Benschop, A, Urbán, R, Kapitány-Fövény, M, Van Hout, MC, Dąbrowska,, K, Felvinczi, ,, K, Hearne, E, Henriques,, S, Kaló, Z, Kamphausen, G, Silva, J, Wieczorek, L, Werse, B, Bujalski, M, Korf, D and Demetrovics, Z

Why do people use new psychoactive substances? Development of a new measurement tool in six European countries.

Why do people use new psychoactive substances? Development of a new measurement tool in six European countries

Annemieke Benschop[1*], Róbert Urbán[2*], Máté Kapitány-Fövény[3,4], Marie Claire Van Hout[5], Katarzyna Dąbrowska[6], Katalin Felvinczi[2], Evelyn Hearne[7], Susana Henriques[8], Zsuzsa Kaló[2], Gerrit Kamphausen[9], Joana Paula Silva[8], Łukasz Wieczorek[6], Bernd Werse[9], Michal Bujalski[6], Dirk Korf[1**], Zsolt Demetrovics[2**§]

[1] Bonger Institute, University of Amsterdam, Amsterdam, Netherlands

[2] Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary

[3] Faculty of Health Sciences, Semmelweis University; Budapest, Hungary

[4] Nyírő Gyula National Institute of Psychiatry and Addictions; Budapest, Hungary

[5] Public Health Institute, Liverpool John Moores University, Liverpool, UK

[6] Institute of Psychiatry and Neurology, Warsaw, Poland

[7] School of Health Sciences, Waterford Institute of Technology, Waterford, Ireland

[8] Centre for Research and Studies in Sociology, University Institute of Lisbon, Lisbon, Portugal

[9] Goethe-Universität, Frankfurt, Germany

[*] The first two authors contributed equally to the manuscript.

[**] The last two authors contributed equally to the manuscript.

[§]**Corresponding author:** Prof. Zsolt Demetrovics, PhD, DSc
Institute of Psychology, ELTE Eötvös Loránd University,
Izabella utca 46., H-1064, Budapest, Hungary
Phone: +36 30 97 610 97
Email: demetrovics.zsolt@ppk.elte.hu

ACKNOWLEDGEMENTS

This study was supported by the European Union (New Psychoactive Substances: transnational project on different user groups, user characteristics, extent and patterns of use, market dynamics, and best practices in prevention [HOME/2014/JDRU/AG/DRUG/7077]), the Hungarian National Research, Development and Innovation Office (Grant number: KKP126835; NKFIH-1157-8/2019-DT). The study was also supported for the realization of this international co-financed science project in 2016-2017 by the Polish Ministry of Science and Higher Education. Máté Kapitány-Fövény acknowledges the support by the János Bolyai Research Scholarship of the Hungarian Academy of Sciences and the support by the ÚNKP-19 New National Excellence Program of the Hungarian Ministry for Innovation and Technology. The funding institutions had no role in the study design or the collection, analysis and interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

Why do people use new psychoactive substances? Development of a new measurement tool in six European countries

Abstract

Introduction: New psychoactive substances (NPS) pose a public health threat. Many studies have tried to identify the reasons of NPS use, however, none of them have so far used any standardised measures. The aim of this study was (I) to develop and cross-culturally validate the New Psychoactive Substance Use Motives Measure (NPSMM) and (II) to compare motives of NPS use across countries and user types. **Methods**: Three subgroups (socially marginalised users; night life attendees; and members of online communities) of NPS users (N=3023) were recruited from six EU-member countries. Demographics, motives and types of NPS used were assessed. NPS use motives were measured by adapting the extended six factor version of the Marijuana Motives Measure. **Results**: Exploratory and confirmatory factor analysis resulted in a similar five-factor solution across most of the countries: coping, enhancement, social, conformity and expansion motives. Marginalized users scored higher on coping and conformity motives, night life groups showed higher endorsement of social motive, whereas online community users showed higher scores on expansion motives. Various types of NPS were also associated with different motives. **Conclusion**: NPS use motives might be associated with both the groups of users and the specific types of NPS being consumed. Expansion (psychedelics) and enhancement (stimulants) motives seemed to be linked to the chosen NPS product type, while coping, social and conformity motives were rather associated with user groups. NPSMM was found to be a valid instrument to measure NPS motives.

Why do people use new psychoactive substances? Development of a new measurement tool in six European countries

INTRODUCTION

In the past two decades, with the appearance of new psychoactive substances (NPS), the global drug market has markedly changed. The altered scenario of contemporary substance use was characterized by a shift to web based trafficking and information sourcing (Corkery et al., 2017; Orsolini et al., 2017), which usually predicts real life NPS scenario (Schifano et al., 2015). With NPS' diffusion on the web, a rapid increase in the number of these drugs was observable as early as the beginning of the 2000s (Schifano et al., 2003). Popularity of NPS can mainly be attributed to their easy availability (e.g., online purchase), relatively low price, high purity, perceived safety profile or misbeliefs about their safety as well as their temporary legal status (e.g., Gittins et al., 2018). Furthermore, NPS became immensely popular in an era in which the availability and purity of classic drugs – such as cocaine or heroin – decreased (e.g., Zawilska, 2017), therefore users of formerly scheduled substances shifted to NPS consumption. Nevertheless, NPS consumers often co-ingest other psychoactive substances, but mostly amphetamine-derivatives, cocaine, cannabis and ethanol (Newcombe, 2009; Matthews and Bruno, 2010; Winstock et al., 2011; Barratt et al., 2013; Caviness et al., 2015).

Users of psychoactive substances started to experiment with phenethylamines, tryptamines, piperazines or ketamine-type substances. However, synthetic cathinones (e.g., mephedrone, methylone, 4-MEC, MDPV or pentedrone) and synthetic cannabinoids (e.g. AM- or JWH-type products) became the most frequently consumed NPS in both the adult and adolescent population. By the end of 2016, over 620 NPS were monitored by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), with 66 NPS identified for the first time in that year (EMCDDA, 2017a). The later emergence of the misuse of novel synthetic opioids (e.g., fentanyl-type substances) created an opioid crisis (especially in the United States), with over 66% of total overdose cases related to opioid overuse in 2016 (Stoicea et al., 2016). Furthermore, recent data regarding heroin-related fatal overdoses (Vaiano et al., 2019) suggests that not only novel synthetic opioids but heroin itself also returned to the drug market as a relevant player. With elevating frequencies of NPS intoxications (e.g., Zawilska, 2015), public awareness increased about the potential adverse health and social outcomes of recurrent NPS consumption. It's however also important to note that a consolidation in the number of newly

introduced NPS may be seen as a novel and decreasing trend in terms of NPS trafficking (EMCDDA, 2019).

There are only a few available studies regarding NPS use prevalence in the general population. In England and Wales, the 2010/2011 British Crime Survey identified a 0.6-1.4% lifetime mephedrone use (Smith and Flatley, 2011). The National Survey of Drug Use and Health assessed a US national representative sample of non-institutionalized individuals between 2009 and 2013, and found psychedelic tryptamines (1.1% lifetime prevalence), phenethylamines (0.2% lifetime prevalence) and synthetic cannabinoids (0.05% lifetime prevalence) the most commonly used NPS (Palamar et al., 2015). The 2015 National Survey on Addiction Problems in Hungary found a 1.9%, 1.3% and 0.6% lifetime prevalence rate for synthetic cannabinoids, designer stimulants and mephedrone respectively (Paksi et al., 2016). A Polish survey conducted in 2015 (N=2052) showed 2.2% lifetime prevalence rate and 0.5% last year prevalence rate for NPS use (Public Opinion Research Center, 2015). Based on the results of the 2015 Epidemiological Survey of Substance Abuse (ESA) a lifetime NPS use prevalence of 2.8% was found in Germany in the general population (EMCDDA, 2017b).

Higher frequencies were observed in specific subpopulations (Orsolini et al., 2019), usually assessing non-representative/non-probability convenience samples. Among an Australian sample of regular psychostimulant users, lifetime use of mephedrone varied between 19-23%, whereas 10% was found for methylone and 5% for MDPV in 2012 (Sindicich and Burns, 2012). Among patrons of US nightlife scenes, a 8.2% lifetime prevalence of synthetic cannabinoid use was identified in 2012 (Kelly et al., 2013). In the Netherlands, among club-goers and ravers in Amsterdam lifetime prevalence rates were: 19% 2C-B, 15% 4-FA, and 9% mephedrone (Nabben, Korf and Benschop, 2014). A 59% of lifetime NPS use was described among a Scottish at-risk group (including people in contact with mental health services, people affected by homelessness, people who inject drugs or men who have sex with men) in a study conducted between 2015 and 2016 (MacLeod et al., 2016). The 2017 Global Drug Survey study showed a 5.8% lifetime prevalence of synthetic cannabinoids, 5.1% of 2C-B, 3.7% of DMT and 1.9% of mephedrone use (Winstock et al., 2017). In an Italian study assessing a sample of adolescents and young adults from both urban and rural areas (Martinotti et al., 2015) 4.7% of the respondents reported lifetime NPS use, with mephedrone (3.3%), synthetic cannabinoid (1.2%) and Salvia divinorum (0.3%) consumption being identified. A lifetime mephedrone and NPS use of 1.1% and 1.5% was identified in a large sample of welsh adolescents (Midgley et al., 2018).

