (2019): 76-92. doi:10.1002/jcop.22100
- Upshur, Carole C et al. "Homeless women's service use, barriers, and motivation for participating in substance use treatment." *The American journal of drug and alcohol abuse* vol. 44,2 (2018): 252-262. doi:10.1080/00952990.2017.1357183
- Aidala, Angela A et al. "Housing Status, Medical Care, and Health Outcomes Among People Living With HIV/AIDS: A Systematic Review." *American journal of public health* vol. 106,1 (2016): e1-e23. doi:10.2105/AJPH.2015.302905
- Watson, D.P., Shuman, V., Kowalsky, J. *et al.* Housing First and harm reduction: a rapid review and document analysis of the US and Canadian open-access literature. *Harm Reduct J* **14**, 30 (2017). <https://doi.org/10.1186/s12954-017-0158-x>
- Palepu, Anita et al. "Housing first improves residential stability in homeless adults with concurrent substance dependence and mental disorders." *American journal of public health* vol. 103 Suppl 2, Suppl 2 (2013): e30-6. doi:10.2105/AJPH.2013.301628

- Tucker, Jalie A et al. "Shifts in behavioral allocation patterns as a natural recovery mechanism: Postresolution expenditure patterns." *Alcoholism, clinical and experimental research* vol. 45,6 (2021): 1304-1316. doi:10.1111/acer.14620
- Bardwell, Geoff et al. "Characterizing peer roles in an overdose crisis: Preferences for peer workers in overdose response programs in emergency shelters." *Drug and alcohol dependence* vol. 190 (2018): 6-8. doi:10.1016/j.drugalcdep.2018.05.023
- Padgett, Deborah K et al. "Complex Recovery: Understanding the Lives of Formerly Homeless Adults with Complex Needs." *Journal of social distress and the homeless* vol. 25,2 (2016): 60-70. doi:10.1080/10530789.2016.1173817
- Tsemberis, Sam. "Housing first: The pathways model to end homelessness for people with mental illness and addiction manual." *European Journal of Homelessness* 5.2 (2011).
- Polcin, Douglas L, and Rachael Korcha. "Motivation to maintain sobriety among residents of sober living recovery homes." *Substance abuse and rehabilitation* vol. 6 103-11. 11 Sep. 2015, doi:10.2147/SAR.S89361
- Henwood, Benjamin F et al. "Examining the health status of homeless adults entering permanent supportive housing." *Journal of public health (Oxford, England)* vol. 40,2 (2018): 415-418. doi:10.1093/pubmed/fox069
- Kertesz, Stefan G et al. "Housing first for homeless persons with active addiction: are we overreaching?." *The Milbank quarterly* vol. 87,2 (2009): 495-534. doi:10.1111/j.1468-0009.2009.00565.x
- Culhane, D.P., Metraux, S., Byrne, T., Stino, M. and Bainbridge, J. (2013), The Age Structure of Contemporary Homelessness: Evidence and Implications For Public Policy. *Analyses of Social Issues and Public Policy*, 13: 228-244. <https://doi.org/10.1111/asap.12004>
- Polcin, Douglas L et al. "Eighteen Month Outcomes for Clients Receiving Combined Outpatient Treatment and Sober Living Houses." *Journal of substance use* vol. 15,5 (2010): 352-366. doi:10.3109/14659890903531279
- Jason, Leonard A et al. "Oxford recovery housing: Length of stay correlated with improved outcomes for women previously involved with the criminal justice system." *Substance abuse* vol. 37,1 (2016): 248-54. doi:10.1080/08897077.2015.1037946
- Moos, R.H. and Moos, B.S. (2006), Rates and predictors of relapse after natural and treated remission from alcohol use disorders. *Addiction*, 101: 212-222. <https://doi.org/10.1111/j.1360-0443.2006.01310.x>
- Polcin, Douglas L et al. "What did we learn from our study on sober living houses and where do we go from here?." *Journal of psychoactive drugs* vol. 42,4 (2010): 425-33. doi:10.1080/02791072.2010.10400705

- Mericle, Amy A et al. "Independent and Interactive Effects of Neighborhood Disadvantage and Social Network Characteristics on Problem Drinking after Treatment." *Journal of social and clinical psychology* vol. 37,1 (2018): 1-21. doi:10.1521/jscp.2018.37.1.1
- Keyes, Katherine M et al. "Stressful life experiences, alcohol consumption, and alcohol use disorders: the epidemiologic evidence for four main types of stressors." *Psychopharmacology* vol. 218,1 (2011): 1-17. doi:10.1007/s00213-011-2236-1
- Smith, Lesley A, and David R Foxcroft. "The effect of alcohol advertising, marketing and portrayal on drinking behaviour in young people: systematic review of prospective cohort studies." *BMC public health* vol. 9 51. 6 Feb. 2009, doi:10.1186/1471-2458-9-51
- Nash, Kelly et al. "Improving executive functioning in children with fetal alcohol spectrum disorders." *Child neuropsychology : a journal on normal and abnormal development in childhood and adolescence* vol. 21,2 (2015): 191-209. doi:10.1080/09297049.2014.889110
- Matud, M. P. (2004). Gender differences in stress and coping styles. *Personality and Individual Differences*, 37(7), 1401–1415. <https://doi.org/10.1016/j.paid.2004.01.010>
- Kessler, Ronald C et al. "The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R)." *JAMA* vol. 289,23 (2003): 3095-105. doi:10.1001/jama.289.23.3095
- Fazel, Mina et al. "Mental health interventions in schools in low-income and middle-income countries." *The lancet. Psychiatry* vol. 1,5 (2014): 388-98. doi:10.1016/S2215-0366(14)70357-8
- Lucas, P., Baron, E.P. & Jikomes, N. Medical cannabis patterns of use and substitution for opioids & other pharmaceutical drugs, alcohol, tobacco, and illicit substances; results from a cross-sectional survey of authorized patients. *Harm Reduct J* 16, 9 (2019). <https://doi.org/10.1186/s12954-019-0278-6>
- Hirschi, Travis. *Causes of Delinquency*. University of California Press, 1969.
- Leonard, Noelle R et al. "A multi-method exploratory study of stress, coping, and substance use among high school youth in private schools." *Frontiers in psychology* vol. 6 1028. 23 Jul. 2015, doi:10.3389/fpsyg.2015.01028
- Tucker, Jeritt R et al. "Disentangling self-stigma: are mental illness and help-seeking self-stigmas different?." *Journal of Counseling Psychology* vol. 60,4 (2013): 520-531. doi:10.1037/a0033555
- Volkow, Nora D, and Maureen Boyle. "Neuroscience of Addiction: Relevance to Prevention and Treatment." *The American Journal of Psychiatry* vol. 175,8 (2018): 729-740. doi:10.1176/appi.ajp.2018.17101174