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ORIGINAL ARTICLE

Association of Substance Use Patterns with Psychiatric Disorders in Homeless Persons with Psychiatric Disorders in Vancouver

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Abstract

Substance use and psychiatric disorders are highly prevalent in persons experiencing homelessness. We aimed to investigate the associations between the patterns of substance use and risk behaviors with specific psychiatric disorders in homeless persons with psychiatric disorders using baseline data of the Vancouver sample ($N = 494$) of the At Home/Chez Soi study. Psychiatric disorders were diagnosed with the MINI Neuropsychiatric Interview 6.0, and substance use was assessed with the Maudsley Addiction Profile. In a multivariate analysis, major depressive disorder was associated with the use of stimulants and benzodiazepines, respectively. Posttraumatic stress disorder (PTSD) was associated with stimulant use. Panic disorder was associated with alcohol and benzodiazepine use, respectively. Opioid use was less common in participants with a psychotic disorder. Injection use of drugs occurred more often among participants with major depressive disorder, PTSD, and mood disorder with psychotic features. Awareness of these associations will be useful for clinicians for targeted prevention, diagnosis, and treatment of this population.

Keywords Alcohol · Opioid · Stimulant · Cannabis · Route of administration · Risk behavior

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Homelessness is a phenomenon of global relevance. According to recent reports, 554,000 people are homeless on a given night in the USA, and for every 10,000 people, there are 17 experiencing homelessness (The U.S. Department of Housing and Urban Development 2017). In Canada, this number is lower with 9 per 10,000 experiencing homelessness, but still, about 235,000 Canadians are affected annually (Gaetz et al. 2014).

Compared with the general population, the prevalence of physical and psychiatric disorders among homeless persons is high (Fazel et al. 2014; Fazel et al. 2008; Kessler et al. 2005; Koegel et al. 1988), yet only a small portion receives adequate care (Hwang et al. 2011; Krausz et al. 2013). Barriers to care and the often complex demands of multiple comorbid conditions impair medical treatment, which is frequently provided through emergency care (Fazel et al. 2014).

Both ICD-10 and DSM-V consider substance use disorders to be mental disorders. However, for the sake of clarity, we will use the term "psychiatric disorders" for mental disorders other than substance use disorders throughout this paper. Anxiety disorders, depression, schizophrenia-spectrum disorders, and posttraumatic stress disorder (PTSD) are much more common in the homeless population in British Columbia than in the general population (Krausz et al. 2013). Prevalence of alcohol or drug dependence is even higher (Krausz et al. 2013), a finding which is supported by the results of a meta-analysis of homeless populations in other settings (Fazel et al. 2008).

Co-occurring substance use and psychiatric disorders (dual diagnosis) are of particular interest in homeless populations for two reasons. First, the prevalence of dual diagnosis is much higher than in non-homeless populations. A Canadian study found it occurs in up to 58% of homeless women (Torchalla et al. 2011). Second, substance use in individuals experiencing homelessness has been associated with an increase of mental health problems (Grinman et al. 2010) and more extensive homeless histories in homeless veterans (Tsai et al. 2014). Concurrent substance use not only puts affected individuals at an increased risk of physical disorders, such as traumatic brain injury, hepatitis C, or HIV but also increases the barriers to care: for many services for homeless persons, substance use is an exclusion criterion (Hwang and Burns 2014).

Generally, the relationship between substance use and psychiatric disorders in comorbid patients is complex. Withdrawal syndromes of substances like benzodiazepines (BZD) or stimulants overlap with symptoms of psychiatric disorders (Ashton 2005; Lago and Kosten 1994). Furthermore, substance use may precipitate psychiatric disorders, but substances may also be used to cope with the symptoms of psychiatric disorders (Bolton et al. 2009; Martins et al. 2009; Robinson et al. 2009). Such a form of self-medication may be particularly relevant for homeless populations, who are facing larger barriers to adequate psychiatric care than substance users in more stable housing conditions.

Most studies in populations experiencing homelessness have focused on the prevalence of co-occurring diagnostic categories of psychiatric disorders and alcohol or drug dependence. However, a person using a substance may not necessarily fulfill diagnostic criteria for dependence or harmful use. Furthermore, these studies tend to aggregate opioid, stimulant or cannabis use as "drug" use. Both procedures may thus not adequately reflect the complexity of this behavior. The association of type and pattern of substances used with specific psychiatric disorders is largely unclear. A more detailed understanding of this relationship in homeless with psychiatric disorders would be instrumental to understand the role that potential self-medication may play, and inform targeted prevention as well as the delivery of effective care in this high-need population.