Intrinsic motives of NPS consumption usually include curiosity, increasing pleasure, experimentation, self-exploration and escapism (Bonar et al., 2014; Corazza et al., 2014; Orsolini et al., 2015; van Amsterdam et al., 2015; Lauritsen and Rosenberg, 2016; Barnard et al., 2017). These reasons are therefore very similar to the explored reasons behind the use of other legal or illegal substances.

Understanding the reasons or motives of why people engage in NPS use is essential for the reduction of its use and the related harms that their use may cause. Similarly to other legal drugs (Cox & Klinger, 1988), psychological motives of use may represent the final decision whether to use different types of NPS or not and therefore they might be the most proximal factor for using them. Thus, many studies have already assessed the reasons behind NPS use, but so far none of them used any standardized measures. Regarding the exploration of substance use motivations, Cooper's four-factor model (1994) has been used and expanded to study alcohol-, cannabis- (Simons et al., 1998) or amphetamine-related motives (Thurn et al., 2017). Cooper – within the theoretical framework of Cox and Klinger's Motivational Model (1988) – described four motivational factors for alcohol use: 1) enhancement (i.e. increasing positive affect and experience), 2) social (i.e. enhancing sociability and social situations), 3) conformity (i.e. avoiding rejection by peers), 4) coping (i.e. reducing negative affect). Simons and colleagues (1998) developed the Marijuana Motives Measure (MMM) and amended Cooper's model with an additional fifth factor, named expansion. This factor primarily refers to the expansion of experimental awareness. The MMM was later extended with two items, reflecting a sixth motive, labelled routine motives (Benschop et al., 2015), consisting of boredom and habit. In case of the Amphetamine-Type stimulants Motive Questionnaire (AMQ), a four-factor solution was retained (i.e., enhancement, coping, social, and conformity motives) similar to that of Cooper's (Thurn et al., 2017). It would be important to understand the motives that could explain the experimentation or regular use of different types of NPS in order to formulate appropriate prevention programs. However, for the present and future research, it is necessary to develop and test psychometrically appropriate measure of motives. Previous efforts to measure NPS use motives (e.g., Kettner et al, 2019; Sutherland et al, 2017; Bonar et al., 2014) used mainly binary, yes/no, items to measure a list of motives and did not apply extensive psychometric analyses to identify latent factors behind the responses of users. In this study we propose that using a five-factor motivation model including enhancement, social, conformity, coping and expansion motives provides deeper understanding of the reasons or motives of the use of NPS. Furthermore, we also propose that the relative importance of different motives may

vary depending on the type of the NPS and the context of the use. NPS are often consumed for experiencing pleasure or enjoyment in general, but on the other hand, varying expectancies might be linked to the use of specific products (Soussan & Kjellgren 2016). For instance, the consumption of hallucinogenic NPS (e.g. 25i-NBOMe, 4-AcO-DMT, 2C-B) is often driven by the need of self-exploration or spiritual attainment. Synthetic cathinones' expected effects include increased self-esteem, sociability, empathy or energy (e.g. Winstock et al., 2011; Karila et al., 2015), which may be linked to mainly recreational purposes. Desired effects of synthetic cannabinoids consist of euphoria, increased creativity or relaxation and well-being (e.g. Spaderna et al., 2013). Tryptamines – like DMT (N,N-dimethyltryptamine), DPT (N,N-dipropyltryptamine) or 5-MeO-DiPT (1-methyl-5-methoxy-diisopropyltryptamine) – are usually chosen by those who seek psychedelic sensations, while piperazines – such as mCPP (m-chlorophenylpiperazine), BZP (n-benzylpiperazine) or TFMPP (1-(3-trifluoromethylphenyl)piperazine) – produce increased energy and euphoria or mild hallucinations (Schifano et al., 2015).

The objective of this paper is twofold. The first aim was to develop the New Psychoactive Substance Use Motives Measure (NPSMM) for a cross-cultural application. Therefore, beside the development of the NPSMM, the measurement invariance of its various language versions should be also tested if it is used in various countries. The second aim was to compare the motivational background of the use of NPS across countries and different types of users.

METHODS

Participants and procedure

The study was implemented within the confines of a transnational, interdisciplinary research project, funded by the EU. Researchers from six EU-member countries participated in the study: Germany, Hungary, Ireland, the Netherlands, Poland and Portugal. A survey was conducted between April and November 2016 among altogether 3023 NPS users. Eligibility criteria were as follows: 1) recent NPS use (at least once in the past 12 months); 2) being resident of the participating country; 3) an age of 18 years or older.

The sample consisted of three subgroups: 1) Socially marginalised users, recruited on the street or through care and treatment facilities (such as drug services or shelters) as well as by using snowball sampling, approached face-to-face by trained fieldworkers or care professionals. A pen-and-paper form of the questionnaire was administered by the interviewers in most of the cases. 2) Night life attendees were recruited on-site at clubs, rave parties or festivals. These respondents were also approached face-to-face, and self-completed either a pen-and-paper or an online form of the questionnaire, that they could access through a link presented at a flyer, which was distributed to them. 3) Members of online communities were recruited via online messages, through drug-related social media sites and internet forums. These participants exclusively filled in the online form of the questionnaire.

The applied questionnaire contained items that measured demographics, routes, motives and frequencies of NPS use, problems related to it, ways of NPS obtainment and possible perceived ways of tackling NPS problems. Five categories of NPS products were included in the study based on their epidemiological and clinical relevance: i.e. herbal blends (e.g. "Spice")' and/or synthetic cannabinoids; branded (e.g. "bath salts")' and/or pure stimulants (e.g. mephedrone, MDPV, a-PVP); psychedelics (e.g. NBOMe-x, 2C-x); dissociatives (e.g. methoxetamine); and 'other' (mainly opioid and benzodiazepine analogues).

To examine motives for NPS use, a 23-item adaptation of the Marijuana Motives Measure (MMM) (Simons et al., 1998) was included in the questionnaire (see table 1). Each item has a five-point response option (1= almost never/never, 2= sometimes, 3= half of the time, 4= most of the time, and 5= almost always/always). Two items from the original MMM ('So that others won't kid me' and 'Because my friends pressure me to') were omitted because they showed little to no validity in previous studies (Chabrol et al., 2005; Zvolensky et al., 2007; Benschop et al., 2015) and were thought to be irrelevant in case of adult respondents.

The detailed data collection process and study methodology (including the translation protocol and the exclusion criteria and process) are available elsewhere (Benschop et al., 2017; Korf et al., 2018; Van Hout et al., 2017).

Statistical analysis plan

Exploratory and confirmatory analyses were performed with Mplus 8.0 (Muthén & Muthén, 1998-2017). Weighted Least Squares Mean and Variance adjusted (WLSMV) estimation

method was used (Brown, 2006; Finney & DiStefano, 2006). The items were treated as ordinal indicators. The analyses were based on WLSMV estimation which utilizes the entire weight matrix to compute S.E. for the parameters, but this method avoids the matrix inversion (Finney & Di Stefano, 2006). Missing values were treated with full maximum likelihood function implemented in Mplus.

The first step was to test the original factor structure of the motive scale, however the degree of fit was unsatisfactory in all countries. The second step was to explore the factor structure in each country separately with exploratory factor analysis, and to identify replicable factor structure and to select items regarding high factor loading (≥0.50) on a relevant factor and low cross-loadings (<0.30) on other factors. The third step was to test the factor structure within confirmatory factor analysis (CFA) framework which included separate CFA analysis on each country data, and testing the measurement invariance across countries in order to support cross-countries comparisons. Invariance of the measurement model across countries was tested using the series of analyses. Equality constraints were set during a progression of analyses focusing on the factor structure (configural invariance), factor loadings (metric invariance), and thresholds (scalar invariance). Invariance was evaluated by a $\chi 2$ test of difference between nested models, in addition to changes in RMSEA and CFI.

