

Research Article

Substance Use in Association with Personality Disorder Traits and the Effects Mediated by Dysfunctional Coping and Sensation Seeking

Michael P. Hengartner^{1*}, Stephanie Rodgers¹, Mario Müller¹, Wulf Rössler^{1,2} and Vladeta Ajdacic-Gross¹

¹University of Zurich, Department of Psychiatry, Psychotherapy and Psychosomatics, Zurich, Switzerland

²Institute of Psychiatry, Laboratory of Neuroscience (LIM 27), University of Sao Paulo, Brazil

Corresponding author

Michael P. Hengartner, PhD, Research Associate, Department of Psychiatry, Psychotherapy and Psychosomatics, University of Zurich, Switzerland, Tel: +41 44 296 75 87; Fax: +41 44 296 74 49; E-mail: michael.hengartner@dgsp.uzh.ch

Submitted: 15 January 2014

Accepted: 05 February 2014

Published: 10 February 2014

Copyright

© 2014 Hengartner

OPEN ACCESS

Keywords

- Substance use
- Personality disorder
- Sensation seeking
- Dopamine
- Disinhibition
- Impulsivity

Abstract

Many research findings link personality disorders (PDs) with substance use. Another line of evidence relates PDs to sensation seeking and dysfunctional coping. We analysed data from 511 participants, aged 20 to 41 years, in the ZInEP Epidemiology Survey, a comprehensive survey of the general population of Zurich, Switzerland. A series of bivariate generalised linear models revealed that smoking, quantity of alcohol use, cannabis use and other drug use were substantially associated with paranoid, schizotypal, antisocial, borderline, and histrionic PDs. In a multivariate path analysis adjusted for sensation seeking and dysfunctional coping, smoking was mainly associated with borderline PD. Frequency and quantity of alcohol use as well as drug use were uniquely related to sensation seeking. Sensation seeking was mainly predicted by antisocial PD and dysfunctional coping by borderline PD. Sensation seeking was a significant mediator of associations between substance use and cluster B PDs, in particular of antisocial PD. PDs and substance use are consistently associated. Sensation seeking was substantially involved in substance use and cluster B PDs and a strong mediator particularly of antisocial PD. We suggest that impulsivity and disinhibition are the main processes underlying this association and hypothesise that the dopaminergic neurocircuitry plays a major role.

INTRODUCTION

The estimated economic cost to society and the global burden of disease due to substance use disorder (SUD) is alarmingly high [1,2]. Therefore it is extremely important to examine all possible factors contributing to SUD. In the present study we focus on personality disorders (PDs) and the effects mediated by sensation seeking and dysfunctional coping.

Various studies have found increased rates of SUD in any DSM-IV PD, including cluster A, B, and C [3-6]. Some researchers argue that in particular cluster B PDs are independent and strong risk factors for subsequent development of SUD [3,5]. However, and unfortunately, little is known about the underlying mechanism of that association. Although there is increasing evidence for neurobiological markers and processes in rats [7-9] there is still a lack of large epidemiological studies in humans focusing on potential psychopathological mechanisms. For instance, an important factor that is related to PDs and that may mediate the association between SUD and PDs is dysfunctional coping. Substance use is an inherent part of dysfunctional coping and

is commonly applied after traumatic stress [10]. Furthermore, coping is systematically related to personality [11] and thus also associated with pathological personality or PDs [12,13]. A second factor that is not just related to personality, but in fact constitutes a facet of personality and which is deeply involved in impulsivity and the reward system, is sensation seeking [14]. In this respect it has been found that sensation seeking is associated with personality pathology, in particular with cluster B PDs [15,16] as well as with substance use and SUD [17,18].

Thus, the aim of the present study was to examine the associations between substance use and PDs in a large sample of the general population. In addition, it is the first study to address the mediating effects of dysfunctional coping and sensation seeking on the relationship between substance use and PDs.

METHOD

Study design and sampling

This study was conducted within the scope of the

Epidemiology Survey of the “Zurich Programme for the Sustainable Development of Mental Health Services” (ZInEP; in German: Zürcher Impulsprogramm zur nachhaltigen Entwicklung der Psychiatrie), a research and health care programme involving several psychiatric research divisions and mental health services in the canton of Zurich, Switzerland. The Epidemiology Survey is one of six ZInEP subprojects and consists of four components: 1) a short telephone screening, 2) a comprehensive semi-structured face-to-face interview followed by self-report questionnaires, 3) tests in the sociophysiological laboratory, and 4) a longitudinal survey (Figure 1). Telephone screening and semi-structured interviews started in August 2010, the tests at the sociophysiological laboratory in February 2011, and the longitudinal survey in April 2011. The screening ended in May 2012, and all other components in September 2012.

First, a total of 9'829 Swiss males and females aged 20-41 years at the onset of the survey and representative of the general population of the canton of Zurich, Switzerland, were screened by computer assisted telephone interview (CATI) using the Symptom Checklist-27 (SCL-27) [19]. All participants were randomly selected through the resident registration offices of all municipalities of the canton of Zurich. Residents not of Swiss nationality were excluded from the study. The CATI was conducted by GfK (Growth for Knowledge), a major marketing and field research institute, in accordance with instructions from the research team. The overall response rate was 53.6%. Reasons for non-response were incorrect telephone number, unavailability during the study period, or refusal. In cases where potential subjects were available by telephone, the response rate was 73.9%.

