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Lack of Premeditation, Negative Urgency and Sensation Seeking Are Associated with Lifetime Use of Different Psychoactive Substances

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ABSTRACT

Background: Impulsivity, anxiety and depression are factors that have previously been associated with the use of various drugs of abuse that have been investigated in isolation. However, little is known about the influence of these variables on the number of different substances tried at least once over a lifetime (i.e. polysubstance use). Objectives: We aimed to assess how facets of trait impulsivity, anxiety and depression pose as risk factors for lifetime polysubstance use. Methods: Adult recreational drugs users ($N = 700$) completed an online survey, reporting each of the psychoactive substances they have consumed at least once. They further completed the Urgency/Premeditation/Perseverance/Sensation-seeking- Positive Urgency scale (UPPS-P) and the Hospital Anxiety and Depression scale (HADS). Results: Negative-Binomial Regressions found that females (Incidence Rates Ratios = 0.79, $p < .001$) reported a lower total number of drugs used. After controlling for age and sex, the UPPS-P subscales Lack of Premeditation (IRR = 1.02, $p < .001$), Negative Urgency (IRR = 1.02, $p = .001$) and Sensation seeking (IRR = 1.01, $p = .008$) were positively associated with a greater number of different substances used. Conclusions: Exploring risk factors for polysubstance use may provide a better understanding of the factors which confer a vulnerability towards problematic / harmful substance use.

KEYWORDS

Anxiety; depression; substance use; trait impulsivity; UPPS-P

Introduction

Polysubstance use refers to using more than one substance, which can mean use of multiple drugs on different occasions (i.e. sequentially), or use of multiple drugs concurrently/at the same time (Crummy et al. 2020). Often, research into substance use effects, or substance use disorders focus on individual substances, however it is very common for substance users in these samples to be polysubstance users (Montgomery & Roberts, 2022). Moreover, many drug deaths involve use of multiple substances. For example, most opioid-related overdose deaths involve multiple substances (Crompton et al., 2021), and co-occurring substance use disorders are common (Jones & McCance-Katz, 2019). Polysubstance use therefore presents an additional risk factor for drug related problems beyond use of a single substance, and experimentation with multiple substances may be a risk factor for development of drug related harms/disorders. However, the psychological factors that underpin, or are associated with, propensity for polysubstance use experimentation are rarely studied. Impulsivity is one psychological factor that has previously been associated with various substance use disorders, albeit there is no consensus on how best to conceptualize or measure the construct (Dougherty et al., 2009). Questionnaire measures assume it is a relatively stable trait (e.g. Verdejo-Garcia & Albein-Urios, 2021), whereas state measures of impulsivity assume

fluctuations within individuals (e.g. Gauggel et al. 2010; Jones et al. 2011). A common trait measure which conceptualizes impulsivity is the Urgency/Premeditation/Perseverance/Sensation-seeking-Positive Urgency scale (UPPS-P; Lynam et al., 2006).

There is a well-established link between UPPS-P impulsivity and substance use (Kempeneers et al., 2023), with different facets accounting for different types and aspects of use. However, much of the research to date has focused on the use of specific substances in isolation, for example predicting frequency of cocaine use (García-Marchena et al., 2018) or cannabis related problems (VanderVeen et al., 2016). To date no paper has explored whether UPPS-P subscales are associated with number of different psychoactive substances used at least once.

Evidence from meta-analyses indicates a strong relationship between all factors on the UPPS-P and frequency of drinking sessions as well as quantity of alcohol units consumed (Coskunpinar et al., 2013). Stautz and Cooper (2013) investigated to what extent these factors predict typical alcohol consumption and problematic use. They found Lack of perseverance is most strongly related to alcohol consumption, whereas sensation seeking and positive and negative urgency are strongly linked to problematic use (e.g. binge drinking). Moreover, negative urgency and lack of premeditation were strongly related to alcohol dependence. Similarly, cannabis use

has also been associated with all traits on the UPPS-P (except for lack of perseverance), with negative consequences arising from cannabis use relating to sensation seeking, lack of premeditation, and positive urgency (VanderVeen et al., 2016). Positive and negative urgency have also been implicated in both cocaine dependence (García-Marhena et al., 2018) and amphetamine-use disorders (Stewart et al., 2023).