In the CFA the satisfactory degree of fit requires the comparative fit index (CFI) to be larger than 0.95, the Tucker-Lewis Index (TLI) to be close to or larger than 0.95. The third fit index applied in this study was root mean square error approximation (RMSEA). RMSEA below 0.05 indicates excellent fit, the value around 0.08 indicates adequate fit, and value above 0.10 specifies poor fit.

As the fourth step, factor scores were calculated for further analyses including comparison of factor scores in three groups, namely marginalized users, nightlife users and online community users in each country.

Finally, as the fifth step we estimated the association between the use of specific product categories and dimensions of motives with CFA with covariates. The CFA with covariates technique was chosen for the present study because it can estimate the effect of several grouping variables such as the use of specific NPS product type, multiple use and marginalized status on latent variables at the same time.

RESULTS

Descriptive statistics

The descriptive statistics of the user samples from the six different countries are presented in Table 2. The samples differed in age and gender composition. The mean age of the samples varied between 23 and 33. In four countries, more than 70% of the respondents were male. The proportion of the three user groups also differed significantly across countries. Usually the online community was the largest, with the exception of Ireland and Portugal. The samples are heterogeneous also in terms of types of NPS used, which may reflect the differences in country-level context of new psychoactive substance use. However, it is important to note that multiple use was frequent in all countries with the exception of Ireland. This might be attributed to Ireland's low respondent rate regarding the nightlife subgroup.

Exploratory Factor Analysis

We tested the original five factor structure across countries, but the degree of fit was unsatisfactory in all countries (for interested readers see Supplement 1), therefore exploratory factor analysis was applied to identify the appropriate measurement model. We performed exploratory factor analysis (EFA) on each country data in which we treated the indicators as ordinal scale, therefore the estimation method was WLSMV and rotation was an oblique type (GEOMIN) (Yates, 1987). In order to find the number of factors to extract, we also considered eigenvalues, fit indices and interpretability of factor solutions. Eigenvalues of factors in each sample are presented in Supplement 2. Finally a five-factor solution was selected in all countries. Factor loadings are presented in Table 3. The five-factor models were similar in four countries, however one country (Portugal) shared four factors with other countries, and one factor was not interpretable.

Confirmatory factor analyses and the test of measurement invariance across countries

In order to test the measurement invariance across countries we performed a series of CFAs using the measurement model developed with EFA. The main goal here was to test the measurement invariance which also included the separate test of model fit in each countries, and also multigroup analyses with increasing constraints. From these analyses we excluded the sample from Ireland due to its small size. The separate test of model fit in each of the remaining five countries revealed that CFI and TLI were above or close to the optimal value of 0.95 in all

countries with the exception of Portugal. In this latter sample the estimation was found not trustworthy due to non-positive definite matrix, therefore we excluded it from further analysis. The source of severe linear dependencies in the Portuguese sample might be explained by the extreme floor effects in some items. RMSEA values were in the acceptable range in three countries, but in Polish sample it was above the cut-off value of 0.10. Inspecting the modification indices revealed that the freeing the error covariance between item 11 [Because it helps me enjoy a party] and item 19 [Because it improves parties and celebrations] improved the model in all countries (see Table 4). The error covariance reflects the similarity in content of these two items. Factor loadings in each country are represented in Table 5. The final questionnaire is presented in the Appendix.

The measurement invariance (equal latent form, equal factor loadings, equal indicator threshold), across countries was examined by use of multiple group CFA. Three nested models with increasing constraints were estimated. The fit indices are reported in Table 4. First, the measurement model was estimated freely in countries together. This unconstrained solution fitted the data satisfactorily. In the second model, the factor loadings were set as equal among countries, this model could not be identified. Finally, we estimated the model with equal factor loadings and equal threshold, the data did satisfactorily fit, however the degree of fit decreased significantly compared to the unconstrained solution. Beside the significant $\Delta\chi^2$ test, Cheung and Rensvold (2002) recommended to consider the change in CFI and RMSEA. The hypothesized invariance should only be rejected if ΔCFI is equal to or larger than 0.010, and/or ΔRMSEA is equal to or larger than 0.015 (Cheung & Rensvold, 2002; Dimitrov, 2010). During the procedure, while estimating configural invariance, the Dutch sample yielded a nonpositive definit matrix, therefore it was excluded from the multigroup analysis. Thus data from three countries – Germany, Hungary and Poland – were included in the further multigroup analysis. Although the $\Delta\chi^2$ test turned out to be significant, the changes in CFI and RMSEA were smaller than the cut-offs in testing metric and scalar invariance. Therefore the series of multigroup analyses supported the configural, metric and scalar invariance across three countries. Hence factor scores and latent means are directly comparable in three countries.

Comparison of different users across motives

Applying factor scores resulting from the measurement model, we compared the users across the three user types (marginalized users, nightlife users and online community users). Table 6

presents the factor scores across the types of users and countries. Two countries are not represented in the table: Ireland was excluded due to the small sample size which would make any estimation imprecise, Portugal was excluded because the data yielded a different factor structure than the data from other countries.

In order to decrease family wise type I error, we focus only on Bonferroni corrected significance level of ANOVA F-value. Further post hoc test was performed when the α value of ANOVA omnibus test is lower than .0025. Marginalized users showed higher endorsement in coping motive and lower endorsement of expansion motive compared to other user groups in all three countries. In night life users, social motive was the strongest motive in three countries (Germany, Hungary and Poland). In case of online community users, the results are more mixed. In Hungary and Poland, this user group scored higher on expansion motive, however in Germany nightlife and online community users did not differ on this motive but scored higher than the marginalized group. Contrasted with other countries, in the Netherlands the online community sample scored lower on the expansion motive than the nightlife sample.

Construct validity of motives scale – CFA with covariates

We estimated the association between the NPS types and motives in a CFA with covariates model. In the model the self-reported use of different NPS categories were the explanatory variables and motive factors as latent variables were the explained variable, whereas user types (marginalized users versus night life and online community users) were entered as covariates. The unstandardized regression coefficients are reported in Table 7. In order to control for multiple use, we also entered the indicator variable of multiple use as well. Each NPS type yielded a specific pattern of associations with motives. Synthetic cannabinoid use was associated with stronger endorsement of coping motive and weaker endorsement of enhancement and social motives. The negative coefficients here show that those people who indicated synthetic cannabinoid use scored lower on enhancement and social motives than those who indicated the use of other types of product. Conformity and expansion motives were not related with synthetic cannabinoid use compared to other products. NPS stimulant use was associated with higher endorsement of enhancement and social motives and lower endorsement of expansion motive. Psychedelics use was strongly linked with higher expansion motive and lower degree of coping, social and conformity motives. The use of dissociatives was linked with higher coping and expansion motives. Marginalized users scored higher on coping and

conformity motives and lower on enhancement, social and expansion motives compared to non-marginalized users.

DISCUSSION

The current study assessed the psychometric properties of a new instrument to measure NPS use motives and found a factor structure similar to Simons and colleagues (1998) for cannabis. Good model fit indices were found across countries and subgroups, even if certain countries had to be excluded from the analysis. Construct validity of NPSMM was proven to be acceptable.

Our finding that the use of stimulant emphathogens is associated with higher levels of enhancement and social motives is in line with former findings emphasizing that empathogen-type psychostimulants – usually consumed within the 'recreational scene' – are expected to increase sociability, feelings of friendliness or playfulness (e.g. Bedi et al., 2010). The use of psychedelics was linked with a higher score on the expansion motive. This result might be explained by the pharmacodynamical properties and subjective effects of psychedelics, characteristically eventuated in unconstrained cognition or a sense of expanded awareness, which was recently interpreted within the framework of the integrated information theory (IIT) by Gallimore (2015). Expansion was also associated with the use of dissociative NPS as well as a higher endorsement of the coping motive. Dissociative NPS, just like classic psychedelics, might be able to provide mind-altered experiences for their users, however, some novel dissociative drugs – such as 3-MeO-PCP – as compared to traditional psychedelics, may induce more severe intoxication and even lethal overdose (Johansson et al., 2017). The coping motive is usually associated with higher level of stress and anxiety (Armeli et al., 2014; Buckner et al., 2014), higher frequency (Thurn et al., 2017) or severity (Vinci et al., 2016) of substance use. Based on these findings, we might consider some of the explored motives (e.g. expansion, social or enhancement motives) as expectations regarding the effects of the consumed NPS.