We use data of the Vancouver sample of the At home/Chez Soi study to investigate the following hypotheses for the associations between psychiatric diagnoses and specific substance use, based on either the theory of self-medication or drug effects described in the literature:

1. A major depressive episode is associated with stimulant and alcohol use and daily alcohol use in participants with any alcohol use. Depressive symptoms have been described in relation to stimulant and alcohol use and withdrawal (Boden and Fergusson 2011; Mahoney et al. 2015), and stimulants have been used in the treatment of depression (McIntyre et al. 2017).
2. Diagnosis of panic disorder is associated with BZD use, as BZD has anxiolytic properties and may be used for self-medication (Esposito et al. 2009).
3. Diagnoses of a current psychotic disorder or mood disorder with psychotic features are associated with cannabis and stimulant use, as both have been reported to cause psychotic symptoms (D'Souza et al. 2004; Roncero et al. 2014; Volkow et al. 2016). These diagnostic categories are also positively associated with the intravenous route of administration in stimulant users, and daily use of cannabis and stimulants in respective users (Tang et al. 2014).

Methods

We used the baseline data of the Vancouver sample of the At Home/Chez Soi study, a pragmatic multicenter randomized controlled trial evaluating the effects of a Housing First intervention in Canadian homeless with psychiatric disorders. The inclusion criteria were a minimum of 19 years of age, the status of absolute homelessness or precarious housing, and diagnosis of a psychiatric disorder with or without substance use in the Mini 6.0 Neuropsychiatric Interview (MINI 6.0) (Sheehan et al. 1998). Therefore, all participants were diagnosed with at least one non-substance-related psychiatric disorder. Patients who were relatively homeless, or were already clients of existing programs offering the study interventions (assertive community treatment or intensive case management) were excluded. Participants were recruited via shelters, drop-in centers, hospitals, outreach teams, community psychiatric health workers, and justice programs. All participants provided written informed consent. The institutional ethics board of the University of British Columbia as well as the Simon Fraser University approved the study. The study procedures have been described in detail elsewhere (Goering et al. 2011). We have previously reported on the association of the daily use of any substance with the general severity of psychiatric symptoms in this sample (Palepu et al. 2012).

Among others, the baseline interview comprised questions on demographic characteristics. Furthermore, current diagnoses of psychiatric disorders were assessed with the MINI 6.0, a structured diagnostic interview based on ICD-10 and DSM-IV criteria for an axis I psychiatric disorders. It has been used in a wide range of settings, demonstrating validity and reliability (Sheehan et al. 1998).

Self-reported substance use was assessed with the Maudsley Addiction Profile (MAP) (Marsden et al. 1998). The MAP contains questions on the presence, frequency, amount, and route of administration of the use of specific non-prescribed substances in the past month.

Furthermore, it assesses health risk behaviors such as drug overdoses, sharing of injection paraphernalia, and unprotected sex in the same period. Validity and reliability of the MAP are also well established (Marsden et al. 1998, 2000). For the purposes of this analysis, in addition to using the individual substances, we also aggregated "heroin" and "illicit methadone" to "illicit opioid," and "crack," "cocaine powder," and "amphetamines" to "stimulants." For the analysis of substance use patterns, we dichotomized the frequency of use to "daily" or "non-daily use" for each substance. The category "non-daily use" also included those participants not using the substance at all. We did not assess tobacco use.

We analyzed bivariate associations of specific psychiatric disorders with substance use parameters by comparing participants with a diagnosis of a specific psychiatric disorder to those without this diagnosis using the chi-square test or Fisher's exact test for categorical variables, and the Mann–Whitney U test for the continuous variables which were not distributed normally. Patterns of use, such as route of administration and daily use of a specific substance, were analyzed in users of the specific substances only. It is of note that all participants had a diagnosis of a psychiatric disorder in accordance with the study inclusion criteria.

Finally, we constructed logistic regression models for each psychiatric disorder as the dependent variable with demographic characteristics as well as dichotomous variables for use of specific substances as explanatory variables applying a forward fitting procedure, including all predictors with a significance of $p < 0.05$ in the model. We ruled out the interaction and multicollinearity.