Taken together, associations between trait impulsivity and single drug use frequency/volume are well evidenced. However, there is a paucity of research investigating the relationship between impulsivity and polysubstance use.

Co-occurring substance use and mental health disorders such as anxiety and depression are well documented (Smith & Brook, 2008; Swendsen & Merikangas, 2000) and may present an additional/alternative psychological factor underpinning propensity for polysubstance use. For example, Williams et al. (2021) observed associations between depression and escalating polysubstance use in male adolescents, as well as consistent polysubstance use in female adolescents. However, critically, the impulsivity trait of negative urgency has been found to moderate the relationship between depression and both alcohol and cannabis use. Taken together this suggests some individuals may, in part, use these substances to alleviate symptoms of negative affect arising from depression/anxiety (Gonzalez et al., 2011; Um et al., 2019).

Other measures of trait impulsivity have been implicated in drug experimentation (de Wit, 2009), i.e. drug use over the course of a lifetime (or number of different drugs used at least once). However, the link between UPPS-P impulsivity subcomponents and this aspect of polysubstance use is currently unexplored. There is also a paucity of research into the relationship between anxiety, depression, and drug experimentation using a broad range of substances (Walters et al., 2018).

Given substance use disorders can be understood as a transition from recreational to compulsive use (Everitt & Robbins, 2016), a better understanding of the factors which confer a vulnerability toward substance use disorders could help prevent and aid those who may be affected. This study aims to explore associations between impulsivity, depression, and anxiety with the number of different substances used over the course of a lifetime. We hypothesize that increased scores UPPS-P and HADS subcomponents will be associated with an increased number of different substances used. We also explore how age and sex were associated with lifetime polysubstance use.

Method

Participants

Seven-hundred participants were recruited *via* advertisement of a study link on drug-related social media pages, forums of websites that provide information about recreational drug use (e.g., www.bluelight.org, www.drugsforum.com, www.reddit.com) and the researchers' social media network. The study was advertised as an investigation into the relationship between substance use and individual differences in personality (including anxiety and depression) and was open only

to adults (>18 years of age). To qualify for participation participants must have used at least one illicit or legal recreational substance in their life but have no current or previous diagnosis of a substance use disorder. Participants were required to be able to read English and to live in the UK, US, Canada, or inside the European Union (EU). Participants were given no monetary incentive or reimbursement for their participation in the study. The study was approved by the University of Liverpool Research Ethics Committee and participants were required to provide informed consent prior to undertaking the survey.

Measures

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-question instrument used to assess levels of anxiety and depression. As such, the HADS is comprised of two subscales: (1) HADS-A (MacDonald's ω_T for the current sample = 0.86) assesses anxiety and is comprised of 7 items that relate to anxiety e.g. "I feel tense or wound up," (2) HADS-D (ω_T = 0.83) assesses depression and is comprised of 7 items that relate to depressive symptomology e.g. "I still enjoy the things I used to enjoy." Each question is scored using a unique response scale all scored between zero (no impairment) and three (severe impairment), with a maximum score of 21 for each subscale.

UPPS-P impulsive Behavior Scale (Lynam, Smith, Whiteside, & Cyders, 2006)

The UPPS-P Impulsive Behavior Scale is a 59-item measure of factors that could lead to impulsive behaviors. There are five subscales: Positive Urgency (ω_T = 0.94) measures the tendency to act impulsively due to positive affect. Twelve items contribute to this score (e.g., "When I am in great mood, I tend to get into situations that could cause me problems"). Negative Urgency (ω_T = 0.90) measures the tendency to act impulsively due to negative affect. Twelve items contribute to this score (e.g., "When I am upset, I often act without thinking"). Lack of Premeditation (ω_T = 0.88) refers to the tendency to act rashly without first reflecting upon the decision to act. Eleven items contribute to this score (e.g., "I am not one of those people who blurt out things without thinking"). Lack of Perseverance (ω_T = 0.86) involves a tendency not to complete projects. Ten items contribute to this score (e.g., "Unfinished tasks really bother me"). Sensation Seeking (ω_T = 0.89) involves motivation to experience novelty. Twelve items contribute to this score (e.g., "I would like to learn to fly an airplane").