Regarding the association between NPS use motives and different user groups, it may be unsurprising that marginalized users showed higher endorsement in coping motive, as low-socioeconomic background has already been linked to higher coping motive (Stapinski et al., 2016). Nonetheless, our results also indicate that marginalization should be considered as a robust, cross-cultural factor behind instrumental substance use. Among the group of nightlife users, social motive was found to be the most dominant motive, showing cultural overlaps,

especially when compared with the other two user groups. As club goers often seek the experience of shared moments and togetherness (e.g. Hunt et al., 2009), NPS – and particularly stimulant NPS – use may serve as a facilitator of enhanced sociability. The result that within the online community users' samples higher expansion motive was identified (in Hungary and Poland), can be explained by the characteristics of this specific subsample, namely that many of these participants could have been labeled as *psychonauts*. As former studies highlighted, psychonauts are mainly interested in exploring the effects of psychoactive substances (e.g. Zawilska, 2017), including the experience of an altered state of consciousness. The motivation to expand their awareness therefore can be interpreted as a subgroup-related specificity as well. Similarly, the result that social motivation is more relevant in the nightlife group than in the online community is far from being surprising as club goers tend to consume psychoactive drugs to increase their sociability (e.g. Soussan and Kjellgren, 2016). Nonetheless, the cross-national variability in the pattern of NPS use motives is also worth mentioning (e.g. the online community showed lower expansion scores than the night life group in only Germany and the Netherlands). This variability indicates that the association between NPS motives and specific user groups cannot be interpreted as a generally applicable tendency across all countries. According to the findings of former studies that assessed potential cross-cultural disparities in the pattern of substance use motives, slight differences might occur as a result of cultural values. For instance, as Mackinnon and colleagues (2017) pointed out, a significant interaction can be expected between drinking motives and dominant cultural values: i.e. respondents from individualistic cultures may more strongly endorse social and enhancement drinking motives as compared to participants from collectivistic countries.

When NPS product types and user groups were both entered in the CFA model to assess the controlled effect of these grouping variables in connection with the distinct motives, we found that the variability of coping and social motives were primarily explained by the membership of the marginalized group. Marginalized individuals showed high coping and low social motives to consume NPS. As these respondents were socially isolated, it is understandable that their main motive was not to increase their sociability or enhance social gatherings with substance use. The enhancement motive was mainly associated with stimulant use. These findings may be indicative of a mixed influence of the chosen NPS product type and the subcultural or socioeconomic background of the respondents with regard to the dominance of specific NPS consumption motives. Homeless and marginalized individuals might be characterized by higher odds of instrumental substance use in order to escape from their

everyday problems and may choose NPS with the lowest price, i.e. herbal blends. Out of the five assessed motives, expansion (psychedelics) and enhancement (stimulants) seemed to be linked to the chosen NPS product type, while the coping, social and conformity motives were rather associated with the user groups. Considerable cross-national differences in the use of various NPS products might have resulted from varying rates of the assessed subgroups across different countries. For instance, the relatively high number of psychedelic and dissociative NPS consumers identified in Germany may primarily be explained by the high proportion of online respondents from the same country who usually experience with mind-altering effects of novel psychedelics and dissociatives. Available epidemiological studies do not indicate major differences in national-level NPS consumption rates between the participating countries that might explain the aforementioned cross-national disparities.

Limitations

Our study relied on the retrospective recall of certain motives, therefore memory bias could have been the source of a potential confounding effect. Recruitment bias might have occurred during data collection, especially in case of online sampling, while many respondents might have limited knowledge or false information about the specific NPS they consumed. This might have led to reporting bias in certain cases. Most of the assessed samples consisted of mainly male respondents. In order to properly explore potential gender differences in NPS use motives, future studies need to assess more balanced samples when it comes to gender distribution. For instance, the study by Orsolini and colleagues (2015) already emphasized gender differences in NPS intake. An argument may arise whether or not NPS use in general significantly differ from other types of substance use in terms of motivation. Nevertheless, our analysis indicated that the consumption of different NPS – such as synthetic cannabinoids, branded stimulants or empathogens/nootropics – may be associated with specific patterns of motives, therefore NPSMM might be used as a valid motivation measurement tool in case of specific subtypes of NPS use as well. As such, it might be redundant to develop distinct motivation questionnaires for synthetic cannabinoids, synthetic cathinones or other NPS products consumption per se. Construct validity of the motives scales were tested and found to be acceptable, however, further measures of validity (e.g. concurrent and convergent) still needs testing regarding NPSMM scales. Finally, another limitation of this study lies in the fact that it assessed only intrinsic motives but no external factors that might be as well important in case of NPS consumption (such as low price or easy availability).

CONCLUSIONS

NPSMM can be used to assess the motivational background of the use of various NPS within different sociocultural context and socioeconomic heterogeneity. The factor structure of NPSMM was confirmed in four out of six countries, however the measurement invariance was demonstrated only in three countries. The utilization of NPSMM in further studies might contribute to the understanding of why people use certain types of NPS. In addition, NPSMM is currently the only validated tool to assess NPS use related intrinsic motives. Its applicability in explaining either the frequency or severity of NPS use needs to be tested in the future, within the context of both clinical and non-clinical settings.

References

Armeli S, Dranoff E, Tennen H, Austad CS, Fallahi CR, Raskin S, Wood R, Pearlson G (2014) A Longitudinal Study of the Effects of Coping Motives, Negative Affect and Drinking Level on Drinking Problems among College Students. *Anxiety, Stress, and Coping* 27(5): 527–541.

Barnard M, Russell C, McKeganey N, Hamilton-Barclay T (2016) The highs and lows of NPS/"Legal High" use: Qualitative views from a UK online survey. *Drugs: Education, Prevention and Policy* 24 (1): 96-102.

Barratt MJ, Cakic V, Lenton S (2013) Patterns of synthetic cannabinoid use in Australia. *Drug and Alcohol Review* 32(2): 141-146.

Bedi G, Hyman D, de Wit H (2010) Is ecstasy an "empathogen"? Effects of MDMA on prosocial feelings and identification of emotional states in others. *Biological Psychiatry* 68 (12): 1134–1140.

Benschop A, Liebregts N, van der Pol P, Schaap R, Buisman R, van Laar M, van den Brink W, de Graaf R, Korf DJ (2015) Reliability and validity of the Marijuana Motives Measure among young adult frequent cannabis users and associations with cannabis dependence. *Addictive Behaviors* 40: 91-95.

Benschop A, Bujalski M, Dabrowska K, Demetrovics Z, Egger D, Felinczi K, Henriques S, Kaló Z, Kamphausen G, Korf DJ, Nabben T, Silva JP, Van Hout MC, Werse B, Wells J, Wieczorek Ł, Wouters M (2017) *New Psychoactive Substances: transnational project on different user groups, user characteristics, extent and patterns of use, market*

dynamics, and best practices in prevention. NPS-transnational Project (HOME/2014/JDRU/AG/DRUG/7077). Available at: https://pure.uva.nl/ws/files/18260517/Final_report.pdf (Accessed 21 December, 2017)

Bonar EE, Ashrafioun L, Ilgen MA (2014) Synthetic Cannabinoid Use Among Patients in Residential Substance Use Disorder Treatment: Prevalence, Motives, and Correlates. *Drug and Alcohol Dependence* 143: 268–271.

Brown T (2006) *Confirmatory factor analysis for applied research*. New York: Guildford Press.

Buckner JD, Zvolensky MJ, Farris SG, Hogan J (2014) Social Anxiety and Coping Motives for Cannabis Use: The Impact of Experiential Avoidance. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors* 28(2): 568–574.

Caviness CM, Tzilos G, Anderson BJ, Stein MD (2015) Synthetic Cannabinoids: Use and predictors in a Community Sample of Young Adults. *Substance Abuse* 36(3): 368–373.

Chabrol H, Ducongé E, Casas C, Roura C, Carey KB (2005) Relations between cannabis use and dependence, motives for cannabis use and anxious, depressive and borderline symptomatology. *Addictive Behaviors* 30(4): 829-840.

Cheung GW, Rensvold RB (2002) Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling* 9(2): 233-255.

Cooper ML (1994) Motivations for alcohol use among adolescents: development and validation of a four-factor model. *Psychological Assessment* 6(2): 117–128.

Corazza O, Simonato P, Corkery J, Trincas G, Schifano F (2014) ''Legal highs'': Safe and legal ''heavens''? A study on the diffusion, knowledge and risk awareness of novel psychoactive drugs among students in the UK. *Rivista di Psichiatria* 49 (2): 89–94.

Corkery JM, Orsolini L, Papanti D, Schifano F (2017) From concept(ion) to life after death/the grave: The 'natural' history and life cycle(s) of novel psychoactive substances (NPS). *Human Psychopharmacology* 32(3). doi: 10.1002/hup.2566.

