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Prevalence and correlates of selling illicit cannabis among people who use drugs in Vancouver, Canada: A ten-year prospective cohort study

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Abstract

Background: The illicit selling and use of cannabis is prevalent among marginalized people who use illicit drugs (PWUD). Given that participation in illicit drug markets has been previously associated with a range of health and social harms, we sought to examine the predictors of selling cannabis among PWUD in Vancouver, Canada, a setting with a *de facto* legalized cannabis market, on the eve of the planned implementation of legalized non-medical cannabis including measures to regulate the existing illicit market.

Methods: Multivariable generalized estimating equations (GEE) logistic regression was used to analyze longitudinal factors associated with selling illicit cannabis among three prospective cohorts of PWUD between September 2005 and May 2015.

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HR and MM designed the study. HR and MM drafted the article, all authors contributed substantially critically reviewing the article for intellectual content, and approved the final version.

Competing Interests: None to declare.

Results: Among the 3258 participants included in this study, 328 (10.1%) reported selling illicit cannabis at baseline, and 46 (5.1%) initiated cannabis selling over the study period. In the multivariable analysis of the whole sample, factors significantly associated with selling cannabis included cannabis use (Adjusted Odds Ratio [AOR]=4.05), dealing other drugs (AOR=3.87), being male (AOR=1.83), experiencing violence (AOR=1.40), non-medical prescription opioid use (AOR=1.32), non-custodial involvement in the criminal justice system (AOR=1.31), being stopped by police (AOR=1.30), crack use (AOR=1.25), homelessness (AOR=1.23), age (AOR=0.96 per year) and participation in sex work (AOR=0.67) (all $p<0.05$). The subanalyses indicated that dealing drugs other than cannabis, cannabis use, and non-custodial involvement in the criminal justice system were the only factors significantly associated with selling cannabis in all four subgroups.

Conclusion: These findings support existing evidence indicating that selling illicit cannabis is often a survival-driven strategy to support the basic needs and substance use of some PWUD. Our findings suggest jurisdictions with planned or impending cannabis legalization and regulation should consider the vulnerability of PWUD when seeking to eradicate illicit cannabis markets, for example, in setting criminal penalties for selling cannabis outside of regulatory frameworks.

Keywords

Cannabis; dealing; illicit drug use; substance use; prospective cohort study

INTRODUCTION

People who use drugs (PWUD) experience an array of physical, social and economic challenges owing to high-intensity substance use and dependence, structural marginalization and endemic criminalization (Blum et al., 2018; Kerr et al., 2016; Kerr et al., 2010; Marshall et al., 2016). As a result, many PWUD engage in survival-driven illicit activities to support their basic needs (Gwadz et al., 2009; Public Health Agency of Canada 2006). One primary strategy for generating income among PWUD in urban settings is engaging in the illicit drug trade (DeBeck et al., 2007; Ross, 2002). Studies from diverse settings in North America have estimated that a substantial proportion (e.g., 17-58%) of PWUD engage in selling illicit drugs, and selling illicit drugs is often a survival-driven strategy among PWUD (i.e., a means to subsidize their personal drug use and support their basic survival needs) (Bellair & McNulty, 2009; Friedman et al., 1998; Gwadz et al., 2009; Kerr et al., 2008; Small et al., 2013; Werb, Kerr, Li, Montaner, & Wood, 2008). Selling illicit drugs among PWUD is associated with high-risk drug use patterns and adverse health outcomes, including high-intensity drug use, high frequency injecting, infectious disease acquisition and the morbidity and mortality associated with overdose (Darke & Hall, 2003; Kerr et al., 2008; Sherman & Latkin, 2002). PWUD who engage in selling drugs almost exclusively occupy low-level retail roles at the bottom of the drug market hierarchy, and are often victim to violent altercations with other PWUD and confrontations with police (Erickson, 2001; Kerr, 2005; May, 2004; Small et al., 2013; Ti, Wood, Shannon, Feng, & Kerr, 2013). However, this research has traditionally focused on illegal drugs other than cannabis.