Results

Three patients of the original sample were excluded because they had not completed the MAP, yielding a final sample of 494 participants. Mean age was 40.8 years (standard deviation 11.0). Demographic characteristics, psychiatric diagnoses, and substance use in the past month are displayed in Table 1.

Overall, substance use was highly prevalent in our sample ($N = 375$, 76.4%). It occurred significantly more often among participants with a depressive episode ($p = 0.003$), a manic or hypomanic episode ($p = 0.017$), PTSD ($p = 0.021$), or panic disorder ($p = 0.003$), and less often in patients diagnosed with a psychotic disorder ($p = 0.003$) at baseline. Furthermore, the number of substances used was higher in participants with a depressive episode ($p < 0.001$), a manic or hypomanic episode ($p = 0.025$), PTSD ($p < 0.001$), or panic disorder ($p < 0.001$), and lower in patients with a psychotic disorder ($p = 0.011$). Drug overdoses were more common in participants with a depressive episode ($p = 0.002$), whereas unsafe sex was positively associated with having a manic or hypomanic episode ($p = 0.001$), PTSD ($p = 0.018$), panic disorder ($p = 0.017$), and a mood disorder with psychotic features ($p = 0.035$). Table 2 shows the results of the bivariate analyses for psychiatric diagnostic categories and substances used as well as high-risk behaviors. Use of specific substances for different psychiatric disorders is displayed in Fig. 1.

Among substance users, injection use was significantly more common in participants with a depressive episode ($p = 0.035$), PTSD ($p = 0.007$), or a mood disorder with psychotic features ($p = 0.033$). We did not find any significant associations between patterns of opioid or cannabis use and any psychiatric diagnoses, but daily stimulant use was more common in participants with a manic or hypomanic episode ($p = 0.004$). Routes of administration for stimulants were

Table 1 Demographic characteristics, psychiatric disorders, substance use, and risk behaviors ($N = 494$)

Variable	*N*	%
Gender		
Male	353	71.5
Female/other	141	28.5
Ethnicity		
Aboriginal	97	19.6
Other	397	80.4
Education		
Less than 9 years	76	15.5
9 years or more	415	84.5
Marital status		
Single, divorced, separated, widowed	465	94.9
Married, partnered	25	5.1
Employment status		
Unemployed	459	93.3
Employed, retired, student, homemaker	33	6.7
Current psychiatric disorders (MINI Neuropsychiatric interview)		
Major depressive episode	199	40.3
Manic or hypomanic episode	97	19.6
Posttraumatic stress disorder	129	26.2
Panic disorder	103	20.9
Mood disorder with psychotic features	84	17.0
Psychotic disorder	261	52.8
Alcohol dependence diagnosis	121	24.5
Substance dependence diagnosis	287	58.1
Alcohol abuse	72	14.6
Substance abuse	110	22.3
Any substance use disorder (alcohol or other)	350	70.9
Substance use and risk behavior[1] (Maudsley Addiction Profile)		
Any substance use	375	76.4
Polysubstance use (3 or more)	117	24.6
Alcohol	225	45.6
Heroin	96	19.4
Methadone	21	4.3
Any opioid	102	20.6
Benzodiazepine	41	8.3
Cocaine powder	83	16.8
Crack/base cocaine	160	32.5
Any cocaine	191	38.7
Amphetamine/methamphetamine	61	12.4
Any stimulant (cocaine or (meth)amphetamine)	221	44.8
Cannabis	205	45.3
Injection use	82	16.6
Drug overdose	12	2.4
Pre-used needle or syringe	4	0.8
Unprotected sex	80	17.6

[1] Refers to past month and non-prescribed use

significantly different between participants with and without a mood disorder with psychotic features ($p = 0.038$), mainly due to a higher proportion of injection users among individuals suffering from mood disorder with psychotic features ($p = 0.012$). Both daily alcohol and daily benzodiazepine use were positively associated with panic disorder ($p = 0.011$). All participants with daily benzodiazepine use fulfilled criteria of both major depression and panic disorder. Polysubstance use, defined as simultaneous use of three or more substances excluding tobacco,

Table 2 Psychiatric disorders, substances used, and risk behaviors. *P* values from chi-square test unless otherwise indicated