Cox WM, Klinger E (1988) A motivational model of alcohol use. *Journal of Abnormal Psychology* 97(2): 168-180.

Dimitrov D (2010) Testing for factorial invariance in the context of construct validation. *Measurement and Evaluation in Counseling and Development* 43(2): 121-149.

Dolengevich-Segal H, Rodríguez-Salgado B, Gómez-Arnau J, Sánchez-Mateos D (2016) Severe Psychosis, Drug Dependence, and Hepatitis C Related to Slamming

Mephedrone. *Case Reports in Psychiatry* 8379562. http://doi.org/10.1155/2016/8379562

EMCDDA (2017a) *High-risk drug use and new psychoactive substances*. EMCDDA Rapid Communication, Luxembourg: Publications Office of the European Union. Available at: http://www.emcdda.europa.eu/system/files/publications/4540/TD0217575ENN.pdf_en (Accessed 28 November, 2017)

EMCDDA (2017b) *Germany - Country Drug Report 2017*. Luxembourg: Publications Office of the European Union. Available at: http://www.emcdda.europa.eu/system/files/publications/4528/TD0416906ENN.pdf (Accessed 27 November, 2019)

EMCDDA (2019) *EU Drug Markets Report 2019*. Publications Office of the European Union, Luxembourg. Available at: http://www.emcdda.europa.eu/system/files/publications/12078/20192630_TD0319332ENN_PDF.pdf (Accessed 26 November, 2019)

Finney SJ, DiStefano C (2006) Non-normal and categorical data in structural equation modeling. In: Hancock GR, Mueller RO (eds) *Structural equation modeling: A second course*. Greenwich, CT: Information Age, pp. 269–314.

Gallimore AR (2015) Restructuring consciousness –the psychedelic state in light of integrated information theory. *Frontiers in Human Neuroscience* 9: 346. http://doi.org/10.3389/fnhum.2015.00346

Gittins R, Guirguis A, Schifano F, Maidment I (2018) Exploration of the Use of New Psychoactive Substances by Individuals in Treatment for Substance Misuse in the UK. *Brain Sciences* 8(4): 58. doi:10.3390/brainsci8040058

Hunt G, Moloney M, Evans K (2009) Epidemiology meets cultural studies: Studying and understanding youth cultures, clubs and drugs. *Addiction Research & Theory* 17(6): 601–621.

Johansson A, Lindstedt D, Roman M, Thelander G, Nielsen EI, Lennborn U, Sandler H, Rubertsson S, Ahlner J, Kronstrand R, Kugelberg FC (2017) A non-fatal intoxication and seven deaths involving the dissociative drug 3-MeO-PCP. *Forensic Science International* 275: 76-82.

Kapitány-Fövény M, Mervó B, Corazza O, Kökönyei G, Farkas J, Urbán R, Zacher G, Demetrovics Z (2015) Enhancing sexual desire and experience: an investigation of the

sexual correlates of gamma-hydroxybutyrate (GHB) use. *Human Psychopharmacology* 30(4): 276-284.

Karila L, Megarbane B, Cottencin O, Lejoyeux M (2015) Synthetic cathinones: a new public health problem. *Current Neuropharmacology* 13(1): 12-20.

Kelly BC, Wells BE, Pawson M, LeClair A, Parsons JT, Golub SA (2013) Novel Psychoactive Drug Use among Younger Adults Involved in US Nightlife Scenes. *Drug and Alcohol Review* 32 (6): 10.1111/dar.12058. http://doi.org/10.1111/dar.12058

Kettner H, Mason NL, Kuypers KPC (2019) Motives for Classical and Novel Psychoactive Substances Use in Psychedelic Polydrug Users. *Contemporary Drug Problems, 46* (3): 304–320.

Lauritsen KJ, Rosenberg H (2016) Comparison of outcome expectancies for synthetic cannabinoids and botanical marijuana. *The American Journal of Drug and Alcohol Abuse* 42(4): 377-384.

Macfarlane A (2016) Sex, drugs and self-control: why chemsex is fast becoming a public health concern. *BMJ Sexual & Reproductive Health* 42(4): 291-294.

Mackinnon SP, Couture ME, Cooper ML, Kuntsche E, O'Connor RM, Stewart SH; DRINC Team (2017) Cross-cultural comparisons of drinking motives in 10 countries: Data from the DRINC project. *Drug and Alcohol Review* 36(6): 721-730.

MacLeod K, Pickering L, Gannon M, Greenwood S, Liddell D, Smith A, Johnstone L, Burton G (2016) *Understanding the patterns of use, motives, and harms of new psychoactive substances in Scotland*. Edinburgh (UK): Scottish Government. Available at: http://www.gov.scot/Resource/0051/00510607.pdf (Accessed: 28 November, 2017)

Martinotti G, Lupi M, Carlucci L, Cinosi E, Santacroce R, Acciavatti T, Chillemi E, Bonifaci L, Janiri L, Di Giannantonio M (2015) Novel psychoactive substances: use and knowledge among adolescents and young adults in urban and rural areas. *Human Psychopharmacology* 30(4): 295-301.

Matthews AJ, Bruno R (2010) *Mephedrone use among regular ecstasy consumers in Australia. EDRS Drug Trends Bulletin, December*. Sydney: National Drug and Alcohol Research Centre, University of New South Wales.

Midgley LS, Murphy S, Moore G, Hewitt G, White J (2018) Multilevel population-based cross-sectional study examining school substance-misuse policy and the use of cannabis, mephedrone and novel psychoactive substances among students aged 11-16 years in schools in Wales. *BMJ Open* 8(6): e020737. doi:10.1136/bmjopen-2017-020737

Muthén LK, Muthén BO (1998-2017) *Mplus User's Guide. Eighth Edition*. Los Angeles, CA: Muthén & Muthén

Nabben T, Benschop A, Korf DJ (2014) *Antenne 2013. Trends in alcohol, tabak en drugs bij jonge Amsterdammers.* Amsterdam: Rozenberg Publishers.

Newcombe R (2009) *The Use of Mephedrone (M-cat,Meow) in Middlesbrough*. Manchester, UK: Lifeline Publications and Research

Orsolini L, Papanti GD, Francesconi G, Schifano F (2015) Mind navigators of chemicals' experimenters? A web-based description of e-psychonauts. *Cyberpsychology, Behavior, and Social Networking* 18(5): 296–300.

Orsolini L, Papanti D, Corkery J, Schifano F (2017) An insight into the deep web; why it matters for addiction psychiatry? *Human Psychopharmacology* 32(3). doi: 10.1002/hup.2573.

Orsolini L, Chiappini S, Corkery JM, Guirguis A, Papanti D, Schifano F (2019) The use of new psychoactive substances (NPS) in young people and their role in mental health care: a systematic review. *Expert Review of Neurotherapeutics* 19(12): 1253-1264.

Paksi B, Magi A, Felvinczi K, Demetrovics Z (2016) *The prevalence of new psychoactive substances in Hungary – based on a general population survey dealing with addiction related problems (OLAAP 2015)*. IV. International Conference on Novel Psychoactive Substances (NPS). Budapest, 30-31 May 2016.

Palamar JJ, Martins SS, Su MK, Ompad DC (2015) Self-reported use of novel psychoactive substances in a US nationally representative survey: Prevalence, correlates, and a call for new survey methods to prevent underreporting. *Drug and Alcohol Dependence* 156: 112-119.

Palamar JJ, Su MK, Hoffman RS (2016) Characteristics of novel psychoactive substance exposures reported to New York City Poison Center, 2011–2014. *The American Journal of Drug and Alcohol Abuse* 42(1): 39–47.

Public Opinion Research Center (2015) *Oszacowanie rozpowszechnienia wybranych uzależnień behawioralnych oraz analiza korelacji pomiedzy wystepowaniem uzależnień behawioralnych a używaniem substancji psychoaktywnych.* Ministry of Health, Warsaw.

Schifano F, Leoni M, Martinotti G, Rawaf S, Rovetto F (2003) Importance of cyberspace for the assessment of the drug abuse market: preliminary results from the Psychonaut 2002 project. *Cyberpsychology & Behavior* 6(4): 405-410.

Schifano F, Orsolini L, Duccio Papanti G, Corkery JM (2015) Novel psychoactive substances of interest for psychiatry. *World Psychiatry* 14(1): 15–26.

Simons JS, Correia CJ, Carey KB, Borsari BE (1998) Validating a five-factor Marijuana Motives Meas-ure: Relations with use, problems, and alcohol motives. *Journal of Counseling Psychology* 45(3): 265–273.