Cannabis is the most trafficked illicit drug worldwide and is the most commonly used illicit substance in North America (United Nations Office on Drugs and Crime, 2016). Compared

to other drug markets, cannabis markets appear to have distinct characteristics and have been described as “the most peaceful of the illicit drug markets” (Hammersvik, 2015; Room, 2010). This has been attributed to the fact that many illicit cannabis producers tend to originate from traditional socio-economic backgrounds with minimal involvement in drug dealing and other types of criminal activity (Potter et al., 2015). Researchers have also found that a significant proportion of illicit cultivators engage in social supply, defined as the non-commercial supply of drugs to friends and acquaintances for little or no profit (Coomber et al., 2018). Together, the demographics of cannabis cultivators and the cohesive social networks among buyers and sellers contribute to the low prevalence of conflict and violence among illicit cannabis markets (Belackova & Vaccaro, 2013; Coomber et al., 2018; Hammersvik, 2015). Despite the scope of the research examining illicit cannabis markets, the characteristics and predictors of cannabis selling among marginalized and vulnerable individuals who use drugs other than or in addition to cannabis (herein referred to as PWUD) have not been well described. Existing studies have found that PWUD often engage in selling illicit drugs to support their personal drug dependence, fulfill basic survival needs (e.g., food or shelter) and a lack of employable job skills or past criminal histories often limit PWUD to prohibited income generating activities (DeBeck et al., 2007; Small et al., 2013). As a result, it is unclear whether selling cannabis among PWUD is associated with the health and social risks involved in traditional illicit drug markets (e.g., high-intensity drug use and violence), or is more consistent with non-violent cannabis markets where social supply is prevalent.

The importance of this evidence gap is magnified by the fact that many jurisdictions are planning or have implemented frameworks to legalize and regulate the production, distribution, sale and non-medical use of cannabis by adults. In Canada, the federal government recently passed the *Cannabis Act*, legalizing and regulating the production, distribution and sale of cannabis to adults for non-medical use (House of Commons of Canada 2018). This legislation has a primary goal of eliminating the illicit (i.e., pre-legalization) market and enacts harsh penalties (e.g., up to 14 years imprisonment) for individuals selling cannabis outside the legal framework (House of Commons of Canada 2018). The justification for these penalties is based on targeting organized crime or people who make cannabis available to youth (Cannabis Legalization and Regulation, 2018). However, many authors have argued that these penalties are disproportionate compared to other psychoactive substances and may lead to unintentional negative consequences for marginalized drug users who are involved in the illicit cannabis trade as a means of economic survival (Valleriani, Lavalley, & McNeil, 2018). In Vancouver, our study setting, the municipal police department has followed a *de facto* policy of cannabis use decriminalization since 2005. Beginning in 2015, retail storefronts selling cannabis to adults have proliferated and a high degree of judicial discretion has been applied to determine individual penalties for street-level cannabis selling (Capler et al., 2017; Coomber et al., 2018). In an effort to understand the possible impacts of cannabis legalization and regulation on the health, well-being and economic security of PWUD in Canada, we sought to estimate the prevalence and correlates of selling illicit cannabis in a *de facto* decriminalized jurisdiction prior to the implementation of non-medical cannabis legalization and regulation.

METHODS

Study Procedure

The analyses for this study were performed with linked data obtained from three ongoing, open and prospective cohort studies of people who use drugs: the Vancouver Injection Drug Users Study (VIDUS), a cohort of HIV-negative people who inject drugs; the AIDS Care Cohort to evaluate Exposure to Survival Services (ACCESS), a cohort of HIV-positive people who use illicit drugs other than or in addition to cannabis; and the At-Risk Youth Study (ARYS), a cohort of street-involved youth (i.e., 14-26 years old) who use illicit drugs other than or in addition to cannabis. The methodology for each of these studies has been described in detail previously (Palepu et al., 2006; Strathdee et al., 1997; Wood, Stoltz, Montaner, & Kerr, 2006). To enroll in any of the three studies, participants were required to reside in the Greater Vancouver Regional District and provide written informed consent. At baseline and at every six-month follow-up contact, participants complete an interviewer-administered questionnaire to collect data related to substance use patterns, income generating activities, drug-related harms and engagement with health and social services. They also complete a nurse-administered questionnaire focused on health status and provide blood samples for diagnostic testing (e.g., HIV and HCV antibody and HIV clinical monitoring). The data for the present analysis were collected from September 2005 to May 2015. Harmonized recruitment and data collection procedures allow combined analyses of data from all three cohorts. At each study visit participants receive $30 CAD as remuneration for their time. The University of British Columbia/Providence Health Care Research Ethics Board has approved these studies.