Variable	Major depressive episode			Manic or hypomanic episode			PTSD			Panic disorder			Mood disorder with psychotic features			Psychotic disorder		
	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*
Any substance use	210 (72)	165 (83)	.003*	292 (74)	83 (86)	.017*	266 (74)	108 (84)	.021*	285 (74)	90 (87)	.003*	305 (75)	69 (82)	.168	191 (82)	184 (71)	.003*
Number of substances used (mean, SD)	1.4 (1.3)	2.0 (1.5)	.000*	1.6 (1.4)	2.0 (1.4)	.025*	1.5 (1.4)	2.1 (1.5)	.000*	1.5 (1.4)	2.2 (1.5)	.000*	1.6 (1.4)	1.8 (1.5)	.246	1.8 (1.4)	1.5 (1.4)	.011*
Alcohol	127 (43)	98 (49)	.186	174 (44)	51 (53)	.126	155 (43)	69 (54)	.035*	167 (43)	58 (56)	.014*	183 (45)	41 (49)	.507	106 (46)	119 (46)	.951
Heroin	45 (15)	51 (26)	.004*	73 (18)	23 (24)	.235	62 (17)	33 (26)	.034*	66 (17)	30 (29)	.005*	75 (18)	20 (24)	.247	53 (23)	43 (17)	.079
Methadone[1]	8 (3)	13 (7)	.039*	17 (4)	4 (4)	1.00[a]	12 (3)	9 (7)	.075	13 (3)	8 (8)	.047*[a]	18 (4)	3 (4)	1.00[a]	11 (5)	10 (4)	.625
Any illicit opioid use	48 (16)	54 (27)	.004*	77 (19)	25 (26)	.149	67 (19)	34 (26)	.056	70 (18)	32 (31)	.003*	80 (20)	21 (25)	.261	58 (25)	44 (17)	.026*
Benzodiazepine use[1]	12 (4)	29 (15)	.000*	30 (8)	11 (12)	.214	20 (6)	21 (16)	.000*	23 (6)	18 (18)	.000*	32 (8)	9 (11)	.386	26 (11)	15 (6)	.030*
Cocaine powder	44 (15)	39 (20)	.172	62 (16)	21 (22)	.154	54 (15)	29 (23)	.046*	59 (15)	24 (23)	.047*	61 (15)	22 (26)	.012*	44 (19)	39 (15)	.242
Crack/base cocaine	82 (28)	78 (39)	.009*	121 (31)	39 (40)	.069	109 (30)	50 (39)	.069	116 (30)	44 (43)	.012*	130 (32)	30 (36)	.493	89 (38)	71 (27)	.010*
Any cocaine use (crack or powder)	98 (33)	93 (47)	.003*	145 (37)	46 (47)	.05	128 (35)	62 (48)	.010*	141 (36)	50 (49)	.022*	152 (37)	39 (47)	.116	104 (45)	87 (34)	.011*
Amphetamines[1]	30 (10)	31 (16)	.072	49 (12)	12 (12)	.993	43 (12)	18 (14)	.513	45 (12)	16 (16)	.278	49 (12)	11 (13)	.788	32 (14)	29 (11)	.394
Any stimulant (coc and amp) use	113 (38)	108 (54)	.001*	172 (43)	49 (51)	.209	149 (41)	71 (55)	.006*	164 (42)	57 (55)	.016*	176 (43)	44 (52)	.121	120 (52)	101 (39)	.005*
Cannabis	117 (43)	88 (49)	.207	160 (44)	45 (49)	.430	143 (43)	62 (53)	.064	155 (43)	50 (56)	.021*	168 (45)	37 (48)	.588	103 (50)	102 (41)	.052
Pre-used needle or syringe	1 (0)	3 (2)	.306[a]	2 (1)	2 (2)	.171[a]	2 (1)	2 (2)	.266 [a]	2 (1)	2 (2)	.178[a]	2 (1)	2 (3)	.133[a]	3 (1)	1 (0)	.349[a]
Drug overdose	2 (1)	10 (5)	.005*[a]	9 (2)	3 (3)	.711[a]	6 (2)	6 (5)	.089[a]	9 (2)	3 (3)	.721[a]	9 (2)	3 (4)	.439[a]	6 (3)	6 (2)	.847
Unprotected sex	40 (15)	40 (21)	.082	53 (15)	27 (30)	.001*	50 (15)	30 (25)	.018*	55 (15)	25 (26)	.017*	60 (16)	20 (26)	.035*	47 (21)	33 (14)	.055