Sindicich N, Burns L (2012) *Australian trends in ecstasy and related drug markets 2012: Findings from the Ecstasy and Related Drugs Reporting System (EDRS). Australian Drug Trends Series No.100*. National Drug and Alcohol Research Centre, University of New South Wales. Available at: https://ndarc.med.unsw.edu.au/sites/default/files/ndarc/resources/EDRS%202012%20national%20report%20FINAL.pdf (Accessed: 28 November, 2017)

Smith K, Flatley J (2011) *Drug misuse declared: findings from the 2010/2011 British Crime Survey England and Wales*. UK: Home Office

Soussan C, Kjellgren A (2016) The users of Novel Psychoactive Substances: Online survey about their characteristics, attitudes and motivations. *International Journal of Drug Policy* 32: 77–84.

Spaderna M, Addy PH, D'Souza DC (2013) Spicing thing up: Synthetic cannabinoids. *Psychopharmacology* 228(4): 525–540.

Stapinski LA, Edwards AC, Hickman M, Araya R, Teesson M, Newton NC, Kendler KS, Heron J (2016) Drinking to Cope: a Latent Class Analysis of Coping Motives for Alcohol Use in a Large Cohort of Adolescents. *Prevention Science* 17(5): 584-594.

Stein L, Lebeau R, Clair M, Martin R, Bryant M, Storti S, Monti P (2011) A Web-Based Study of Gamma Hydroxybutyrate (GHB): Patterns, Experiences, and Functions of Use. *The American Journal on Addictions / American Academy of Psychiatrists in Alcoholism and Addictions* 20(1): 30–39.

Stoicea N, Costa A, Periel L, Uribe A, Weaver T, Bergese SD (2019) Current perspectives on the opioid crisis in the US healthcare system: A comprehensive literature review. *Medicine (Baltimore)* 98(20): e15425. doi: 10.1097/MD.0000000000015425.

Sutherland R, Bruno R, Peacock A, Lenton S, Matthews A, Salom C, … Barratt MJ (2017) Motivations for new psychoactive substance use among regular psychostimulant users in Australia. *International Journal of Drug Policy 43*: 23–32.

Thurn D, Kuntsche E, Weber JA, Wolstein J (2017) Development and Validation of the Amphetamine-Type Stimulants Motive Questionnaire in a Clinical Population. *Frontiers in Psychiatry* 8: 183. http://doi.org/10.3389/fpsyt.2017.00183

Tomkins A, Ahmad S, Cannon L, Higgins SP, Kliner M, Kolyva A, Ward C, Vivancos R (2017) Prevalence of recreational drug use reported by men who have sex with men attending sexual health clinics in Manchester, UK. *International Journal of STD and AIDS*, 2017: 956462417725638. doi: 10.1177/0956462417725638.

Vaiano F, Pascali JP, Bertol E (2019) New psychoactive substances: An actual problem or an overestimated phenomenon? *Forensic Science International* 304: 109941. doi: 10.1016/j.forsciint.2019.109941

Van Amsterdam JG, Nabben T, Keiman D, Haanschoten G, Korf DJ (2015) Exploring the attractiveness of New Psychoactive Substances (NPS) among experienced drug users. *Journal of Psychoactive Drugs* 47(3): 177–181.

Van Hout MC, Benschop A, Bujalski M, Dabrowska K, Demetrovics Z, Felvinczi K, Hearne E, Henriques S, Kaló Z, Kamphausen G, Korf DJ, Silva JP, Wieczorek Ł, Werse B (2017) Health and Social Problems Associated with Recent Novel Psychoactive Substance (NPS) Use Amongst Marginalised, Nightlife and Online Users in Six European Countries. *International Journal of Mental Health and Addiction* https://doi.org/10.1007/s11469-017-9824-1

Vinci C, Spears CA, Peltier MR, Copeland AL (2016) Drinking Motives Mediate the Relationship between Facets of Mindfulness and Problematic Alcohol Use. *Mindfulness* 7(3): 754–763.

Winstock AR, Mitcheson LR, Deluca P, Davey Z, Corazza O, Schifano F (2011) Mephedrone, new kid for the chop? *Addiction* 106 (1): 154-161.

Winstock AR, Barratt M, Ferris J, Maier L (2017) Global Drug Survey 2017 – Global overview and highlights. Available at: https://www.globaldrugsurvey.com/wp-content/themes/globaldrugsurvey/results/GDS2017_key-findings-report_final.pdf (Accessed: 27 November, 2017)

Wood DM, Measham F, Dargan PI (2012) 'Our favourite drug': prevalence of use and preference for mephedrone in the London night-time economy 1 year after control. *Journal of Substance Use* 17 (2): 91–97.

Yates A (1987) *Multivariate exploratory data analysis: a perspective on exploratory factor analysis*. Albany, NY: State University of New York Press

Zawilska JB (2015) "Legal Highs" - An Emerging Epidemic of Novel Psychoactive Substances. *International Review of Neurobiology* 120: 273-300.

Zawilska JB (2017) An Expanding World of Novel Psychoactive Substances: Opioids. *Frontiers in Psychiatry* 8: 110. http://doi.org/10.3389/fpsyt.2017.00110

Zvolensky MJ, Vujanovic AA, Bernstein A, Bonn-Miller MO, Marshall EC, Leyro TM (2007) Marijuana Use Motives: A Confirmatory Test and Evaluation among Young Adult Marijuana Users. *Addictive Behaviors* 32(12): 3122-3130.

Table 1. The original 23-items questionnaire to measure the motives of new psychoactive substance use

No[1]	No[2]		
9	16	To be liked	Conformity
12	22	To fit in with the group I like	Conformity
20	25	So I won't feel left out	Conformity
1	1	To forget my worries	Coping
6	2	To cheer me up when I am in a bad mood	Coping
17	4	To forget about my problems	Coping
4	8	Because it helps me when I feel depressed or nervous	Coping
7	5	Because I like the feeling	Enhancement
13	7	Because it gives me a pleasant feeling	Enhancement
18	10	Because it's fun	Enhancement
10	12	To get high	Enhancement
9	30	Because it's exciting	Enhancement
21	9	To know myself better	Expansion
24	23	To expand my awareness	Expansion
22	26	Because it helps me to be more creative and original	Expansion
23	28	To understand things differently	Expansion
25	29	To be more open to experiences	Expansion
3	11	Because it helps me enjoy a party	Social
5	13	To be sociable	Social
11	17	Because it makes social gatherings more fun	Social
14	19	Because it improves parties and celebrations	Social
15	21	Because I feel more self-confident and sure of myself	Social
6	31	To celebrate a special occasion with friends	Social

Notes: [1]Original MMM item number; [2]item number used in the current study

Table 2. Descriptive statistics of participating countries.

	Germany	Hungary	Ireland	Netherlands	Poland	Portugal	χ^2/F (p)
N	663	272	62	1190	596	240	
Age, Mean (SD)	25.17 (7.31)	28.49 (8.51)	32.76 (6.84)	23.01 (4.54)	25.21 (7.19)	26.99 (6.49)	60.9 (p<.001)
Gender, N (%) of men	571 (87.2)	201 (75.3)	36 (58.1)	591 (50.0)	472 (80.1)	174 (72.8)	340.9 (p<.001)
User types							
Marginalized user N (%)	23 (3.5)	101 (37.1)	48 (77.4)	1 (0.1)	86 (14.4)	7 (2.9)	1253.0 (p<.001)
Night life users N (%)	98 (14.8)	15 (5.5)	3 (4.8)	189 (15.9)	172 (28.9)	170 (70.8)	
Online community users N (%)	542 (81.7)	156 (57.4)	11 (17.7)	1000 (84.0)	338 (56.7)	63 (26.3)	
Last 12-month use							
Herbal blends and/or Synthetic cannabinoids N (%)	276 (41.6)	188 (69.1)	17 (27.4)	122 (10.3)	325 (54.5)	61 (25.4)	595.9 (p<.001)
Branded and or pure stimulants N (%)	262 (39.5)	178 (65.4)	35 (56.5)	1148 (96.5)	436 (73.2)	64 (26.7)	920.0 (p<.001)
Psychedelics N (%)	425 (64.1)	43 (15.8)	6 (9.7)	393 (33.0)	167 (28.0)	181 (75.4)	435.0 (p<.001)
Dissociatives N (%)	156 (23.5)	50 (18.4)	3 (4.8)	100 (8.4)	95 (15.9)	36 (15.0)	88.0 (p<.001)
Other NPS N (%)	228 (34.4)	76 (27.9)	16 (25.8)	277 (23.3)	139 (23.3)	93 (38.8)	47.1 (p<.001)
Multiple use* N (%)	368 (55.5)	156 (57.4)	13 (21.0)	583 (49.0)	319 (53.5)	127 (52.9)	35.2 (p<.001)

Notes: *More than one product type was mentioned.