Participants and Measures

In the present study, we included all VIDUS, ACCESS and ARYS participants aged ≥18 years and completed at least one follow-up visit over the study period (September 2005 to May 2015). The primary outcome of interest was self-reported engagement in selling cannabis in the last six months. To provide a comprehensive assessment of predictors of cannabis selling, we selected potential explanatory variables to include in the analysis *a priori* based on previous studies of drug selling among PWUD (DeBeck et al., 2007; Kerr et al., 2008; Werb et al., 2008). These variables included demographic factors such as: age (per year older); sex (male vs. female); self-reported ethnicity/ancestry (white vs. others); and high-school completion (high school education or greater achieved vs. less the high school level education). Drug-related variables included: cannabis use (yes vs. no); binge alcohol use, defined as using alcohol more than usual (yes vs. no); crack cocaine use (yes vs. no); injection heroin use (yes vs. no); injection cocaine use (yes vs. no); and non-medical prescription opioid use (yes vs. no). Social/structural exposure variables included: experiencing violence (having been attacked, assaulted, or suffered any kind of violence, (yes vs. no); homelessness (yes vs. no); employment (having a regular, temporary, or self-employed work vs. none); encounters with police, including being stopped, searched or detained by police without arrest (yes vs. no); having an arrest warrant (yes vs. no); incarceration, defined as spending at least one night in a detention centre, jail, prison or penitentiary (yes vs. no); non-custodial involvement in the criminal justice system, defined as having a bail/parole condition including an area restriction (yes vs. no); involvement in

selling drugs other than cannabis (yes vs. no); involvement in sex work (yes vs. no); and engagement with alcohol or drug treatment programs (yes vs. no). The definitions of these variables are consistent with previous studies and all behavioural variables refer to the six-month period preceding the interview (Wood et al., 2001).

Statistical Analysis

First, we examined the characteristics at baseline of the study sample stratified by selling cannabis in the last six months. Second, to estimate the relationships between the outcome and each explanatory variable, we employed logistic regression with generalized estimating equations and an exchangeable correlation structure to account for the correlated data from repeated measures of each participant. We used a previously described backward selection process whereby variables with a significant bivariable association with cannabis selling, at the $p<0.10$ threshold, were included in the final multivariable model (Maldonado & Greenland, 1993). The lowest quasilikelihood under the independence model criterion (QIC) value was used to identify the model with the best overall fit (Pan, 2001). Since engagement with selling illicit drugs has been found to vary by gender and age, and because of strong age and gender correlates of cannabis selling in the preliminary analyses, we also conducted subanalyses to identify predictors of selling cannabis in specific sex and age strata (Bellair & McNulty, 2009; Fast, Shoveller, & Kerr, 2017; Gwadz et al., 2009; Hepburn et al., 2016; Mayock, 2005). These additional models included subgroups of females ≤ 30 years old, males ≤ 30 years old, females > 30 years old, males >30 years old. These four additional models applied the same model building approach as the primary analysis that included the entire sample of participants. Given that the amount of missing data for the predictor variables was low (<1%), these values were excluded from the analysis. If participants were missing data for a specific follow-up visit, these values were imputed using data from the next most recent follow-up interview. SAS version 9.4 (SAS Institute, USA) was used for all statistical analyses and all tests of significance were two sided.

RESULTS

A total of 3258 participants were enrolled into the VIDUS (N=1210), ACCESS (N=833) or ARYS (N=1215) cohorts during the study period (September 2005 to May 2015), completed at least one interview, and were included in this analysis. The mean number of follow-up visits completed by the participants was 7.6 (standard deviation = 5.9). The median age of participants at baseline was 33.2 years (interquartile range [IQR] = 22.8-44.3), 2195 (67.4%) were male, and 2025 (62.2%) were white. Participants completed a median of six study visits (IQR = 2–13) and the median observation time per participant was 44.5 months (IQR = 12.0–94.2).

At baseline, 328 (10.1%) participants reported selling cannabis in the past six months and 46 (5.1%) initiated selling cannabis at least once during the study period. The number of participants reporting cannabis selling was greatest at baseline and the prevalence decreased significantly over the remaining follow-up visits (Figure 1). The prevalence of selling cannabis at baseline varied between study cohorts (ARYS: 229, 18.8%; ACCESS: 34, 4.1%; VIDUS: 65, 5.4%), and 1294 (39.7%) reported selling drugs of any kind. The baseline