Second, 1500 subjects were randomly selected from the initial screening sample for subsequent face-to-face interviews (response rate: 65.2%). We applied a stratified sampling

procedure including 60% high-scorers (scoring above the 75th percentile of the global severity index of the SCL-27) and 40% low-scorers (scoring below the 75th percentile of the global severity index). The basic sampling design was adapted from the longitudinal Zurich cohort-study [20] and was chosen to enrich the sample with subjects at high risk for mental disorders. Such a two-phase procedure with initial screening and subsequent interview with a stratified subsample is fairly common in epidemiological surveys [21].

Face-to-face interviews were conducted by experienced and extensively trained clinical psychologists. The interviews took place either in the participants' homes or at the Zurich University Hospital of Psychiatry. All participants who completed the semi-structured interview were required to complete additional questionnaires. For this purpose, the sample was divided into subsamples focusing either on psychosis (N=820) or on PDs (N=680), respectively. Out of a total of 680 subjects in the PD subsample, 169 (24.9%) refused to return or to complete all questionnaires required for the present study, resulting in a reduced final sample size of N=511.

The ZInEP Epidemiology Survey was approved by the ethics committee of the canton of Zurich (KEK) to fulfil all legal and data privacy protection requirements and is in strict accordance with the declaration of Helsinki of the World Medical Association. All participants gave their written informed consent.

Instruments and measures

To provide dimensional PD scores we used the Assessment of DSM-IV Personality Disorders Questionnaire (ADP-IV) [22]. The ADP-IV design allows a dimensional trait-score and a categorical PD diagnosis for each of the DSM-IV PDs. The ADP-IV is a paper-pencil self-report instrument consisting of 94 items, which represent the 80 criteria of the 10 DSM-IV PDs and the 14 research criteria of the depressive and the passive-aggressive PDs. Each trait-question is rated on a 7-point Likert scale, ranging from “totally disagree” to “totally agree”. The dimensional score of a given PD is computed by adding all scores of its respective items and by dividing this value by the number of items. For the present study we used the German translation by Doering et al. [23]. Internal consistency of the ADP-IV dimensional PD scales is good for the original Dutch version [24] and for the German adaptation [23] (median Cronbach's $\alpha=0.77$ and 0.76 , respectively). Test-retest reliability and concurrent validity of the dimensional ADP-IV trait-scores is also satisfactory [23,24]. Most importantly, the ADP-IV showed good concordance with the SCID-II interview [25] and may be considered an economical and valid alternative to semi-structured interviews.

The Sensation Seeking Scale form V (SSS-V) [14] is the result of a constant psychometric development of the correspondent psychobiological construct. Marvin Zuckerman defined sensation seeking as a trait marked by striving for novel and complex experiences and the willingness to take physical, social, legal and financial risks for the sake of such experiences. The SSS-V consists of 4 subscales, each of them comprising 10 items presented in forced-choice format, which was used to control for the effects of social desirability. For the present study we considered only the total score, which is a sum score of all subscales. The SSS-V has proven its validity and reliability over several decades [26]. For this study a German translation of the SSS-V [27] was applied.

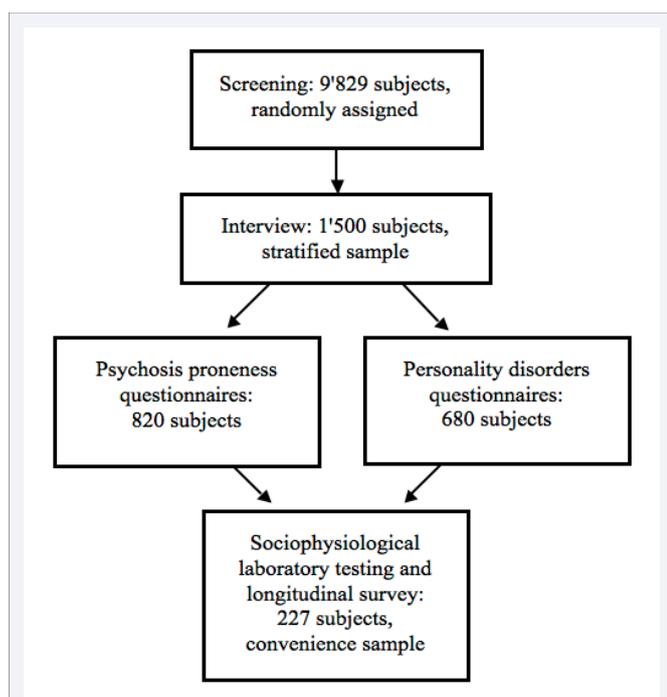


Figure 1 The design of the ZInEP Epidemiology Survey.

Coping strategies were assessed with the brief Coping Orientation to Problems Experienced (COPE) [28]. This self-report questionnaire allows the measurement of features of emotion-focused coping (e.g. to search for social support and accept reality), problem-focused coping (e.g. to conceive problem solving strategies) and dysfunctional coping (e.g. to distract oneself with alcohol use, denial) [29]. For the present study we considered only dysfunctional coping, which comprises the 6 subscales *behavioural disengagement*, *denial*, *self-distraction*, *self-blame*, *substance use*, and *venting*. The strategies assessed by dysfunctional coping have also been summarised as disengagement coping. Each subscale is assessed by two items rated on a 4-point Likert scale ranging from “I haven’t been doing this at all” to “I’ve been doing this a lot”. Internal consistency and test-retest reliability of the three different coping strategies is high and convergent, and concurrent validity has been provided [29].