Table 3. Exploratory factor analyses of motive items in five countries.

No[1]	No[2]	Coping					Enhancement					Social					Conformity					Expansion					Portugal (not defined)
		GER	HUN	NED	POL	POR	GER	HUN	NED	POL	POR	GER	HUN	NED	POL	POR	GER	HUN	NED	POL	POR	GER	HUN	NED	POL	POR	
1	1	**.97**	**.96**	**.91**	**.94**	**.93**	.00	-.12	.13	-.03	.04	-.02	-.01	-.03	-.04		-.03	-.04	.01	.01	.07	-.03	-.04	.01	-.01	-.01	.01
17	4	**.95**	**.97**	**.95**	**.99**	**.89**	.00	-.05	.12	-.01	.01	.02	.01	-.02	.01		-.04	-.02	.01	-.04	.14	-.02	-.01	-.02	-.01	.00	.04
6	2	**.87**	**.78**	**.82**	**.81**	**.55**	.04	.05	-.01	.20	.17	.06	.06	.07	.00		.03	.03	.05	.03	-.04	-.04	.02	.02	-.02	-.08	-.35
4	8	**.85**	**.66**	**.73**	**.68**	**.67**	.10	.18	-.04	.30	-.06	-.07	-.17	.04	-.06		.05	.10	.17	.14	-.07	.11	.19	.06	.01	.05	**-.53**
7	5	.03	-.02	.25	-.01	.08	**.91**	**.92**	**.87**	**.76**	**.55**	.01	.00	-.02	.23		-.02	.05	-.01	-.01	-.56	-.03	.06	-.02	.08	.20	.00
13	7	.08	.04	.07	.00	.08	**.88**	**.81**	**.91**	**.78**	**.66**	-.03	.12	.04	.30		.04	-.02	.01	.02	-.43	-.01	.01	-.05	-.03	.13	.03
23	28	.06	.07	.07	.08	-.10	.08	.11	-.03	-.02	.05	-.14	-.07	-.04	-.03		-.03	-.05	-.08	-.09	.04	**.88**	**.86**	**.94**	**.92**	**.92**	.01
24	23	.00	.12	.11	-.08	.00	-.04	-.01	-.02	-.04	-.04	.17	.02	-.10	.03		-.35	**.40**	.00	.03	-.02	**.88**	.14	**.81**	**.89**	**.85**	.35
25	29	-.03	-.13	-.05	.02	-.04	.10	-.04	.06	.04	.21	-.10	.03	.00	.04		.08	.17	.07	.23	.00	**.87**	**.87**	**.84**	**.74**	**.61**	-.09
21	9	-.02	.01	.25	-.04	.11	-.07	-.04	-.05	-.01	-.10	.06	.05	-.08	-.02		-.22	.03	-.06	.02	.00	**.81**	**.73**	**.72**	**.87**	**.74**	.09
22	26	.25	.05	.19	-.01	.24	-.01	.09	-.09	.10	.05	-.01	-.01	.06	-.04		.03	.29	.02	.33	-.02	**.67**	**.54**	**.66**	**.53**	**.52**	-.12
9	30	-.01	.00	-.13	.08	.00	.35	.19	.11	.32	**.86**	.11	.31	.06	.36		.09	-.03	.22	.00	-.02	**.53**	**.50**	**.58**	.36	-.03	**.47**
3	11	.09	.03	.07	.03	-.01	-.05	.30	.08	.01	**.77**	**.93**	**.88**	**.79**	**.92**		.00	-.03	.01	.03	.08	-.03	-.07	-.10	-.10	-.01	.12
14	19	.03	-.03	-.01	-.01	-.07	.01	.20	-.02	-.02	**.79**	**.92**	**.76**	**.94**	**.86**		.06	.10	-.07	.21	.21	-.02	-.06	-.05	-.09	-.04	-.03
6	31	-.08	.05	-.11	.08	.11	.15	.03	.10	.06	**.63**	**.51**	**.59**	.23	**.54**		.28	.10	.15	.11	.00	.15	.17	**.50**	.04	-.08	-.04
11	17	-.01	-.14	.07	-.07	-.11	.14	-.12	.05	-.07	**.86**	**.47**	**.51**	**.52**	**.49**		.40	.44	.22	**.49**	.24	.05	.09	.13	.03	.00	-.03
10	12	.11	.08	.15	.34	-.01	.36	.25	.19	.19	**.54**	.34	.35	.19	.23		-.04	.00	.06	-.11	.04	-.21	.26	.28	.04	-.07	.07
20	25	.38	-.01	.16	.41	.37	-.04	.08	.06	-.13	-.08	-.04	-.24	-.25	.07		**.74**	**.87**	**.82**	**.47**	**.72**	.04	-.04	.02	.04	-.13	.11
12	22	.28	.00	-.08	.03	.02	-.03	.02	-.01	.07	.15	.07	-.03	-.04	.00		**.70**	**1.01**	**.95**	**.87**	**.94**	-.10	-.32	-.05	-.03	.03	-.09
9	16	.36	.09	.25	.26	.25	-.08	-.17	-.16	-.16	-.01	.03	.06	.14	.05		**.69**	**.77**	**.65**	**.65**	**.95**	-.03	.00	.01	.00	.07	.07
5	13	-.03	-.02	-.04	.00	.28	.18	-.08	.27	.03	.33	.29	.37	.35	.09		**.41**	**.45**	.16	**.72**	.30	-.01	.22	.15	.15	.06	-.13
15	21	**.46**	.17	.22	.02	.35	.00	.10	-.05	.25	.23	.22	.09	.27	-.07		.35	**.64**	**.48**	**.86**	**.45**	.07	.09	.03	-.02	.22	-.12
18	10	-.16	-.03	-.10	-.09	.00	**.63**	.36	**.68**	.26	**.86**	.28	**.65**	.23	**.71**		-.05	-.01	-.03	-.03	-.09	.09	.03	.13	.10	.03	**.63**

Table 4. Model fit and multigroup analyses

	χ^2	df	CFI	TLI	RMSEA	Cfit of RMSEA	$\Delta\chi^2$	Δdf	ΔCFI	ΔRMSEA
Confirmatory factor analysis in countries										
Germany	388	94	0.983	0.979	0.069	<0.001				
Hungary	247	94	0.968	0.959	0.079	<0.001				
Netherlands	673	94	0.960	0.949	0.072	<0.001				
Poland	667	94	0.963	0.953	0.102	<0.001				
Portugal#										
Germany*	337	93	0.986	0.982	0.063	0.001				
Hungary*	238	93	0.970	0.961	0.077	<0.001				
Netherlands*	497	93	0.972	0.964	0.061	<0.001				
Poland*	585	93	0.968	0.959	0.095	<0.001				
Portugal#										
Ireland###										
Multigroup analyses including (Germany. Hungary. Poland)##										
Configural invariance	1125	279	0.978	0.971	0.077	<0.001				
Metric invariance	1244	301	0.975	0.970	0.079	<0.001				
Metric against configural invariance							158	22	0.003	0.002
Scalar invariance	1536	387	0.970	0.972	0.077	<0.001				
Scalar against metric invariance							360	86	0.005	-0.002

Notes: *: Applying error covariancies between item 11 and item 19. Configural invariance – unconstrained model. Metric invariance –factor loadings are constrained. Scalar invariance – thresholds and factor loadings are constrained. #: the latent covariance matrix is not positive definit therefore the estimation is not trustworthy in Portugal sample. We did not use data from Portugal in the multigroup analyses. ##: In the multigroup analysis the Netherlands sample yielded nonpositive definit matrix, therefore it was excluded from the multigroup analysis. ###: Ireland was excluded from this step of analysis due to the low sample size.

Table 5. Confirmatory factor analyses in each countries: standardized factor loadings

No[1]	No[2]	Coping				Enhancement				Social				Conformity				Expansion			
		GER	HUN	NED	POL	GER	HUN	NED	POL	GER	HUN	NED	POL	GER	HUN	NED	POL	GER	HUN	NED	POL
1	1	0.95	0.90	0.92	0.93																
17	4	0.91	0.79	0.86	0.86																
6	2	0.94	0.95	0.94	0.96																
4	8	0.85	0.83	0.85	0.82																
7	5					0.86	0.93	0.93	0.87												
13	7					0.93	0.86	0.87	0.90												
3	11									0.71	0.72	0.56	0.66								
11	17									0.86	0.78	0.95	0.91								
14	19									0.75	0.71	0.56	0.80								
9	16													0.90	0.85	0.89	0.78				
12	22													0.86	0.85	0.75	0.85				
20	25													0.95	0.81	0.86	0.80				
21	9																	0.75	0.73	0.78	0.79
22	26																	0.65	0.79	0.77	0.74
23	28																	0.87	0.85	0.92	0.83
25	29																	0.89	0.88	0.84	0.88

Table 6. Comparison of factors scores among different type of users in each countries.