characteristics of the study participants, stratified by involvement in cannabis selling, are summarized in Table 1. The bivariable and multivariable analyses are reported in Table 2. Time-updated factors positively associated with cannabis selling in the multivariable analyses included cannabis use (adjusted odds ratio [AOR] = 4.05; 95% confidence interval [CI]: 3.12 – 5.24), selling drugs other than cannabis (AOR = 3.87; 95% CI: 3.18–4.71), male sex (AOR = 1.83; 95% CI: 1.38–2.43), experiencing violence (AOR = 1.40; 95% CI: 1.19–1.65), non-medical prescription opioid use (AOR = 1.32; 95% CI: 1.06–1.64), non-custodial involvement in the criminal justice system (AOR = 1.31; 95% CI: 1.08–1.59), being stopped by police, crack use and homelessness (AOR = 1.30; 95% CI: 1.11–1.51). Older age (per year older) (AOR = 0.96; 95% CI: 0.94–0.97) and involvement in sex work (AOR = 0.67; 95% CI: 0.49–0.92) were negatively associated with selling cannabis.

The subanalyses of the four sex and age subgroups (females ≤ 30 years old, males ≤ 30 years old, females > 30 years old, males >30 years old) demonstrated that dealing drugs other than cannabis, cannabis use, and non-custodial involvement in the criminal justice system were the only three factors significantly associated with selling cannabis in all four subgroups. Homelessness and encounters with police were significantly associated with selling cannabis in all subgroups, except for among females over 30 years old. Non-medical prescription opioid use was positively associated with selling cannabis in the overall analysis and this association was only significant among females over 30 years old, while involvement in sex work was negatively associated with selling cannabis in the overall analysis and only significant among females ≤ 30 years old (Table 3).

DISCUSSION

Our findings indicate that nearly 15% of PWUD sample living in Vancouver, Canada engaged in selling cannabis during the approximately 10-year study period. Consistent with previous research, many of the correlates identified are consistent with cannabis selling being a survival-driven economic strategy to support the substance use and basic needs of PWUD, especially among members of certain age and sex groups (Bellair & McNulty, 2009; Gwadz et al., 2009; Kerr et al., 2008; Public Health Agency of Canada 2006; Werb et al., 2008). However, previous studies have also reported that drug dealing is associated with intense patterns of drug use such as high frequency injecting, and we did not observe these associations with cannabis selling in the present study (Kerr et al., 2008; Sherman & Latkin, 2002).

We observed greater likelihoods of cannabis selling among younger individuals and males, consistent with cohort data from at-risk youth in North America reporting that over half of the participants have engaged in drug dealing, while studies of older PWUD report prevalence estimates of 17-25% (Gwadz et al., 2009; Kerr et al., 2008; Semple, Strathdee, Zians, & Patterson, 2013; Werb et al., 2008). Many PWUD initiate and continue drug dealing despite the associated risks, due to the need to support ongoing drug use, as well as the stigmatization and marginalization that persist as barriers to participation in the legal economy (Fast et al., 2017; Hepburn et al., 2016; Small et al., 2013; Werb et al., 2011). Looking beyond economic explanations, qualitative work suggests that drug dealing can enmesh individuals in valued forms of sociality, morality, dignity and belonging in places

characterized by entrenched marginalization and exclusion (Bourgois, 1996; Cheng et al., 2016; Fast et al., 2017; Fast, Shoveller, Shannon, & Kerr, 2010; Wakeman, 2016). Therefore, expanding low-threshold employment opportunities for PWUD and pairing these opportunities with addiction services may not only serve to alleviate economic constraints, but also provide PWUD with valued forms of sociality and belonging outside of the illicit drug market (DeBeck et al., 2007). The health, social and economic benefits of integrating employment opportunities for PWUD with substance use treatment have been reported in settings such as Portugal, where the average employment rate of PWUD undergoing treatment is nearly 50% (Goncalves, Lourenco, & Silva, 2015; Hughes & Stevens, 2010). Our finding that selling cannabis was more common among males and is associated with experiencing violence is also congruent with previous research (Bourgois, Prince, & Moss, 2004; Denton, 1999; Hayashi et al., 2016; Hepburn et al., 2016; Mayock, 2005). With no recourse to legal dispute settlement mechanisms, street-based drug dealing is often animated by gendered hierarchies and forms of sociality that position men in dominant roles with greater control over resources, as well as at higher risk for experiencing violence (Bourdieu, 2001; Epele, 2002; Fairbairn, Small, Shannon, Wood, & Kerr, 2008). As a result, women tend to be systematically excluded from illicit drug markets altogether, or excluded from upper-level roles in the drug dealing hierarchy, and derive less benefit from involvement in illicit drug trade (Braitstein et al., 2003; Fairbairn et al., 2008; Maher & Daly, 1996; Shannon et al., 2008; Small et al., 2013). Nevertheless, previous literature has shown that some female participants engage in drug dealing as a temporary reprieve from less desirable forms of income generation, such as sex work (Maher, 1997; Small et al., 2013).

