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Research paper

Risk perception and risk aversion among people who use New Psychoactive Substances

Michał Bujalski*, Łukasz Wieczorek, Janusz Sierosławski

Institute of Psychiatry and Neurology

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ABSTRACT

Introduction: New Psychoactive Substances (NPS) are often considered to be harmful and less safe alternatives to traditional recreational drugs. Yet we have little knowledge of the ways in which risk aversion affects NPS risk perception and how risk judgements differ across types of NPS. In the analysis that follows, we investigate whether the perceived severity of risk is amplified or attenuated by users' experiences, risk avoidance strategies and modes of knowledge on risk.

Material and Methods: The data were derived from a Polish cross-sectional study on patterns of NPS use and associated risks. A convenience sample of 605 users of NPS (Mean age = 22; range 15-49 years) completed a questionnaire. A principal component analyses and ordinal regression models were used to reveal the latent variables indicating modes of knowledge on NPS risk and risk avoidance strategies, and to determine the associations between risk aversion and perceived personal risk of NPS use.

Results: Several precautionary measures were employed by the majority of participants in the study. The perception of individual risk differed across NPS types. Principal component analysis yielded three components in both risk avoidance strategies ('avoiding mixes', 'precautionary measures', 'planning') and modes of knowledge on risk ('experience', 'technical knowledge', 'harm reduction'). However, ordinal regression models show that perceptions of risk are only partially affected by the modes of knowledge on NPS risk and by risk avoidance strategies.

Discussion: The results indicate that risk perception largely depends on NPS type. The perception of risk is driven by both modes of knowledge and risk avoidance strategies. However, they have different impacts on how individuals judge risk across various types of NPS. The perspective of risk perception should inform policy-makers and prevention experts to focus their efforts on honest and substantive risk communication.

Conclusions: The present study shows that individuals tend to rely on various strategies of risk avoidance, which indicates the need to improve the substantive communication on NPS risks, with a particular focus on the types of NPS, which could help people using them make informed choices.

Introduction

New Psychoactive Substances (NPS) raise a number of controversies in public opinion and among health, medicine, and drug policy experts around the world. In Poland, media have popularized the image of NPS as extremely harmful substances and a deadly threat to young people (Dąbrowska & Bujalski 2013, 2014), contributing to the understanding of NPS as a specific, singular entity popularly known as *dopalacze*. Despite vague, incomplete, and sometimes inconsistent knowledge on the nature of NPS (Fraser & Moore 2011; Gibbons 2012), these substances were considered extremely harmful by regulators who have implemented largely ineffective actions in an attempt to crack down on the growing, quasi-legal NPS market (Bujalski et al. 2017). Starting from 2009, the list of substances included in the Act on Counteracting Drug Addiction has been constantly extended, as NPS poisonings grew in numbers year by year, accompanied by dozens of emerging substances (Malczewski & Kidawa 2018). After numerous amendments to the Act by parliament and several initiatives of the Ministry of Health, the surge in NPS poisonings was stopped, yet remained at the level of ca. 300 cases per month in the years 2016-2018 (Burda 2019). In August 2018, blanket-ban legislation was enacted which equated all existing psychoactive substances to the status of illicit drugs.

There is a common notion underlying drug legislation, including Polish drug laws, that risk and uncertainty are inherent features of NPS as these substances produce unpredictable effects on users

* Corresponding author.
E-mail address: bujalski@ipin.edu.pl (M. Bujalski).

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(Barrat et al. 2017; Fraser & Moore 2011). The data on users' risk perception are not consistent. Some studies show that users may consider NPS as safer and more convenient than traditional drugs, while the 'unknown' in NPS – a feature commonly associated with high risk, can be an appealing incentive to consumption (Soussan et al. 2018). Another study examining the correlates of young people's use of illicit substances, including NPS, reported that perceived risk was not consistently related to use of these substances (Kollath-Catano et al. 2020). However, there is also evidence that NPS users display a higher propensity for risk behaviours and lower awareness of risk than non-NPS users (Vreeker 2017). Research in the Polish NPS landscape indicates that users consider these substances to be more risky than traditional drugs (Wieczorek et al. 2018).