All other variables included in the analysis were provided by the semi-structured interview, which was conducted using the “Structured Psychopathological Interview and Rating of the Social Consequences of Psychological Disturbances for Epidemiology” (SPIKE) [30]. This semi-structured interview was developed for epidemiological surveys in psychiatric research and assesses data about socio-demography, somatic syndromes, psychopathology, substance use, medication, health services, impairment, and social activity. Its reliability and validity have been reported elsewhere [20]. All substance use variables referred to the most recent twelve-month period. Smoking was assessed as a binary variable (yes or no). Smoking frequency and quantity were not analysed separately because both measures were highly correlated. Alcohol frequency and quantity were assessed as ordered categorical variables, which were afterwards standardised and dichotomised along the mean. Cannabis and drug use were also assessed as binary variables (yes or no). Cannabis use was first analysed separately from other drug use. Because users of drugs other than cannabis were rare, the two groups needed to be combined for the multivariate mediator analysis.

Statistical analysis

First, because values on all continuous variables included in the analysis (i.e. PD dimensions, sensation seeking, and coping) were missing completely at random (MCAR) according to Little’s MCAR test ($\chi^2=479.390$, $df=496$, $p=0.696$) we conducted a missing value analysis (MVA). No variable was missing in more than maximally 27 subjects (5.3%). MVA was carried out with the full information maximum likelihood estimation as recommended by Schafer and Graham [31]. Second, we analysed the associations between every substance use variable and each dimensional PD trait-score by applying a series of generalised linear regression models (GLM). All dependent variables (i.e. substance use variables) were dichotomous; therefore we fitted models with binomial distribution and logit-link function. A robust estimator was used to reduce the effects of outliers and influential observations. Results were reported with unstandardized regression coefficients for a 1-point increase in PD trait-score and the corresponding standard error (SE). All associations were adjusted for sex, age, and education. The MVA and GLM were performed with SPSS version 20 for Macintosh.

Third, we conducted a path analysis, which is a multivariate regression model where all predictors are adjusted for each other and covariance between dependent variables is accounted for. Path analysis is helpful in minimising the unwanted effects of several interrelated predictor variables (multicollinearity) and correlated dependent variables (endogeneity). Most importantly, path analysis allows the estimation of indirect effects, that is, the effects of a given variable on the outcome mediated by another variable. Substance use variables were regressed on all PD dimensions, on the sensation seeking score and on dysfunctional coping. Sensation seeking and dysfunctional coping were, in turn, also regressed on the PD dimensions. We then estimated the indirect effect of a given PD dimension via sensation seeking or dysfunctional coping on substance use. If such an indirect effect was statistically significant, sensation seeking or coping might be considered as mediators. Significance testing was performed with a bias corrected bootstrapping procedure with 1000 random samples as recommended by MacKinnon et al. [32]. According to that procedure an indirect effect is considered statistically significant when the bootstrapped 95% confidence interval (CI) of the regression coefficient does not encompass the value 0. We used a means and variance adjusted weighted least squares (WLSMV) estimator, which has been recommended for categorical and non-normally distributed data [33]. The results of the path analysis were reported with standardised regression coefficients (β) and their corresponding 95% CI. The path analysis was conducted with Mplus version 7 for Macintosh [34].

RESULTS

The descriptive statistics of all variables included in the analyses are shown in Table 1. For the associations between substance use and PDs see Table 2. In general, substance use was mainly predicted by paranoid, schizotypal, antisocial, borderline, and histrionic PDs when adjusted for sex, age, and education. Alcohol frequency was not related to either PD dimensions. Schizotypal, antisocial, borderline, and histrionic PD were significantly related to smoking, alcohol quantity, cannabis use, and other drug use. Paranoid PD was significantly associated with smoking, alcohol quantity, and in particular other drug use, but not with cannabis use. Narcissistic and avoidant PD were exclusively related to other drug use, whereas schizoid, dependant and obsessive compulsive PDs revealed no association with any substance use variable. The largest effect sizes were observed in antisocial PD: with respect to smoking and alcohol quantity the regression coefficients represented a medium-to-large effect size and with respect to cannabis and other drug use a large effect size. Associations of substance use variables with the other significant PD dimensions were somewhat lower.

The direct effects in the path analysis are reported in Table 3. Most importantly, dysfunctional coping was not related to any substance use variable, whereas sensation seeking highly predicted all smoking, alcohol frequency, alcohol quantity, and drug use. Smoking was in addition to sensation seeking significantly positively predicted by schizoid and borderline PD, and negatively by avoidant PD. Alcohol frequency and quantity as well as drug use were uniquely predicted by sensation seeking. Regression of sensation seeking on PD dimensions revealed significant positive associations with antisocial, histrionic and narcissistic PD as well as a negative association with dependant

Table 1: Descriptive statistics.