Our results also have important implications for drug policy. Canada's recently-passed *Cannabis Act* legalizes and regulates the production, distribution and sale of non-medical cannabis by certain producers and retailers, depending on the jurisdiction. These regulations include criminal penalties for the illegal distribution and sale of cannabis ranging from small fines for unauthorized street-level sales to adults, to up to 14 years imprisonment for offences such as unauthorized distribution to minors (House of Commons of Canada 2018). The Cannabis Act received criticism for introducing additional criminal offences related to cannabis, including penalties for possession of illicitly-sourced cannabis that are drastically disproportionate to infractions involving any other licit substance (Bill C-45 2018; Valleriani et al., 2018). Evidence from Portugal, which has decriminalized the possession of all illicit drugs, reported that the social cost of drugs decreased by 12% in the five years following the approval of the National Strategy for the Fight Against Drugs (Goncalves et al., 2015). Other criticized shortcomings of Cannabis Act include the failure to expunge cannabis-related offences that were legalized in October 2018. These penalties are a legal and social burden to members of marginalized groups such as PWUD and racial minorities and failure to implement the appropriate reparations will allow these disparities to continue post-legalization (Valleriani et al., 2018). As an example, cannabis-related charges have decreased significantly in US states that have legalized access to non-medical cannabis, yet the racial disparities in these charges have continued (Valleriani et al., 2018).

The current evidence, including the findings from this study, demonstrate that there is a high prevalence of illicit drug selling among PWUD and the harsh penalties for drug selling offences may be misplaced among of PWUD (Dwyer & Moore, 2010; Fitzgerald, 2009;

Small et al., 2013). This is particularly relevant for at-risk youth who use drugs, where the prevalence of drug selling has been found to be over 60% in some settings (Cheng et al., 2016; Hepburn et al., 2016; Werb et al., 2008). In addition to their social and economic vulnerability, these PWUD are struggling with other forms of illicit drug use, which is supported by the observation that people who sell cannabis are also more likely to report the use of crack and illicit prescription opioids (Decker, 2000; Fast, Small, Wood, & Kerr, 2009; Small et al., 2013). Lastly, the challenges faced by PWUD who sell drugs are compounded by high rates of homelessness and violent encounters with other PWUD and law enforcement (Marshall et al., 2016; May, 2004). Together, these findings demonstrate that many PWUD are contending with the intersection of multiple social, economic and health vulnerabilities. There is also evidence suggesting that participation in drug dealing is often a means of economic survival that provides alternate forms of sociality, mediates boredom of 'life in the margins' and is a strategy to support their addiction, rather than as a method of gainful employment (DeBeck et al., 2007; Fast et al., 2017). In fact, a previous study reported that decreased intensity of drug use was an independent predictor of drug dealing cessation among PWUD (Werb et al., 2011). Linking low-threshold employment opportunities with addiction services may be an opportunity for PWUD to replace their participation in illicit drug selling with productive legal occupations, and prevent PWUD from transitioning into other forms of drug selling that are often more violent than illicit cannabis markets (DeBeck et al., 2007; Hammersvik, 2015).

The findings from the subanalyses highlighted unique correlates of cannabis selling in these cohorts. Cannabis use, dealing drugs other than cannabis and non-custodial involvement in the criminal justice system were the only factors associated with cannabis selling in all four age and sex subgroups. Given that people who sell drugs often do so to gain access to illicit substances, it is not surprising that cannabis selling was common among those who use cannabis (Small et al., 2013). In contrast to previous studies of illicit drug markets, cannabis selling was not significantly associated with high-risk drug use patterns such as injection drug use or binge drug use, and injection drug use was only significantly associated with cannabis selling among males over 30 years old and this was restricted to cocaine use (Kerr et al., 2008). Cannabis selling was however significantly associated with being a victim of violence, encounters with police and homelessness, which is consistent with existing studies of illicit drug markets (Erickson, 2001; Kerr, 2005; May, 2004; Small et al., 2013; Ti, Wood, Shannon, Feng, & Kerr, 2013). These associations were observed in the overall analysis (Table 2) as well as in all age and sex subgroups except females over 30 years old (Table 3). Interestingly, the subgroup analyses indicated that selling cannabis was negatively associated with participation in sex work but this was restricted to females younger than 30 years of age. This may lend support to previous findings that female PWUD engage in drug selling as a temporary reprieve from sex work (Small et al., 2013). Therefore, PWUD engaged in selling cannabis appear to share some characteristics of other illicit markets, and experience health and economic insecurities that are less common in traditional cannabis markets (Hammersvik, 2015; Potter et al., 2015).