*$p \leq 0.05$

[a] *P* value from Fisher's exact test

[1] illicit, non-prescribed use only

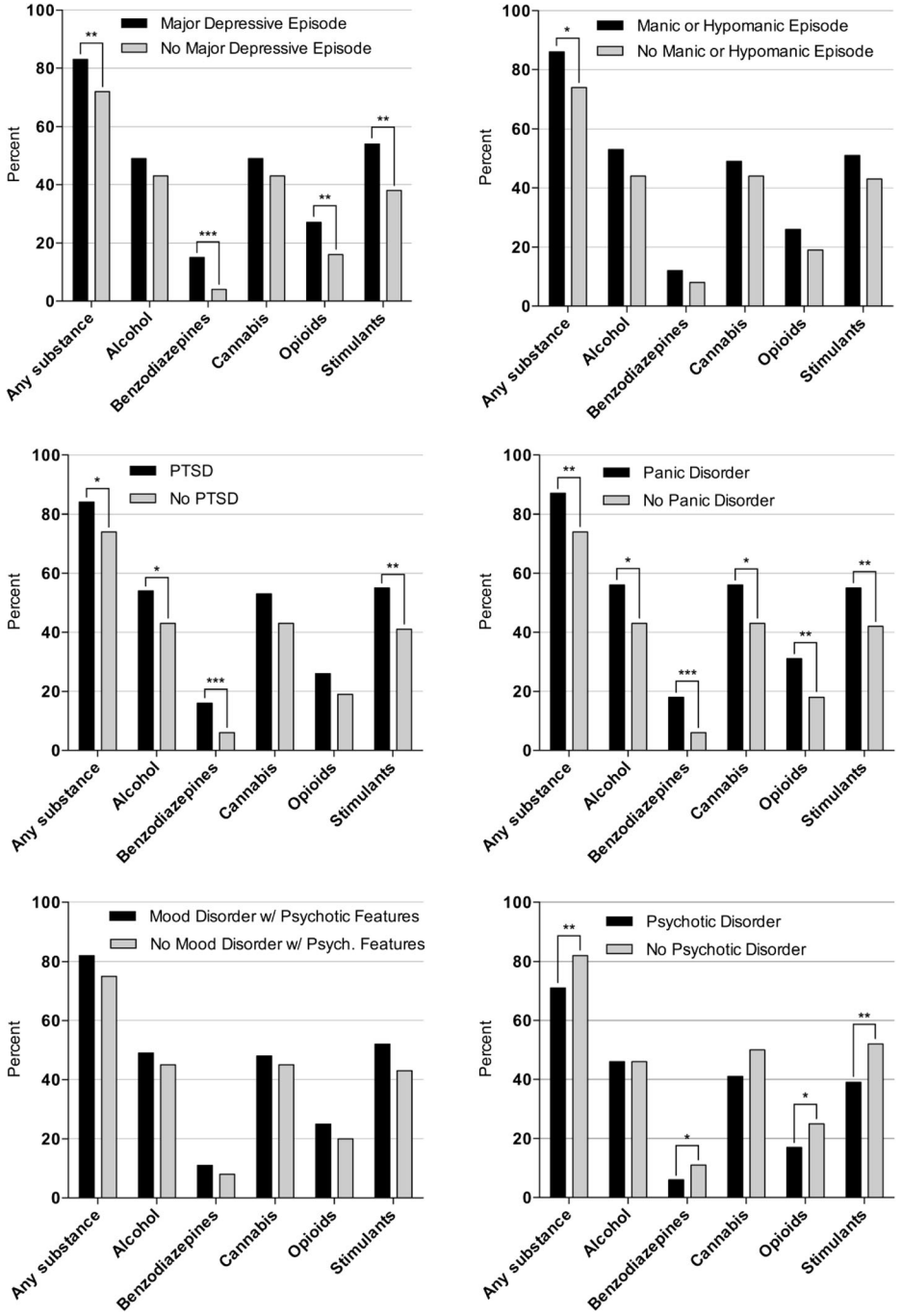

Fig. 1 Use of specific substances by diagnostic category ($N = 494$). P value from chi^2 test. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

was significantly more common among participants with a depressive episode ($p = 0.017$), PTSD ($p = 0.002$), or panic disorder ($p = 0.019$). Substance use patterns for different diagnostic categories are shown in Table 3.

Logistic regression models for each diagnostic category are displayed in Table 4. Stimulant use was associated with a diagnosis of major depressive disorder and PTSD, BZD was associated with a major depressive episode and panic disorder, and alcohol with panic disorder. Opioids were negatively associated with psychotic disorders. No specific substance was a significant predictor for manic or hypomanic disorder or mood disorder with psychotic features.