Recreational substance use

Participants were provided with a list of 26 substances (alcohol, amphetamine, benzodiazepines, cannabis, cocaine, crack, ecstasy, GHB, glue, heroin, ketamine, LSD, magic mushrooms, methamphetamine, mephedrone, modafinil, nitrous

Table 1. Sample characteristics of the sample including descriptives of psychometric inventories used.

	Mean ($\pm$ SD)
Age	27.68 (12.90)
Sex = <i>n</i> female (%)	571 (81.6%)
HADS Anxiety	9.88 (4.20)
HADS Depression	5.87 (3.65)
UPPS-P Negative urgency	30.44 (7.17)
UPPS-P Positive urgency	30.24 (9.59)
UPPS-P Sensation seeking	30.20 (7.44)
UPPS-P Lack of Premeditation	22.72 (5.32)
UPPS-P Lack of Perseverance	21.55 (4.93)

HADS: Hospital Anxiety and Depression Scale; UPPS-P: Urgency/Premeditation/Perseverance/Sensation-seeking- Positive Urgency scale.

oxide, PCP, poppers, prescription opioids, Ritalin, spice, tobacco, tranquilizers, Viagra, 2CB). They were asked to “tick any and all of the drugs you have used at any point in your lifetime.”

Procedure

Data was collected between 2020 and 2023. Participants completed the online survey *via* Qualtrics (Qualtrics, Provo, UT, 2023). They were presented with an information sheet and provided informed consent before providing their age and sex. The survey consisted of three components: participants first listed all of the recreational drugs they have used at least once, before completing the UPPS-P and HADS. The survey took approximately 15 min to complete. Finally, they were debriefed and thanked for their participation.

Data analyses

Our dependent variable was the total number of different recreational drugs used. Firstly, we fitted a null Poisson model which found the data to be over dispersed (see Table 2). Next, we fitted a null negative-binomial model which showed no evidence of over- or under-dispersion and demonstrated a significantly better fit than the Poisson null model using Pearson X^2 .

We created a demographic model by adding Age and Sex to the model and compared this to the null using Pearson X^2 and Akaike's Information Criteria differences (Δ AIC). We then added our subscale scores from the HADS and UPPS-P into the model and compared it to the demographic model using Pearson X^2 and Δ AIC.

Finally, to test the hypothesis that individuals who display higher levels of depression and negative urgency report a greater number of different recreational drugs used, we included the interaction term *HADS-D* $\times$ *UPPS-P Negative Urgency*. We compared this model to the previous model using the same process of model comparison as outline above.

For associations between predictors and drug use, incidence risk ratios (IRR) are reported with 95% CIs. The IRR relates to the effect of a one-unit increase in the predictor on the likelihood of consuming another drug (i.e. the count of drugs increasing by one). The α level was set as $p < 0.05$.

Analyses were performed using the “*glmmTMB*” package (Brooks et al., 2017) in R studio v.2023.09.0+463 (RStudio Team, 2020).

Table 2. Frequency and proportion of the sample who reported recreational use of each of the substances listed.

Substance	Frequency	Proportion of sample (%)
Alcohol	692	98.9
Cannabis	527	75.3
Tobacco	510	72.9
Cocaine	302	43.1
Ecstasy	267	38.1
Ketamine	246	35.1
Nitrous oxide	228	32.6
Poppers	213	30.4
Prescription opioids	161	23
LSD	109	15.6
Magic mushrooms	101	14.4
Tranquilizers	77	11
Amphetamine	70	10
Benzodiazepines	67	9.6
2CB	55	7.9
Viagra	27	3.9
Spice	20	2.9
Modafinil	19	2.7
Methamphetamine	16	2.3
Ritalin	16	2.3
Glue	15	2.1
Mephedrone	13	1.9
Crack	12	1.7

Results

Sample characteristics (Table 1)

Table 1 provides demographic information and average scores on the inventories used within the study. Table 2 provides the frequency of substances used and the proportion of the sample who reported using the substance. Figure 1 displays the proportion of the sample for the total amount of different substances used.