The strengths of this study include the prospective repeated measures design, the nine year and eight month follow-up period, and the thorough data collection procedures. Including three different cohorts of participants also provided data from PWUD at varying points in

their drug use career. The limitations of this study include self-reported data collection, which creates the potential for socially desirable responding of stigmatized and criminalized behaviours and recall error. Measurement error associated with an exposure generally produces an underestimate of the true effect size (Reddon, Gueant, & Meyre, 2016). However, self-reported drug use data has been found to produce reliable and valid measures in previous studies (Darke, 1998). Since these cohorts do not represent random samples of PWUD, these results may not be generalizable to PWUD in other settings. It is also important to note that analyzing the three study cohorts as a combined sample may have prevented the identification of associations that were specific to individual cohorts. There is also a possibility that the correlates of cannabis selling may differ among people who inject drugs and people who do not inject drugs, and this was not analyzed in the present study. Lastly, residual confounding may have influenced the association between the independent variables and cannabis selling since this was an observational study.

The findings from the present study support the existing evidence indicating that many PWUD engage in selling drugs as a survival strategy to meet their basic financial needs and support their illicit drug use. The illicit sale of cannabis was also associated with experiences of violence and confrontations with police. Future cannabis legalization policy should consider the vulnerability of PWUD when designing the criminal penalties for selling cannabis outside of the regulatory framework.

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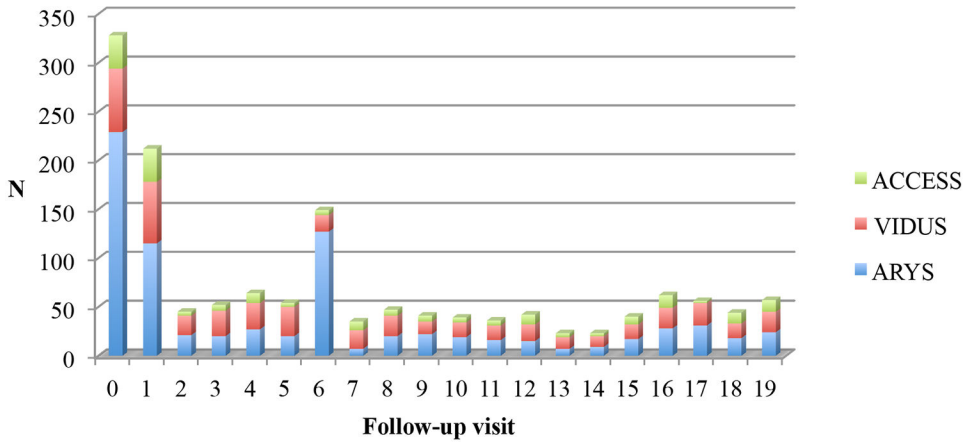

Figure 1.

Number of participants reporting selling cannabis at baseline (follow-up visit 0) and each subsequent follow-up visit.

Table 1:

Baseline characteristics of the study sample stratified by involvement in cannabis selling in the past six months.

Characteristic	Cannabis selling		Odds Ratio (95% CI)	*p* – value
	Yes (n=328) n (%)	No (n=2930) n (%)		
Age (per year older				
Median	22.8	34.9	0.93 (0.92 – 0.94)	**<0.001**
IQR	(20.4 - 28.0)	(23.3 - 45.0)		
Male				
Yes	75 (22.9)	988 (33.7)	1.72 (1.31 – 2.25)	**<0.001**
No	253 (77.1)	1942 (66.3)		
Caucasian ethnicity				
Yes	227 (69.2)	1798 (61.4)	1.43 (1.12 – 1.83)	**0.005**
No	100 (30.5)	1131 (38.6)		
Homeless[A]				
Yes	235 (71.6)	1388 (47.4)	2.81 (2.19 – 3.62)	**<0.001**
No	92 (28.0)	1529 (52.2)		
High-school diploma				
Yes	119 (36.3)	1305 (44.5)	0.70 (0.55 – 0.89)	**0.003**
No	204 (62.2)	1564 (53.4)		
Employment[A]				
Yes	160 (48.8)	985 (33.6)	1.88 (1.49 – 2.37)	**<0.001**
No	168 (51.2)	1945 (66.4)		
Sex work[A]				
Yes	23 (7.0)	414 (14.1)	0.46 (0.29 – 0.71)	**<0.001**
No	303 (92.4)	2489 (84.9)		
Dealing drugs other than cannabis[A]				
Yes	77 (23.5)	82 (2.8)	10.65 (7.61 – 14.9)	**<0.001**
No	251 (76.5)	2848 (97.2)		
Cannabis use[A]				
Yes	291 (88.7)	1909 (65.2)	4.17 (2.54 – 5.92)	**<0.001**
No	37 (11.3)	1012 (34.5)		
Binge alcohol use[A]				
Yes	33 (10.1)	180 (6.1)	1.71 (1.16 – 2.52)	**0.009**
No	294 (89.6)	2737 (93.4)		
Crack use[A]				
Yes	210 (64.0)	2059 (70.3)	0.76 (0.60 – 0.96)	**0.026**
No	116 (35.4)	861 (29.4)		
Injection cocaine use[A]				