Legal status is considered an important motivation for NPS consumption (Sutherland et al. 2017; Champion et al. 2016), particularly among socially marginalised users (Benschop et al. 2020). Studies also often investigate its role in risk perception, yet with more ambiguous results. In a study by Corazza et al. (2014) a majority of respondents did not consider NPS safer than illicit drugs and more than a half claimed that the legal status of NPS did not matter to them. Similarly, a study by Rychert et al. (2018) suggested that users' risk judgements are made regardless of the legal status of NPS. In turn, a recent study by Delignanni et al. reported that after a year from the introduction of the Psychoactive Substances Act in the UK, NPS consumption increased, whilst health risk awareness did not change and remained poor (Deligianni et al. 2020). There is also an increasing body of evidence on NPS users' motivation which emphasises that enjoyment, enhancement and curiosity are major drivers of the popularity of NPS (Corazza et al. 2014; Kettner et al. 2019; Soussan & Kjellgren 2016; Soussan et al. 2018; Werse & Morgenstern 2012; Vreeker et al. 2017), whereas reasons for NPS use are found to vary between specific types of substances (Benschop et al. 2020; Kettner et al. 2019; Soussan & Kjellgren 2016; Sutherland et al. 2017).

Understanding drug users' own accounts of risk is an important factor for the effectiveness of drug policy and harm reduction interventions, yet the communication of NPS risk can often be viewed as a one-way 'risk message' model (Wardmann 2008) in which receivers are conceived to respond in a rational way to information from expert sources (Alaszewski 2005a, b). However, the scholarship on risk perception indicates a gap between public and technical assessments and perceptions of risk (Kahneman & Tversky 1979; Slovic 1987), and emphasise the fact that individual and objective estimations of risk are largely inconsistent (Lichtenstein et al. 1978; Sjöberg 1998, 2000).

There are several psychological, social, and cultural processes that interact with risk. Our understanding of risk is mediated through social networks (Alaszewski 2005a; Lupton & Tulloch 2002; Rhodes 1997) and sources such as mass media, the internet, peer groups, and personal and indirect exposure, which result in some risks being amplified or attenuated (Kasperson et al. 1988; Renn et al., 1992). Moreover, concepts of risks are culturally biased by social values and beliefs (Douglas 1992). Research findings suggest that drug users actively engage in learning about risk and avoid certain forms of information (Alaszewski 2005a), and individuals who use, in particular, are well-informed and seek information about their drugs of choice (Barrat et al. 2018; Soussan & Kjellgren 2014; Werse & Morgenstern 2012). However, little knowledge exists about the ways in which knowledge on risks and individual strategies of risk avoidance affect NPS risk perception. In the analysis that follows, we investigate whether the perceived severity of personal risk is amplified or attenuated by users' experiences, the salience of risk, risk avoidance strategies and modes of knowledge on NPS risk. More specifically, we pose two research questions: 1.) How is experience of risk-related situations linked to personal risk perception of NPS use? and 2.) How and to what extent do modes of knowledge on risk and risk avoidance strategies affect personal risk perception of NPS use? We view risk in the context of potential harm (severity of consequences) to NPS users, while users' experiences, modes of knowledge on NPS risk and risk avoidance strategies we consider to be components of NPS risk aversion. We also hypothesize that the risk avoidance strategies employed would have different impacts across the types of NPS investigated. In the conduct of our analysis, we employed data from Polish surveys on patterns of NPS consumption and NPS risk experience. Our study concerns issue relevant for harm reduction policies to better understand the role of individual experiences and perceptions of risk among people who use NPS.