Categorical variables	Category	N	%
Smoking	Yes	142	27.8
	No	369	72.2
Alcohol frequency	High	206	40.4
	Low	304	59.6
Alcohol quantity	High	172	33.7
	Low	339	66.3
Cannabis use	Yes	81	15.9
	No	430	84.1
Other drug use	Yes	29	5.7
	No	482	94.3
Continuous variables	Range	Mean	SD
Paranoid PD	1.00 – 5.71	2.27	0.94
Schizoid PD	1.00 – 5.71	2.17	0.85
Schizotypal PD	1.00 – 6.11	2.12	0.90
Antisocial PD	1.00 – 6.13	1.65	0.70
Borderline PD	1.00 – 6.80	2.30	1.05
Histrionic PD	1.00 – 5.63	2.26	0.89
Narcissistic PD	1.00 – 5.89	2.24	0.80
Avoidant PD	1.00 – 6.14	2.44	1.15
Dependant PD	1.00 – 5.29	2.19	0.89
Obsessive-compulsive PD	1.00 – 6.25	2.77	0.92
Sensation seeking	7.00 – 40.00	23.86	6.00
Dysfunctional coping	1.00 – 3.33	1.78	0.37

Table 2: Substance use in association with personality disorders, adjusted for sex, age, and education. Associations indicated in bold are statistically significant at $p < 0.05$.

		PAR	SZ	ST	AS	BDL	NAR	HIS	AV	DEP	OC
		b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)	b (SE)
Smoking	Yes	0.32 (0.11)	0.13 (0.12)	0.23 (0.11)	0.49 (0.16)	0.40 (0.10)	0.22 (0.12)	0.40 (0.11)	-0.03 (0.09)	0.09 (0.11)	0.07 (0.10)
	No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol frequency	High	-0.08 (0.10)	-0.06 (0.11)	-0.14 (0.11)	0.05 (0.14)	-0.04 (0.09)	-0.09 (0.12)	0.12 (0.10)	-0.09 (0.08)	-0.07 (0.11)	-0.12 (0.10)
	Low	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Alcohol quantity	High	0.22 (0.11)	0.05 (0.12)	0.23 (0.11)	0.39 (0.17)	0.25 (0.10)	0.17 (0.13)	0.36 (0.12)	0.11 (0.09)	0.19 (0.11)	-0.04 (0.11)
	Low	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Cannabis	Yes	0.17 (0.13)	0.06 (0.14)	0.40 (0.14)	0.65 (0.18)	0.35 (0.12)	0.15 (0.14)	0.45 (0.13)	0.06 (0.11)	0.13 (0.14)	0.01 (0.13)
	No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Other drugs	Yes	0.75 (0.18)	0.30 (0.20)	0.47 (0.18)	0.56 (0.23)	0.71 (0.16)	0.55 (0.21)	0.57 (0.19)	0.41 (0.16)	0.28 (0.19)	0.37 (0.20)
	No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

PAR: Paranoid PD; SZ: Schizoid PD; ST: Schizotypal PD; AS: Antisocial PD; BDL: Borderline PD; NAR: Narcissistic PD; HIS: Histrionic PD; AV: Avoidant PD; DEP: Dependent PD; OC: Obsessive-compulsive PD

PD. Finally, dysfunctional coping was significantly predicted by borderline and histrionic PD.

The portion of variance explained was 18.4% for smoking, 17.3% for alcohol frequency, 22.1% for alcohol quantity, 37.2% for drugs, 22.7% for sensation seeking and 37.7% for dysfunctional coping. These effect size estimates may be considered medium-to-large to large.

The indirect or mediated effects in the path analysis are indicated in Table 4. Only sensation seeking was a significant mediator. Furthermore, only cluster B PDs yielded significant positive indirect effects. Antisocial PD revealed significant effects mediated by sensation seeking on smoking, alcohol frequency, alcohol quantity, and drugs. Histrionic PD showed a significant

indirect effect via sensation seeking on alcohol frequency, alcohol quantity, and drugs. Narcissistic PD revealed an indirect effect via sensation seeking on alcohol frequency and drugs. Interestingly, effects of dependant PD were negatively mediated by sensation seeking on all substance use variables. That is, while in cluster B PDs high sensation seeking potentiated the effects on substance use, in dependant PD low sensation seeking reduced the effects on substance use.

DISCUSSION

This study was designed to examine the association between PDs and substance use in a large sample of the general population of Zurich, Switzerland. A special focus lay on the mediated effects via sensation seeking and dysfunctional coping. Surprisingly, this is the first study to have had such a focus.

Table 3: Direct effects in the multivariate path analysis. Associations indicated in bold are statistically significant at $p < 0.05$.