Characteristic	Cannabis selling			
	Yes (n=328) n (%)	No (n=2930) n (%)	Odds Ratio (95% CI)	*p* – value
Yes	74 (22.6)	985 (33.6)	0.57 (0.44 – 0.75)	**<0.001**
No	254 (77.4)	1932 (65.9)		
Injection heroin use[A]				
Yes	115 (35.1)	1308 (44.6)	0.66 (0.52 – 0.84)	**0.001**
No	213 (65.1)	1610 (54.9)		
Prescription opioid use[A]				
Yes	104 (31.7)	778 (26.6)	1.31 (1.02 – 1.68)	**0.035**
No	216 (65.9)	2119 (72.3)		
Victim of violence[A]				
Yes	160 (48.8)	860 (29.4)	2.30 (1.82 – 2.90)	**<0.001**
No	163 (49.7)	2013 (68.7)		
Encounters with police[A]				
Yes	155 (47.3)	836 (28.5)	2.33 (1.85 – 2.95)	**<0.001**
No	163 (49.7)	2052 (70.0)		
Arrest warrant[A]				
Yes	130 (39.6)	575 (19.6)	2.71 (2.13 – 3.45)	**<0.001**
No	193 (58.8)	2316 (79.0)		
Recent incarceration[A]				
Yes	87 (26.5)	469 (16.0)	1.91 (1.46 – 2.49)	**<0.001**
No	236 (72)	2429 (82.9)		
Non-custodial involvement in the criminal justice system [A]				
Yes	84 (25.6)	394 (13.4)	2.25 (1.71 – 2.94)	**<0.001**
No	237 (72.3)	2496 (85.2)		
Participation in alcohol or drug treatment[A]				
Yes	114 (34.8)	1278 (43.6)	0.68 (0.54 – 0.87)	**0.002**
No	211 (64.3)	1612 (55.0)		

Notes: CI: confidence interval; IQR: interquartile range; p-values based on Fischer exact test

[A]denotes activities in the six months prior to follow-up interview; bold values indicate p-values <0.05.

Table 2.

Bivariable and multivariable GEE analysis of factors associated with cannabis selling.

Characteristic	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Age		
(per year older)	0.94 (0.93 – 0.95)	**0.96 (0.94 – 0.97)**
Sex		
(male vs. female)	2.21 (1.74 – 2.80)	**1.83 (1.38 – 2.43)**
Caucasian ethnicity		
(yes vs. no)	1.22 (0.98 – 1.51)	–
Homeless [A]		
(yes vs. no)	3.08 (2.61 – 3.63)	**1.23 (1.03 – 1.45)**
High school diploma		
(yes vs. no)	0.70 (0.57 – 0.87)	0.91 (0.73 – 1.14)
Employment [A]		
(yes vs. no)	1.52 (1.29 – 1.78)	1.21 (1.00 – 1.47)
Sex work [A]		
(yes vs. no)	0.71 (0.53 – 0.94)	**0.67 (0.49 – 0.92)**
Dealing drugs other than cannabis [A]		
(yes vs. no)	4.67 (3.94 – 5.52)	**3.87 (3.18 – 4.71)**
Cannabis use [A]		
(yes vs. no)	6.81 (5.38 – 8.63)	**4.05 (3.12 – 5.24)**
Binge alcohol use [A]		
(yes vs. no)	1.86 (1.45 – 2.40)	1.11 (0.85 – 1.46)
Crack use [A]		
(yes vs. no)	1.36 (1.15 – 1.62)	**1.25 (1.04 – 1.50)**
Injection cocaine use [A]		
(yes vs. no)	0.99 (0.82 – 1.20)	–
Injection heroin use [A]		
(yes vs. no)	1.22 (1.01 – 1.48)	0.97 (0.77 – 1.23)
Prescription opioid use [A]		
(yes vs. no)	1.96 (1.65 – 2.33)	**1.32 (1.06 – 1.64)**
Victim of violence [A]		
(yes vs. no)	2.92 (2.51 – 3.40)	**1.40 (1.19 – 1.65)**
Encounters with police [A]		
(yes vs. no)	3.16 (2.72 – 3.67)	**1.30 (1.11 – 1.51)**
Arrest warrant [A]		