Model specification (Table 3)

A negative binomial model showed no issues with dispersion or outliers and was a significantly better fit than the Poisson null model ($p < 0.001$; Δ AIC = 399.1). We created three separate negative binomial predictor models: (i) *Model 1* was comprised of Age and Sex; (ii) *Model 2* was comprised of Model 1 + HADS and UPPS-P sub-scores; (iii) *Model 3* was comprised of Model 2 + the interaction term *HADS-D* $\times$ *UPPS-P Negative Urgency*.

Model 1 was a significantly better fit to the data compared to the null. *Model 2* also displayed a better fit than *Model 1*. The inclusion of the interaction term in *Model 3*, however, did not result in a better fit to the data compared to *Model 2*, with no evidence of an interaction effect between HADS-D and negative urgency. Therefore, *Model 2* was specified as the final model.

Model predictors (Table 4)

A significant association with Sex was found, whereby females reported a lower total number of different drugs used compared to males.

UPPS-P Negative Urgency, Lack of Premeditation, and Sensation Seeking were associated with a greater total number of different recreational drugs used. No other significant associations were found (all $p > 0.05$).

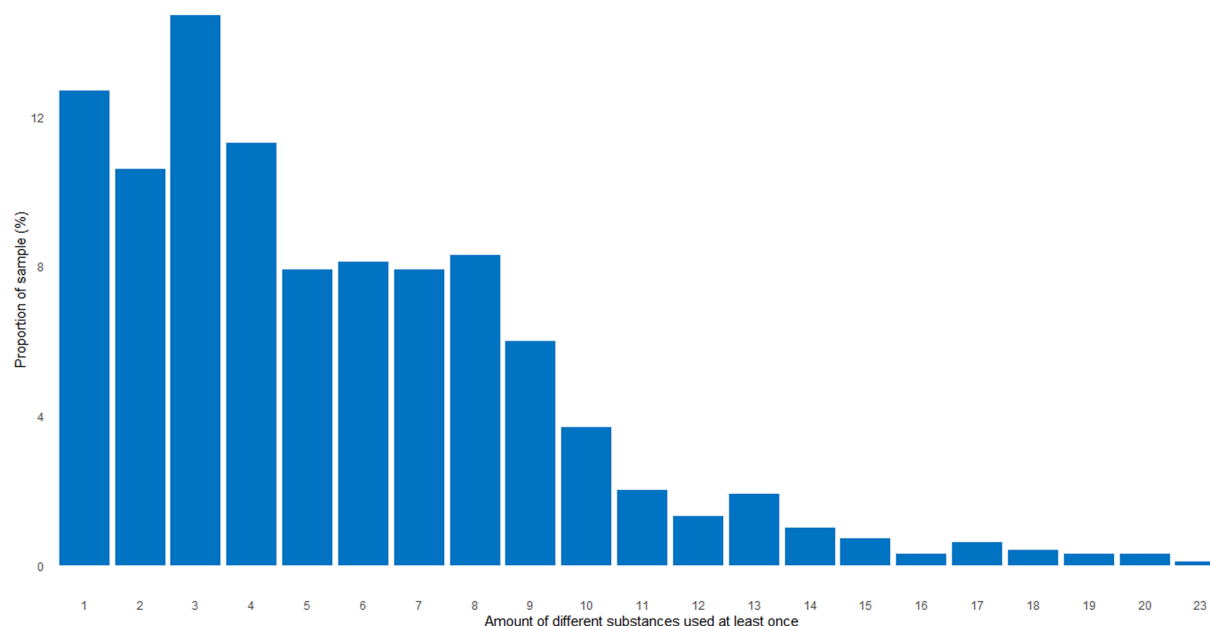


Figure 1. The proportion of the sample by the total number of different substances used recreationally at least once.

Table 3. Model specification detailing the selection of an optimal model for total number of different recreational drugs used.