	Smoking	Alcohol frequency	Alcohol quantity	Drugs	Sensation Seeking	Dysfunctional coping
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
PAR	0.165 (-0.028; 0.352)	0.011 (-0.169; 0.213)	0.098 (-0.097; 0.292)	0.068 (-0.142; 0.249)	-0.104 (-0.218; 0.031)	-0.037 (-0.165; 0.094)
SZ	0.209 (0.027; 0.378)	0.108 (-0.050; 0.262)	0.061 (-0.110; 0.211)	0.035 (-0.156; 0.212)	-0.048 (-0.166; 0.064)	-0.023 (-0.119; 0.064)
ST	-0.119 (-0.352; 0.094)	-0.157 (-0.357; 0.039)	-0.042 (-0.239; 0.168)	0.024 (-0.199; 0.248)	-0.065 (-0.210; 0.068)	-0.032 (-0.147; 0.099)
AS	0.035 (-0.145; 0.226)	-0.048 (-0.215; 0.118)	0.061 (-0.104; 0.243)	0.058 (-0.142; 0.224)	0.420 (0.315; 0.544)	0.023 (-0.075; 0.140)
BDL	0.368 (0.108; 0.630)	-0.176 (-0.391; 0.058)	-0.138 (-0.367; 0.094)	0.129 (-0.116; 0.394)	-0.013 (-0.171; 0.146)	0.519 (0.374; 0.652)
HIS	0.059 (-0.151; 0.269)	0.138 (-0.049; 0.317)	0.041 (-0.141; 0.227)	0.012 (-0.203; 0.218)	0.170 (0.047; 0.308)	0.133 (0.026; 0.258)
NAR	-0.074 (-0.281; 0.136)	-0.053 (-0.258; 0.113)	0.013 (-0.177; 0.194)	-0.116 (-0.334; 0.095)	0.140 (0.003; 0.272)	0.047 (-0.068; 0.183)
AV	-0.301 (-0.536; -0.065)	0.031 (-0.180; 0.242)	0.065 (-0.154; 0.278)	0.095 (-0.163; 0.320)	-0.047 (-0.196; 0.091)	0.026 (-0.087; 0.136)
DEP	-0.022 (-0.250; 0.206)	0.061 (-0.121; 0.259)	0.120 (-0.071; 0.322)	-0.124 (-0.342; 0.121)	-0.185 (-0.328; -0.043)	0.012 (-0.107; 0.115)
OC	-0.070 (-0.266; 0.113)	0.016 (-0.153; 0.172)	-0.121 (-0.274; 0.055)	0.012 (-0.192; 0.196)	-0.110 (-0.239; 0.008)	-0.039 (-0.143; 0.068)
SS	0.238 (0.105; 0.372)	0.414 (0.297; 0.521)	0.444 (0.299; 0.544)	0.564 (0.427; 0.679)	-	-
DCop	-0.023 (-0.186; 0.140)	0.024 (-0.108; 0.160)	0.029 (-0.110; 0.175)	0.122 (-0.046; 0.270)	-	-
R ²	0.184	0.173	0.221	0.372	0.227	0.377

PAR: Paranoid PD; SZ: Schizoid PD; ST: Schizotypal PD; AS: Antisocial PD; BDL: Borderline PD; NAR: Narcissistic PD; HIS: Histrionic PD; AV: Avoidant PD; DEP: Dependent PD; OC: Obsessive-Compulsive PD; SS: Sensation Seeking; DCop: Dysfunctional Coping

Table 4: Analysis of mediators: indirect effects in the multivariate path analysis. Associations indicated in bold are statistically significant at $p < 0.05$.

		Smoking	Alcohol frequency	Alcohol quantity	Drugs
		β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
PAR	DCop	0.001 (-0.010; 0.012)	-0.001 (-0.011; 0.009)	-0.001 (-0.011; 0.009)	-0.004 (-0.022; 0.014)
	SS	-0.023 (-0.053; 0.008)	-0.042 (-0.093; 0.009)	-0.044 (-0.099; 0.011)	-0.054 (-0.119; 0.011)
SZ	DCop	0.000 (-0.007; 0.008)	-0.001 (-0.007; 0.006)	-0.001 (-0.008; 0.006)	-0.003 (-0.016; 0.011)
	SS	-0.011 (-0.037; 0.016)	-0.019 (-0.067; 0.028)	-0.021 (-0.071; 0.030)	-0.025 (-0.086; 0.035)
ST	DCop	0.001 (-0.010; 0.011)	-0.001 (-0.011; 0.009)	-0.001 (-0.011; 0.010)	-0.004 (-0.021; 0.014)
	SS	-0.014 (-0.047; 0.018)	-0.026 (-0.082; 0.029)	-0.028 (-0.087; 0.032)	-0.034 (-0.106; 0.039)
AS	DCop	0.000 (-0.009; 0.008)	0.001 (-0.007; 0.008)	0.001 (-0.008; 0.009)	0.003 (-0.012; 0.017)
	SS	0.092 (0.039; 0.146)	0.170 (0.105; 0.235)	0.179 (0.116; 0.242)	0.219 (0.150; 0.287)
BDL	DCop	-0.011 (-0.087; 0.065)	0.012 (-0.055; 0.079)	0.014 (-0.056; 0.085)	0.059 (-0.017; 0.134)
	SS	-0.003 (-0.038; 0.032)	-0.005 (-0.069; 0.059)	-0.006 (-0.074; 0.063)	-0.007 (-0.089; 0.076)
HIS	DCop	-0.003 (-0.024; 0.018)	0.003 (-0.017; 0.023)	0.004 (-0.017; 0.025)	0.015 (-0.011; 0.041)
	SS	0.037 (-0.001; 0.076)	0.069 (0.010; 0.127)	0.072 (0.009; 0.136)	0.088 (0.014; 0.163)
NAR	DCop	-0.001 (-0.013; 0.011)	0.001 (-0.010; 0.012)	0.001 (-0.009; 0.012)	0.005 (-0.015; 0.025)
	SS	0.031 (-0.003; 0.065)	0.057 (0.000; 0.113)	0.060 (-0.003; 0.123)	0.073 (0.000; 0.145)
AV	DCop	-0.001 (-0.010; 0.009)	0.001 (-0.008; 0.009)	0.001 (-0.008; 0.010)	0.003 (-0.013; 0.019)
	SS	-0.010 (-0.044; 0.024)	-0.019 (-0.080; 0.042)	-0.020 (-0.085; 0.045)	-0.025 (-0.103; 0.054)
DEP	DCop	0.000 (-0.009; 0.008)	0.000 (-0.008; 0.008)	0.000 (-0.008; 0.009)	0.001 (-0.015; 0.017)
	SS	-0.041 (-0.081; -0.001)	-0.075 (-0.137; -0.013)	-0.079 (-0.143; -0.014)	-0.096 (-0.174; -0.018)
OC	DCop	0.001 (-0.009; 0.010)	-0.001 (-0.010; 0.008)	-0.001 (-0.010; 0.008)	-0.004 (-0.020; 0.011)
	SS	-0.024 (-0.055; 0.007)	-0.045 (-0.095; 0.006)	-0.047 (-0.101; 0.007)	-0.057 (-0.121; 0.007)