Countries	Motives	Marginalized Mean	Night life Mean	Internet Mean	F	p
Germany	coping	1.03_a	0.57_b	-0.01_c	**49.40**	**<.001**
	enhancement	-0.14	0.12	-0.10	4.55	.011
	social	0.07_a	0.48_b	-0.07_a	**35.96**	**<.001**
	conformity	0.93_a	0.73_a	-0.01_b	**78.77**	**<.001**
	expansion	-0.55_a	0.02_b	0.00_b	**8.04**	**<.001**
Hungary	coping	0.47_a	-0.37_b	-0.19_b	**27.72**	**<.001**
	enhancement	-0.10	-0.04	-0.01	0.43	.649
	social	-0.31_a	0.52_b	0.17_b	**27.91**	**<.001**
	conformity	0.15	0.37	0.07	1.92	.148
	expansion	-0.07_a	-0.29_a	0.13_b	5.22	.006
Netherlands	coping		0.22	0.17	1.04	.308
	enhancement		-0.27_a	-0.07_b	**13.76**	**<.001**
	social		-0.03	0.02	2.17	.141
	conformity		0.20	0.14	1.46	.228
	expansion		0.22_a	0.04_b	**13.50**	**<.001**
Poland	coping	0.58_a	-0.06_b	0.00_b	**23.56**	**<.001**
	enhancement	-0.15	-0.05	0.04	2.58	.077
	social	-0.27_a	0.16_b	0.01_c	**16.20**	**<.001**
	conformity	0.09	0.12	0.02	1.41	.244
	expansion	-0.25_a	-0.11_a	0.17_b	**19.32**	**<.001**

Notes: The factor scores and means of each country were calculated separately. Factor scores are standardized values (Mean=0; SD=1). F values which are significant after Bonferroni correction ($p<.0025$) are boldfaced. Means sharing a common subscript are not statistically different at $\alpha=.05$ according to Games-Howell test.

Table 7. Concurrent predictors of motives: CFA with covariates analyses.

	Coping	Enhancement	Social	Conformity	Expansion
Product types					
Herbal blends and/or Synthetic cannabinoids	0.45*** (0.06)	-0.29*** (0.07)	-0.30*** 0.06	0.21** 0.08	0.01 (0.06)
Branded and or pure stimulants	-0.10 (0.07)	0.36*** (0.07)	0.67*** 0.07	0.06 0.09	-0.56*** (0.06)
Psychedelics	-0.18** (0.06)	0.06 (0.07)	-0.14* 0.07	-0.20* 0.08	0.68*** (0.06)
Dissociatives	0.33*** (0.07)	-0.03 (0.07)	-0.07 0.08	0.17 0.09	0.25*** (0.07)
Other NPS	0.27*** (0.06)	0.11 (0.07)	0.07 0.07	-0.03 0.08	0.14* (0.06)
Multiple use	0.06 (0.08)	0.14 (0.08)	0.12 0.08	0.06 0.10	0.10 (0.07)
Marginalized users	1.35*** (0.07)	-0.31*** (0.08)	-0.96*** 0.08	0.83*** 0.09	-0.20** (0.07)
R^2	21.9%	7.7%	18.9%	8.6%	19.9%

Notes: N=2761. In this analysis the data from Germany, Hungary, Ireland, Netherlands and Poland are included. The table represents unstandardized regression coefficients with standard errors.

*:p<.05; **:p<0.01; ***: p<.001.

APPENDIX

The New Psychoactive Substance Use Motives Questionnaire (NPSMQ)

Thinking now of all the times you have used new psychoactive substances in the past year, how often you have uses these substances for the following reasons?

		Never/ almost never	Some of the time	About half of the time	Most of the time	Almost always/ always
1	To forget my worries	1	2	3	4	5
2	Because I like the feeling	1	2	3	4	5
3	Because it helps me enjoy a party	1	2	3	4	5
4	To be liked	1	2	3	4	5
5	To know myself better	1	2	3	4	5
6	To cheer me up when I am in a bad mood	1	2	3	4	5
7	Because it gives me a pleasant feeling	1	2	3	4	5
8	Because it makes social gatherings more fun	1	2	3	4	5
9	To fit in with the group I like	1	2	3	4	5
10	Because it helps me to be more creative and original	1	2	3	4	5
11	To forget about my problems	1	2	3	4	5
12	Because it improves parties and celebrations	1	2	3	4	5
13	So I won't feel left out	1	2	3	4	5
14	To understand things differently	1	2	3	4	5
15	Because it helps me when I feel depressed or nervous	1	2	3	4	5
16	To be more open to experiences	1	2	3	4	5

Coping: 1, 6, 11, 15

Enhancement: 2, 7

Social: 3, 8, 12

Conformity: 4, 9, 13

Expansion: 5, 10, 14, 16

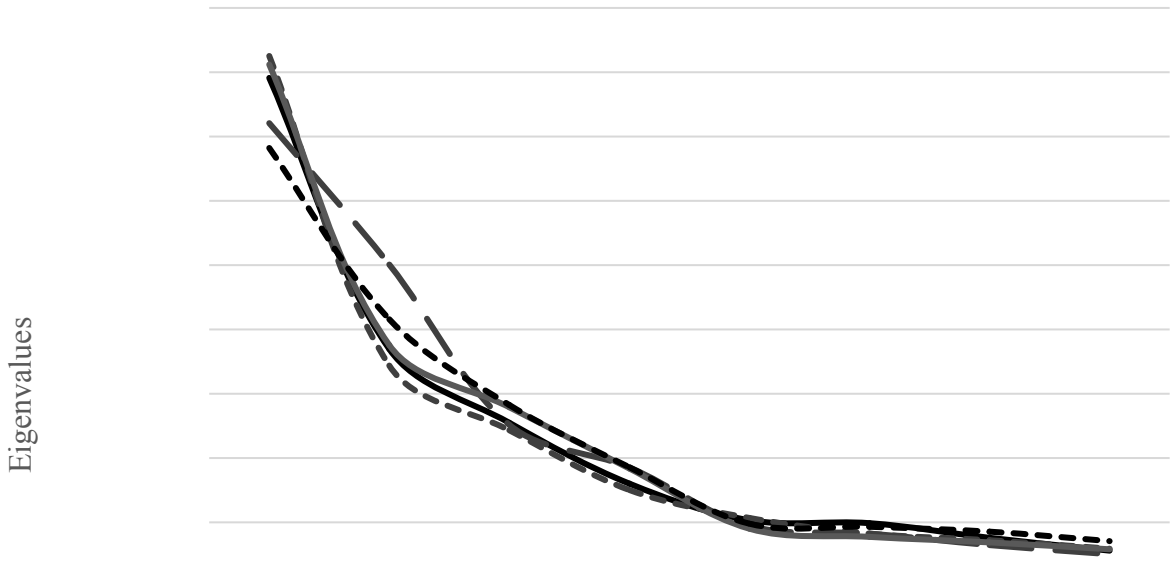
SUPPLEMENTS

Supplement 1. The degree of fit of the original model.

	χ^2	df	CFI	TLI	RMSEA	Cfit of RMSEA
Germany	2034	220	0.911	0.898	0.112	<0.001
Hungary	875	220	0.890	0.873	0.106	<0.001
Ireland	435	220	0.874	0.855	0.128	<0.001
Netherlands	3402	220	0.845	0.822	0.110	<0.001
Poland	2235	220	0.891	0.874	0.124	<0.001
Portugal*						

Notes: *: the latent covariance matrix is not positive definit therefore the estimation is not trustworthy.

Supplement 2. Scree plots in the samples from 5 countries.



	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Hungarian	7.912	3.695	2.548	1.602	1.033	0.987	0.759	0.56
German	7.208	5.009	2.517	1.853	0.945	0.825	0.646	0.505
Dutch	8.253	3.438	2.432	1.503	1.068	0.824	0.722	0.59
Polish	8.12	3.756	2.79	1.837	0.901	0.774	0.688	0.581
Portugal	6.822	4.158	2.825	1.857	0.979	0.931	0.855	0.708