Model	Dispersion ratio	Dispersion test	Outlier test	p-Value for $\Delta\chi^2$	Δ AIC compared to previous model
Poisson null	2.59	$p < .001$	$p < .001$	NA	NA
NB null	1.04	$p = .223$	$p = .671$	$p < .001$	399.1
Model 1	1.03	$p = .280$	$p = .391$	$p < .001$	18.5
Model 2	1.06	$p = .143$	$p = 1.00$	$p < .001$	65.8
Model 3	1.06	$p = .137$	$p = .671$	$p = .988$	-2.0

NB: Negative binomial; $\Delta\chi^2$: Change in Pearson's Chi-Squared; Δ AIC: Change in Akaike's Information Criteria.

Table 4. Results of the negative binomial regression adjusted for Demographics, HADS and UPPS scores (Model 2).

Predictors	Predictors of different recreational drugs used		
	IRR	CI	P
Age	1.00	0.99–1.00	.160
Sex = female	0.78	0.71–0.89	<.001
HADS Anxiety	0.99	0.98–1.01	.324
HADS Depression	1.00	0.98–1.02	.985
UPPS-P Negative Urgency	1.02	1.01–1.03	.001
UPPS-P Positive Urgency	1.00	0.99–1.00	.617
UPPS-P Sensation Seeking	1.01	1.00–1.02	.008
UPPS-P Lack of Premeditation	1.02	1.01–1.03	<.001
UPPS-P Lack of Perseverance	1.00	0.99–1.01	.543

HADS: Hospital Anxiety and Depression Scale; UPPS-P: Urgency/Premeditation/Perseverance/Sensation-seeking-Positive Urgency scale; IRR: Incidence rates ratios; 95% CI: 95% confidence intervals.

Bold values are statistically significant predictors.

Discussion

Our results indicate that impulsivity-related traits are associated with a greater number of different substances tried at least once across a lifetime, namely *Negative Urgency*, *Lack of Premeditation* and *Sensation Seeking*. Our findings support previous studies into impulsivity-related risk factors for substance use (Coskunpinar et al., 2013; Stautz & Cooper, 2013; VanderVeen et al., 2016; Kempeneers et al., 2023).

Negative Urgency refers to the tendency to act impulsively due to negative affect. It is interesting that this facet of impulsivity is positively associated with number of substances used across a lifetime in the current sample, it suggests that the impulsive desire to relieve negative affect observed in studies on problematic individual substance use (e.g. VanderVeen et al., 2016; Stewart et al., 2023; Roberts et al., 2021) may translate to seeking out multiple and various substances. We provide support for McHugh and Kneeland (2019) who describe negative affectivity as a risk factor for and consequence of substance misuse. *Sensation seeking* refers to motivation to experience novelty, and therefore it is not surprising that this facet predicts use of a greater number of psychoactive substances, as the novelty of new experiences can readily apply to psychoactive substance experiences. The predictive utility of sensation seeking has been assessed previously for optimized targeting of substance use intervention programs (Sargent et al., 2010). Our results provide support for this facet of impulsivity in seeking out differing drug experiences. *Lack of Premeditation* refers to the tendency to act rashly without first reflecting upon the decision to act, and is regularly observed in research with substance use disorders. For example Vilar-Ribo et al., (2025) recently observed lack of premeditation to be independently genetically associated with substance use and substance use disorders, acknowledging that specific facets of impulsivity confer risk at distinct stages of substance use involvement.

Our findings support this assertion in that we observe three specific facets of impulsivity to be associated with use or experimentation of multiple substances.

We extend upon previous findings which indicate trait impulsivity is a risk factor for drug experimentation (de Wit, 2009) by providing an account of this relationship using the UPPS-P. The factors we found to be predictive of number of substances used have also been strongly related to various types of harmful substance use, such as binge drinking and alcohol dependence (Stautz & Cooper, 2013), negative consequences of cannabis use (VanderVeen et al., 2016), cocaine dependency and amphetamine-use disorders (García-Marchena et al., 2018; Stewart et al., 2023). This may suggest that individuals with greater levels of negative urgency, lack of premeditation and sensation seeking appear to be more likely to both experiment with *and* experience harms from substance use. However, it is important to note that our findings are associational and do not establish causality. As such we cannot rule out the possibility that increased substance use results in changes to impulsivity. In addition, we cannot generalize our findings to all impulsive behaviors. One suggested avenue for future work is to investigate the influence of UPPS-P impulsivity on changes in drug experimentation longitudinally, especially during potentially fertile periods of experimentation (e.g., throughout an undergraduate degree). This could shed further light onto how UPPS-P impulsivity influences the transition between problematic to harmful substance use, as well as being an improved test of the tool's predictive ability.