PAR: Paranoid PD; SZ: Schizoid PD; ST: Schizotypal PD; AS: Antisocial PD; BDL: Borderline PD; NAR: Narcissistic PD; HIS: Histrionic PD; AV: Avoidant PD; DEP: Dependent PD; OC: Obsessive-Compulsive PD; SS: Sensation Seeking; DCop: Dysfunctional Coping

The results show that alcohol frequency was not related to any PD dimension. Smoking, alcohol quantity, cannabis use and other drug use however were mostly associated with paranoid, schizotypal, antisocial, borderline, and histrionic PD. Other drug use was considerably related to all PD dimensions except for schizoid, dependant and obsessive-compulsive PD. Especially subjects with high scores on cluster B PDs appear to be susceptible to substance use in general and to drug use in particular. The corresponding effect sizes were largest in antisocial PD. The prominent role of cluster B PDs in association with SUD has previously been emphasised [3,5]. A further PD dimension that yielded a particularly strong association with drug use was

schizotypal PD. The association between schizotypal symptoms and drug use is also in line with the literature [35,36].

A multivariate path analysis including sensation seeking and dysfunctional coping showed that substance use was almost uniquely predicted by sensation seeking. Only smoking revealed a strong additional association with borderline PD (positively) and avoidant PD (negatively). Sensation seeking was, in turn, mainly associated with cluster B PDs, in particular with antisocial PD, and dysfunctional coping was principally related to borderline PD. There is a consistent body of research indicating that sensation seeking is highly involved in substance use. For a review see for instance Blanchard et al. [37]. There is also some

evidence that antisocial PD may be particularly strongly related to sensation seeking [15,16], although more research is needed to elaborate that finding. Associations between borderline PD and dysfunctional coping have also been shown previously [38,39], but here as well there is no clear and coherent theoretical foundation.

The mediator analysis revealed no significant indirect effect for dysfunctional coping. In turn, indirect positive effects of PDs via sensation seeking on substance use were found for antisocial, histrionic and narcissistic PD. A negative indirect effect was found for dependant PD. The mediated effects were particularly strong in antisocial PD, which was substantially related to smoking, alcohol frequency, alcohol quantity, and drug use. Thus, in contrast to the bivariate analyses and the multivariate direct effects the indirect effects via sensation seeking also showed significant associations with alcohol frequency. In other words, subjects scoring high on dependant PD and low on sensation seeking used less tobacco, alcohol and drugs than subjects who only scored high on dependant PD. In contrast to this, subjects scoring high in particular on antisocial and to a lesser extent on histrionic and narcissistic PD were very prone to substance use and even more vulnerable when they were additionally high on sensation seeking. Consequently, sensation seeking has to be conceived as an important mediator of cluster B PDs. To the best of our knowledge this is the first study to report such mediated effects. This finding has important clinical implications and we suggest that the evaluation of sensation seeking should complement the assessment of substance use in subjects with PDs.

Impulsivity and disinhibition are main symptoms of cluster B PDs [12] and principal factors related to SUD [40,41]. Sensation seeking is closely related to both impulsivity and Disinhibition [14], thus it is reasonable to assume that sensation seeking potentiates the effects of cluster B personalities. Dopamine and its link to the reward system plays an important role in sensation seeking and SUD [37,42]. There is also evidence that dopamine is involved in antisocial personality traits [43], which would link the three constructs together and provide a hypothesis for why associations were particularly strong in antisocial PD. Thus it may be the case that the effects of antisocial PD on substance use mediated by sensation seeking operate amongst other things on the dopaminergic neurocircuitry and involve impulsivity and disinhibition. However, sensation seeking impacts other systems than dopamine neurotransmission, such as testosterone [44] or serotonin [45]. It would thus be worthwhile to examine the neurological circuits involved in the sensation seeking mediation of the PD-SUD relationship in more detail. Moreover, the association between impulsivity and SUD, for instance, calls for further research on a phenotypic, genotypic, and neurophysiological level.