Discussion

In addition to underlining the frequent occurrence of substance use in homeless persons with psychiatric disorders, our findings show distinct associations of specific substance use patterns with current psychiatric disorders in this population. Keeping in mind the cross-sectional nature of our study precluding identification of causality or a temporal relationship, there are plausible explanations for these associations. Either the self-medication hypothesis, increased psychopathological symptoms as a consequence of substance use or an interaction of both phenomena are conceivable. Awareness of these associations will help clinicians be involved in treating persons experiencing homelessness to deliver more effective care. However, our hypotheses were only partly confirmed.

Consistent with our first hypothesis, the diagnosis of a current major depressive episode was associated with past-month use of stimulants in a multivariate analysis. However, this was also the case for BZD. Both substances have been applied in the treatment of depression (McIntyre et al. 2017; van Marwijk et al. 2012), so participants could use them to self-medicate respective symptoms. Because the effects of BZD and stimulants are quite different, self-medicating homeless persons with depression may intend to target different symptoms. For instance, stimulants may improve fatigue and BZD alleviate insomnia. However, both stimulants and BZD may also precipitate depressive symptoms, and longitudinal studies have found an increased incidence of depression for users (Degenhardt et al. 2007). Coming off of stimulants has been associated with depressive symptomatology (Lago and Kosten 1994), as has BZD withdrawal (Ashton 2005). Large studies in general population samples also found associations between depression and stimulant or sedative use (Conway et al. 2006). We did not find evidence for an association with alcohol use in our sample, which may be due to the overall very high proportion of alcohol users.

Moreover, participants with a current major depressive disorder used more substances than those without and were more likely to engage in certain risky behaviors, such as polysubstance use, injection use, or overdosing (OD). The combination of BZD use, polysubstance use, and injection use may have contributed to accidental OD, but we cannot rule out that suicidal ideations were involved. It may, therefore, be useful to clinicians to pay special heed to risky substance use patterns and suicidality in depressed homeless individuals.

Stimulant use almost doubled the odds of having a current diagnosis of PTSD, as were female or other gender and aboriginal ethnicity. The latter associations of PTSD are consistent with former research in a sample of homeless persons in Canada (Torchalla et al. 2013). In the

Table 3 Patterns of substance use by psychiatric disorder. *P* values from chi-square test unless otherwise indicated

	Major depressive episode			Manic or hypomanic episode			PTSD			Panic disorder			Mood disorder with psychotic features			Psychotic disorder		
	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*	No *N* (%)	Yes *N* (%)	*P*
Polysubstance use[1]	56 (28)	61 (40)	.017*	91 (33)	26 (33)	.953	71 (28)	45 (45)	.002*	81 (30)	36 (43)	.019*	95 (33)	21 (33)	.966	60 (34)	57 (32)	.653
Injection use[2]	41 (20)	47 (29)	.035*	67 (23)	21 (25)	.701	53 (20)	35 (33)	.007*	66 (23)	22 (25)	.694	64 (21)	23 (33)	.033*	53 (28)	35 (19)	.053
Daily opioid use[3]	14 (29)	10 (19)	.206	18 (23)	6 (24)	.949	14 (21)	19 (29)	.342	17 (24)	7 (22)	.790	20 (25)	4 (19)	.775[a]	13 (22)	11 (25)	.760
Route of administration for opioids[3]																		
Oral/snorted	5 (10)	4 (7)	.823	6 (8)	3 (12)	.809	7 (10)	2 (6)	.460	5 (7)	4 (13)	.597	8 (10)	1 (5)	.383	7 (12)	2 (5)	.272
Smoked	16 (33)	17 (32)		25 (33)	8 (32)		23 (34)	9 (27)		22 (31)	11 (34)		28 (35)	5 (24)		16 (28)	17 (39)	
Injected	27 (56)	33 (61)		46 (60)	14 (56)		37 (55)	23 (68)		43 (61)	17 (53)		44 (55)	15 (71)		35 (60)	25 (57)	
Injection opioid use[3]	27 (56)	33 (61)	.619	46 (60)	14 (56)	.741	37 (55)	23 (68)	.230	43 (61)	17 (53)	.429	44 (55)	15 (71)	.174	35 (60)	25 (57)	.720
Daily stimulant use[4]	30 (27)	29 (27)	.959	38 (22)	21 (43)	.004*	34 (23)	24 (34)	.084	42 (26)	17 (30)	.535	43 (24)	16 (36)	.110	32 (27)	27 (27)	.991
Route of administration for stimulants[4]																		
Oral/snorted	5 (4)	9 (8)	.431	11 (6)	3 (6)	.471	8 (5)	6 (9)	.598	9 (6)	5 (9)	.558	11 (6)	3 (7)	.038*	6 (5)	8 (8)	.283
Smoked	84 (74)	75 (69)		126 (73)	32 (65)		106 (71)	51 (72)		120 (73)	38 (67)		132 (75)	25 (57)		83 (69)	75 (74)	
Injected	24 (21)	25 (23)		35 (20)	14 (29)		35 (24)	14 (20)		35 (21)	14 (25)		33 (19)	16 (36)		31 (26)	18 (18)	
Injection stimulant use[4]	24 (21)	25 (23)	.733	35 (20)	14 (29)	.222	35 (24)	14 (20)	.530	35 (21)	14 (25)	.614	33 (19)	16 (36)	.012*	31 (26)	18 (18)	.153
Daily alcohol use[5]	11 (9)	15 (15)	.122	19 (11)	7 (14)	.581	15 (10)	11 (16)	.177	15 (9)	11 (19)	.040*	22 (12)	4 (10)	.794[a]	14 (13)	12 (10)	.464
Daily cannabis use[6]	34 (29)	36 (41)	.077	54 (34)	16 (36)	.821	47 (33)	23 (37)	.557	49 (32)	21 (42)	.178	56 (33)	14 (38)	.601	40 (39)	30 (29)	.155
Daily benzodiazepine use[7]	0 (0)	5 (17)	.298[a]	4 (13)	1 (9)	.100[a]	1 (5)	4 (19)	.343[a]	0 (0)	5 (28)	.011*[a]	3 (9)	2 (22)	.299[a]	3 (12)	2 (13)	1.00[a]