We found no evidence for any effect of anxiety or depression on the number of substances used at least once in a lifetime. This is at odds with our finding that negative urgency was associated with a greater number of substances used. One possible explanation is that HADS being a state measure may not be sensitive enough to detect differences in our outcome. A trait measure evaluating tendencies toward experiencing symptoms of anxiety and depression may be more predictive of *lifetime* substance usage. Likewise, it is possible that the severity of symptoms within the current sample was too low for depression (mean = 5.9 out of 21) or anxiety (mean = 9.9 out of 21) to be influential on the number of substances used. We found no evidence of an interaction between HADS scores and negative urgency on substances used. Whilst state-level negative affect has been found to moderate the relationship between substance use and negative urgency (Gonzalez et al., 2011; Um et al., 2019), it may only be relevant for substance use within much shorter periods of time, i.e. concurrent or subsequent polysubstance use.

We observed that females reported a lower total number of different drugs used compared to males. This is not surprising, recent research on sex differences in substance use suggest that (a) men have higher odds of reporting perceived access to drugs, b) men have higher odds of lifetime use of commonly used drugs such as cannabis, cocaine, and heroin, and c) men have higher odds of past year cannabis and cocaine use disorders (from analyses of United States national drug use surveys; Ellis et al., 2024). Our study contributes new information to these findings, in that, males also report use of a wider range of substances in the current

sample. This potentially aligns to the observation of Ellis et al. (2024) of increased odds in perceived access to drugs in males compared to females. Moreover, Ellis et al., suggest that sex differences emerge in the earliest stage of drug use (access) and may accumulate across the stages of use. Given that substance use disorders can be understood as a transition from recreational to compulsive use (Everitt & Robbins, 2016), it is important to understand psychological underpinnings that contribute to drug experimentation, and polysubstance experimentation/use as assessed in the current study. Importantly, in our study, UPPS-P Negative Urgency, Lack of Premeditation, and Sensation Seeking are predictive of number of different drugs used independently of sex differences, suggesting that these could be important drivers of drug use regardless of sex.

A limitation of this study is that it only provides information about single usage and thus cannot elucidate as to the amount/frequency of use of each substance used, which may be a more informative risk factor for the development of problematic use. More research is needed to investigate whether the measure of substance use we employed is associated with similar harms that arise from concurrent or simultaneous polysubstance use. Another limitation is that because we asked participants to tick any and all of the drugs that they have used in their lifetime, without specifying “recreationally,” it is possible that in some instances some of the substances listed could have been used for medicinal rather than recreational purposes (i.e. prescription opioids). However, due to the large sample size of our study, it is likely that this would have minimal impact on our results. Additionally, we only focused on tobacco which excludes the use of other nicotine products (e.g., vapes) which have become more prevalent within recent years. Finally, there may be demographic factors which may have exerted an influence on our results. For example, the sample we recruited in the study was 81% female reducing the generalizability of these findings. Furthermore, it is possible that cultural influences can impact substance use, and rates of anxiety and depression. However, as we did not record the nationality or ethnicity of participants in our sample we could not formally explore this.

Conclusion

We found evidence that trait impulsivity-related risk factors are associated with the number of different substances used at least once in a lifetime. This is supportive of previous evidence for specific substance and polysubstance use outcomes. Females also reported lower rates of substances used relative to males within our sample. A better understanding of the risk factors that influence the use of different substances used over the course of a lifetime may aid and prevent the development of substance misuse in those with vulnerabilities toward these outcomes. For example, behavioral tasks of impulsivity can be used to identify people who people who may be at risk of drug related problems (Poulton & Hester, 2019), and drug prevention efforts can target impulsive adolescents who have a history of behavioral addictions (Chuang et al., 2017).

Declaration of interest

The authors declare that they have no conflict of interest. The authors alone are responsible for the content and writing of the article

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