Since ethical principles in research with humans obviously limit opportunities to determine a strict temporal order and, consequently, questions of causality, it is still unknown whether a predisposing personality actually precedes substance use or whether substance use can even modify or change personality and behavioural tendencies. In this respect a prospective community study over 6 years found that sensation seeking

significantly predicted SUD at follow-up [46], which is also in line with an experimental study in rats [7]. On the other hand, a comprehensive review of the role of impulsivity in SUD found evidence for both directions of causation [41]. However, more prospective studies are needed to elaborate the findings reported here. Besides its cross-sectional design, this study is also limited in its interpretation by the missing values of participants who did not complete the required questionnaires; these led to a restricted sample and rather low numbers of drug users. The few cases of drug use other than cannabis use also made it impossible for us to analyze this group separately from the cannabis-only users in the multivariate path analysis. Moreover, we acknowledge that all data used in the present study relied on self-reports, which means we cannot exclude a certain bias caused by omission, denial, or concealment.

ROLE OF FUNDING SOURCE

ZInEP was supported by a private donation. The donor had no further role in the experimental design, the collection, analysis, and interpretation of data, the writing of this report, or the decision to submit this paper for publication.

REFERENCES

1. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet*. 2009; 373: 2223-2233.
2. Rehm J, Taylor B, Room R. Global burden of disease from alcohol, illicit drugs and tobacco. *Drug Alcohol Rev*. 2006; 25: 503-513.
3. Cohen P, Chen H, Crawford TN, Brook JS, Gordon K. Personality disorders in early adolescence and the development of later substance use disorders in the general population. *Drug Alcohol Depend*. 2007; 88 Suppl 1: S71-84.
4. Coid J, Yang M, Tyrer P, Roberts A, Ullrich S. Prevalence and correlates of personality disorder in Great Britain. *Br J Psychiatry*. 2006; 188: 423-431.
5. Johnson JG, Cohen P, Skodol AE, Oldham JM, Kasen S, Brook JS. Personality disorders in adolescence and risk of major mental disorders and suicidality during adulthood. *Arch Gen Psychiatry*. 1999; 56: 805-811.
6. Lenzenweger MF, Lane MC, Loranger AW, Kessler RC. DSM-IV personality disorders in the National Comorbidity Survey Replication. *Biol Psychiatry*. 2007; 62: 553-564.
7. Belin D, Mar AC, Dalley JW, Robbins TW, Everitt BJ. High impulsivity predicts the switch to compulsive cocaine-taking. *Science*. 2008; 320: 1352-1355.
8. Lee JL, Di Ciano P, Thomas KL, Everitt BJ. Disrupting reconsolidation of drug memories reduces cocaine-seeking behavior. *Neuron*. 2005; 47: 795-801.
9. Vanderschuren LJ, Di Ciano P, Everitt BJ. Involvement of the dorsal striatum in cue-controlled cocaine seeking. *J Neurosci*. 2005; 25: 8665-8670.
10. Walsh K, Fortier MA, Dilillo D. Adult Coping with Childhood Sexual Abuse: A Theoretical and Empirical Review. *Aggress Violent Behav*. 2010; 15: 1-13.
11. Connor-Smith JK, Flachsbart C. Relations between personality and coping: a meta-analysis. *J Pers Soc Psychol*. 2007; 93: 1080-1107.
12. Hengartner MP, Müller M, Rodgers S, Rössler W, Ajdacic-Gross V.