*$p \leq 0.05$

[a] *P* value from Fisher's exact test

[1] i.e., 3 or more substances; only in participants with substance use and no missing data on any substance ($N = 357$)

[2] Only in participants with substance use (incl. alcohol) ($N = 375$)

[3] Only in opioid users ($N = 102$)

[4] Only in stimulant users (cocaine, amphetamines etc.) ($N = 221$)

[5] Only in alcohol users ($N = 225$)

[6] Only in cannabis users ($N = 205$)

[7] Only in benzodiazepine users ($N = 41$)

Table 4 Logistic regression models for psychiatric disorders ($N = 442$)

Dependent variable	Predictor	OR	95% CI		*P*
			Lower	Upper	
Major depressive episode	Female or other gender	1.763	1.147	2.708	.010
	Stimulant use	1.696	1.128	2.550	.011
	Benzodiazepine use	3.014	1.317	6.897	.009
Manic or hypomanic episode	NA				
PTSD	Female or other gender	2.147	1.352	3.411	.001
	Aboriginal ethnicity	2.123	1.270	3.550	.004
	Stimulant use	1.881	1.210	2.924	.005
Panic disorder	Benzodiazepine use	2.465	1.155	5.261	.020
	Alcohol use	1.684	1.039	2.729	.034
Mood disorder with psychotic symptoms	NA				
Psychotic disorder	Married or partnered	.273	.097	.768	.014
	Opioid use	.530	.327	.860	.010

NA, no significant predictors

literature, several studies describe an association of PTSD with stimulant use (Afful et al. 2010; Smith et al. 2010). An Australian study found that stimulant use was associated with an increased risk of violent victimization in a homeless sample (Larney et al. 2009). Stimulant-using homeless persons may thus be at a higher risk of exposure to trauma and subsequent development of PTSD. An interesting finding in this context is the higher likelihood of past-month risk behaviors such as unprotected sex, injection substance use, and polysubstance use in this subgroup. However, it is also conceivable that the homeless suffering from PTSD uses stimulants in order to increase vigilance and reduce fatigue. For affected persons, it may indeed often not be desirable to fall asleep on the street or even in a shelter for fear of falling prey to theft or violence. This would also explain the absence of a significant association with substances bearing sedative properties, such as BZD, alcohol, or opioids in a multivariate analysis. Some case reports also point to a beneficial effect of stimulants in the treatment of PTSD, indicating a potential role in self-medication (Houlihan 2011).