Characteristic	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
(yes vs. no)	2.40 (2.02 – 2.86)	0.87 (0.71 – 1.06)
Recent incarceration [A]		
(yes vs. no)	2.67 (2.23 – 3.20)	1.12 (0.91 – 1.37)
Non-custodial involvement in the criminal justice system [A]		
(yes vs. no)	2.81 (2.39 – 3.31)	**1.31 (1.08 – 1.59)**
Participation in alcohol or drug treatment [A]		
(yes vs. no)	0.77 (0.64 – 0.93)	1.00 (0.83 – 1.20)

Notes: CI: confidence interval

[A] denotes activities in the six months prior to follow-up interview; bold values indicate p-values <0.05.

Table 3.

Multivariable GEE analysis of factors associated with selling cannabis among female and male participants stratified by age (≤30 years old vs. >30 years old).

	Females		Males	
	≤30 years old	>30 years old	≤30 years old	>30 years old
Characteristic	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Caucasian ethnicity (yes vs. no)	–	–	–	–
Homeless[A] (yes vs. no)	**1.69 (1.42 – 2.01)**	–	**1.69 (1.42 – 2.02)**	**1.70 (1.43 – 2.03)**
High school diploma (yes vs. no)	0.80 (0.65 – 1.00)	–	–	–
Employment[A] (yes vs. no)	**1.53 (1.28 – 1.82)**	–	–	–
Sex work[A] (yes vs. no)	**0.62 (0.46 – 0.83)**	–	–	–
Dealing drugs other than cannabis[A] (yes vs. no)	**4.03 (3.31 – 4.91)**	**4.00 (3.35 – 4.77)**	**3.72 (3.09 – 4.48)**	**3.72 (3.09 – 4.48)**
Cannabis use[A] (yes vs. no)	**5.16 (4.03 – 6.61)**	**6.20 (4.89 – 7.85)**	**5.51 (4.34 – 6.99)**	**5.54 (4.37 – 7.04)**
Binge alcohol use[A] (yes vs. no)	–	–	1.21 (0.93 – 1.58)	–
Crack use[A] (yes vs. no)	–	–	0.94 (0.78 – 1.14)	0.94 (0.78 – 1.15)
Injection cocaine use[A] (yes vs. no)	–	–	0.74 (0.61 – 0.91)	**0.74 (0.61 – 0.90)**
Injection heroin use[A] (yes vs. no)	0.87 (0.68 – 1.11)	–	–	–
Prescription opioid use[A] (yes vs. no)	**1.24 (1.00 – 1.54)**	**1.22 (1.01 – 1.46)**	1.19 (0.99-1.45)	1.19 (0.98 – 1.44)
Victim of violence[A] (yes vs. no)	**1.57 (1.34 – 1.86)**	–	**1.61 (1.36-1.89)**	**1.62 (1.37 – 1.91)**
Encounters with police[A] (yes vs. no)	**1.45 (1.24 – 1.71**	–	**1.43 (1.22-1.68)**	**1.43 (1.22 – 1.68)**
Arrest warrant[A] (yes vs. no)	1.08 (0.88 – 1.32)	–	1.03 (0.84-1.27)	1.03 (0.84 – 1.27)
Recent incarceration[A] (yes vs. no)	–	**1.52 (1.24 – 1.86)**	1.14 (0.93-1.41)	1.15 (0.93 – 1.42)
Non-custodial involvement in the criminal justice system[A] (yes vs. no)	**1.43 (1.17 – 1.74)**	**1.70 (1.42 – 2.03)**	**1.41 (1.16-1.72)**	**1.41 (1.16 – 1.71)**
Participation in alcohol or drug treatment[A] (yes vs. no)	0.90 (0.75 – 1.09)	–	–	–

Notes: Cl: confidence interval

[A] denotes activities in the six months prior to follow-up interview; bold values indicate p-values <0.05.