- Can protective factors moderate the detrimental effects of child maltreatment on personality functioning? *J Psychiatr Res.* 2013; 47: 1180-1186.
13. van Wijk-Herbrink M, Andrea H, Verheul R. Cognitive coping and defense styles in patients with personality disorders. *J Pers Disord.* 2011; 25: 634-644.
14. Zuckerman, M. Behavioral expressions and biosocial bases of Sensation Seeking. Cambridge University Press, Cambridge. 1994.
15. Aluja A, Cuevas L, Garcia LF, Garcia O, Zuckerman's personality model predicts MCMI-III personality disorders. *Personality and Individual Differences* 2007; 42: 1311-1321.
16. Huang J, He W, Chen W, Yu W, Chen W, Shen M, et al. The Zuckerman-Kuhlman Personality Questionnaire predicts functioning styles of personality disorder: a trial in healthy subjects and personality-disorder patients. *Psychiatry Res.* 2011; 186: 320-325.
17. Battista SR, Stewart SH, Fulton HG, Steeves D, Darredeau C, Gavric D. A further investigation of the relations of anxiety sensitivity to smoking motives. *Addict Behav.* 2008; 33: 1402-1408.
18. Martin CA, Kelly TH, Rayens MK, Brogli BR, Brenzel A, Smith WJ, et al. Sensation seeking, puberty, and nicotine, alcohol, and marijuana use in adolescence. *J Am Acad Child Adolesc Psychiatry.* 2002; 41: 1495-1502.
19. Hardt J, Egle UT, Kappis B, Hessel A, Brähler E. [Symptom Checklist SCL-27]. *Psychother Psychosom Med Psychol.* 2004; 54: 214-223.
20. Angst J, Gamma A, Neuenschwander M, Ajdacic-Gross V, Eich D, Rössler W, et al. Prevalence of mental disorders in the Zurich Cohort Study: a twenty year prospective study. *Epidemiol Psychiatr Soc.* 2005; 14: 68-76.
21. Dunn G, Pickles A, Tansella M, Vázquez-Barquero JL. Two-phase epidemiological surveys in psychiatric research. *Br J Psychiatry.* 1999; 174: 95-100.
22. Schotte CK, de Donker D. ADP-IV Questionnaire. University Hospital Antwerp, Antwerp, Belgium. 1994.
23. Doering S, Renn D, Höfer S, Rumpold G, Smrekar U, Janecke N, et al. [Validation of the "Assessment of DSM-IV Personality Disorders (ADP-IV)" Questionnaire]. *Z Psychosom Med Psychother.* 2007; 53: 111-128.
24. Schotte CK, de Doncker D, Vankerckhoven C, Vertommen H, Cosyns P. Self-report assessment of the DSM-IV personality disorders. Measurement of trait and distress characteristics: the ADP-IV. *Psychol Med.* 1998; 28: 1179-1188.
25. Schotte CK, De Doncker DA, Dmitruk D, Van Mulders I, D'Haenen H, Cosyns P. The ADP-IV questionnaire: differential validity and concordance with the semi-structured interview. *J Pers Disord.* 2004; 18: 405-419.
26. Zuckerman, M., 2007. The Sensation Seeking Scale V (SSS-V): Still reliable and valid. *Personality and Individual Differences* 43, 1303-1305.
27. Beauducel A, Strobel A, Brocke B. Psychometrische Eigenschaften und Normen einer deutschsprachigen Fassung der Sensation Seeking-Skalen, Form V. *Diagnostica.* 2003; 49: 61-72.
28. Carver CS. You want to measure coping but your protocol's too long: consider the brief COPE. *Int J Behav Med.* 1997; 4: 92-100.
29. Cooper C, Katona C, Livingston G. Validity and reliability of the brief COPE in carers of people with dementia: the LASER-AD Study. *J Nerv Ment Dis.* 2008; 196: 838-843.
30. Angst J, Dobler-Mikola A, Binder J, The Zurich study--a prospective epidemiological study of depressive, neurotic and psychosomatic syndromes. I. Problem, methodology. *European Archives of Psychiatry and Neurological Sciences.* 1984; 234: 13-20.
31. Schafer JL, Graham JW. Missing data: our view of the state of the art. *Psychol Methods.* 2002; 7: 147-177.
32. Mackinnon DP, Lockwood CM, Williams J. Confidence Limits for the Indirect Effect: Distribution of the Product and Resampling Methods. *Multivariate Behav Res.* 2004; 39: 99.
33. Beauducel A, Herzberg P Y. on the performance of maximum likelihood versus means and variance adjusted weighted least squares estimation in CFA. *Structural Equation Modeling.* 2006; 13: 186-203.
34. Muthén L K, Muthén B O, Mplus User's Guide. Seventh Edition. Muthén & Muthén, Los Angeles, CA. 1998-2012.
35. Rössler W, Hengartner MP, Angst J, Ajdacic-Gross V. Linking substance use with symptoms of subclinical psychosis in a community cohort over 30 years. *Addiction.* 2012; 107: 1174-1184.
36. Van Dam NT, Earleywine M, DiGiacomo G. Polydrug use, cannabis, and psychosis-like symptoms. *Hum Psychopharmacol.* 2008; 23: 475-485.
37. Blanchard MM, Mendelsohn D, Stamp JA. The HR/LR model: Further evidence as an animal model of sensation seeking. *Neurosci Biobehav Rev.* 2009; 33: 1145-1154.
38. Bijttebier P, Vertommen H, Coping strategies in relation to personality disorders. *Personality and Individual Differences.* 1999; 26: 847-856.
39. American Psychiatric Association, 2000. Diagnostic and Statistical Manual of Mental Disorders DSM-IV-TR (4th text revision). American Psychiatric Association, Washington, DC.
40. Kreek MJ, Nielsen DA, Butelman ER, LaForge KS. Genetic influences on impulsivity, risk taking, stress responsivity and vulnerability to drug abuse and addiction. *Nat Neurosci.* 2005; 8: 1450-1457.
41. Perry JL, Carroll ME. The role of impulsive behavior in drug abuse. *Psychopharmacology (Berl).* 2008; 200: 1-26.
42. Schenk S. MDMA ("ecstasy") abuse as an example of dopamine neuroplasticity. *Neurosci Biobehav Rev.* 2011; 35: 1203-1218.
43. Buckholtz JW, Treadway MT, Cowan RL, Woodward ND, Benning SD, Li R, et al. Mesolimbic dopamine reward system hypersensitivity in individuals with psychopathic traits. *Nat Neurosci.* 2010; 13: 419-421.
44. Perini T, Ditzgen B, Hengartner M, Ehlert U. Sensation seeking in fathers: the impact on testosterone and paternal investment. *Horm Behav.* 2012; 61: 191-195.
45. Netter P, Hennig J, Roed IS. Serotonin and dopamine as mediators of sensation seeking behavior. *Neuropsychobiology.* 1996; 34: 155-165.
46. Sher KJ, Bartholow BD, Wood MD. Personality and substance use disorders: a prospective study. *J Consult Clin Psychol.* 2000; 68: 818-829.

Cite this article

Hengartner MP, Rodgers S, Müller M, Rössler W, Ajdacic-Gross V (2014) Substance Use in Association with Personality Disorder Traits and the Effects Mediated by Dysfunctional Coping and Sensation Seeking. *Ann Psychiatry Ment Health* 2(1): 1005.