The finding of higher BZD use in participants with a diagnosis of panic disorder is in agreement with our second hypothesis. Furthermore, the same association was found for alcohol. Studies in the general population show that anxiety disorders are associated with alcohol use and may precede or follow the latter (Kushner et al. 1999). There is also evidence for individuals using alcohol and BZD to self-medicate anxiety-related symptoms (Bolton et al. 2009; Esposito et al. 2009). Overall, BZD use was not very common in our sample. Daily use of BZD, however, exclusively occurred in participants with a current diagnosis of panic disorder, indicating that the use may indeed be related to self-medication.

Contrary to our third hypothesis, homeless persons with a psychotic disorder were less likely to be substance users and used fewer different substances than those without this diagnosis. We also found a negative association of opioid use with a diagnosis of a psychotic disorder, which persisted after controlling for demographic characteristics and use of other substances. Therefore, participants with opioid use had lower odds of psychosis. However, it has to be kept in mind that psychotic disorders in this sample generally occurred very often. There is some literature indicating a potential antipsychotic effect of opioids (Schmauss et al. 1987). One interpretation for our finding is that if opioids indeed contribute to a reduction of psychotic symptoms in homeless individuals with psychiatric disorders, opioid-using

participants may have been less likely to fulfill diagnostic criteria for a current psychotic disorder. Another interpretation could be related to the fact that all participants had a psychiatric disorder and there was no healthy control group. Possibly, a psychotic disorder is severe enough on its own to lead to homelessness, whereas, for the other diagnostic categories, it is the combination of psychiatric disorders with substance use (and opioid use, in particular). Future studies in homeless persons with psychiatric disorders should further investigate the association of psychiatric disorders and opioid use as well as the temporal relationship of the onset of homelessness, psychosis, and substance use.

Concerning the route of administration of stimulants, we did not find an association with psychotic disorders. While we hypothesized the proportion to be higher in injection users, this was not the case. Actually, there was even a tendency in this subgroup for a lower proportion of injectors.

The hypothesis of an association of cannabis and stimulant use with mood disorders with psychotic features was equally not confirmed. However, among stimulant users, there was a significant association with the route of administration. This group was more likely to inject rather than inhale, insufflate, or swallow stimulants. Our data, therefore, suggest that in homeless persons with a mood disorder, injecting stimulants may be associated with an increased risk for psychotic symptoms compared to other routes. Injection use is generally regarded as the most severe form of drug use (Novak and Kral 2011). It is also the route with the highest bioavailability of a substance (Quinn et al. 1997). When abstinence does not seem attainable, harm reduction measures, such as encouraging patients to use less harmful routes of administration than injecting, could then be helpful for reducing psychotic symptoms among this group.

For mania or hypomania, we found some evidence for a riskier pattern of use. Manic or hypomanic participants were more likely to be substance users and used more substances than participants without this disorder. Furthermore, hypomanic or manic stimulant users were more likely to use these substances on a daily basis than their counterparts. Risky behavior was also more common in the form of unprotected sex, which almost a third of homeless persons with this disorder reported. During a manic episode, impulse control and evaluation of negative health consequences of behavior may be impaired (Meade et al. 2008; Swann 2009). Unprotected sex was also positively associated with a diagnosis of mood disorder with psychotic features, which may have been due to overlap with mania.

Our study has some limitations. Due to the cross-sectional design, we cannot infer causality. Prospective studies over a long time period would be useful in this respect but will pose difficulties in terms of attrition. Furthermore, we did not assess prescribed medications, in particular, agonist treatment with opioids or BZD. Our substance use measures were based on self-report, so we cannot rule out that participants under- or over-reported substance use. Regional differences in substance use as well as patterns of psychiatric disorders among homeless persons, e.g., due to local provision of psychiatric or social services, may limit generalizability to other settings. Because of the absence of a non-homeless control group, our results may also not generalize to non-homeless populations.

Among the strengths of our study is the large sample size of a difficult-to-reach population and the use of validated instruments for the assessment of substance use and psychiatric disorders. Furthermore, we report on substance use patterns rather than diagnostic categories of abuse and dependence, which conveys a more detailed information and allows the identification of patterns of use.

Conclusions

Our study provides evidence for the associations of specific patterns of substance use with particular psychiatric diagnoses in homeless persons with psychiatric disorders. Considering these associations in their work may be useful for clinicians involved in the treatment of this population, and inform prevention, diagnosis, and treatment. Future research should focus on identifying the underlying mechanisms of these associations, which would further enhance our understanding of these relationships.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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