Material and methods

Participants and data collection

Data was collected from a study on NPS testing (i.e. on-site drug testing) conducted between 1st August 2018 and 15th October 2018. The survey was based on convenience sampling. Participants were recruited in nightlife and party settings (n=30) as well as via the internet (n=575). Initially, the questionnaire was designed as a supplementary tool for drug testing analysis; however, at the beginning of the field work in August 2018 the Polish parliament introduced blanket-ban legislation which prevented any possibility of NPS testing. It was decided that the study would continue in the form of a survey on patterns of NPS use and its associated risks. Information on the study was promoted within harm-reduction services during parties in Warsaw and Cracow. Additionally, an internet link to the survey was placed on the Facebook account and webpage of the harm reduction NGO Social Drug Policy Initiative (*Społeczna Inicjatywa Narkopolityki*). Participants were asked to complete the questionnaire only if they had used any NPS at least once during previous 12 months. Interviews conducted during parties were subsequently digitalized and combined with internet questionnaires into one database. All in all, the cross-sectional study included 605 participants aged 15-49 who completed the questionnaire. All participants were provided with information on the study's aims, assured of confidentiality and anonymity, with participation indicating informed consent. The study was approved by the Ethical Board of the Institute of Psychiatry and Neurology (No. 24/2018).

Instrument

The survey consisted of three main sections; the first two concerned patterns and experiences of NPS use. The third part comprised a set of risk perception questions. Background information included sociodemographic data.

To assess beliefs about the personal risk of using NPS, participants were asked "How much do you think you risk harming yourself – physically or in other ways – by using the following substances (…)?". Response options included: *no risk or slight risk; low risk; moderate risk; high risk; very high risk*. Answers were given separately for the six types of NPS analysed. Additionally, two questions addressed the salience of risk; respondents were asked whether they had experienced NPS poisoning, and whether they had been exposed to adulterated NPS – that is to say had they received a substance other than that ordered from a vendor, as assessed on the basis of effects experienced or drug testing.

Furthermore, given that risk perception might be dependent on knowledge and individual patterns of behaviour, we examined modes of knowledge on risk and risk avoidance strategies. First, respondents were asked to indicate whether they usually use any of the following sources of knowledge: *seeking information on Internet forums and social media, seeking for scientific data, asking friends who tried or used NPS, gaining knowledge from your own experiences, using information from Harm Reduction programmes, making an assessment of the actual appearance of a substance, using information from prevention campaigns*. In the second question we utilised the following measures of risk avoidance: *beginning with a small portion of a substance, planning where, when using NPS; no zeroing, planning how to use NPS and with whom, preparing substance before consumption, avoiding sharing paraphernalia, avoiding mixing depres-*

sants, avoiding mixing stimulants, avoiding mixing stimulants and depressants, avoiding mixing NPS and alcohol. The above measures were abstracted from the discussions with harm reduction experts at the initial stage of the study.

The questionnaire also covered NPS use. Learning from our experiences from other NPS studies in Poland, and after a thorough discussion within the research team and with harm reduction experts, we chose to depart from confusing legal classifications in favour of a broad and descriptive definition of NPS, as following:

By New Psychoactive substances (colloquially known as 'dopalacze') we mean substances of synthetic or natural origin that are not subject to the control of Polish law, as well as those that have been entered on the list of controlled substances after 2009, e.g., mephedrone, Alpha-PVP, etc. These types of substances are sometimes marketed as branded products in the form of herbal mixtures (eg 'Spice') or chemical mixtures ('bath salts'). We mean 'dopalacze' both in their pure form and those being sold under brand names. If you are not sure which of the following types of legal highs have you used, please select the option 'Other'.

The above definition preceded the question on NPS consumption, which comprised a list of six types of NPS: herbal mixes, synthetic cannabinoids, branded stimulants, stimulants & empathogens (pure), psychedelics, dissociatives. The additional category 'other NPS' was treated as missing values and excluded from subsequent analyses. Responses to the above question included: *never used; use more than 12 months ago; use within past 12 months but not within past 30 days; use within past 30 days.* Answers were given separately for each of the types of NPS.

Data analyses

In the first step of our analysis, we examined participant characteristics as gender, age group, and self-reported prevalence of NPS use, as well as self-reported prevalence of NPS poisonings and adulteration to give an overview of the study sample. In the next step, we checked which of the analysed NPS types were considered most risky. Then, principal component analyses were conducted to reveal the latent variables indicating modes of knowledge on NPS risk, and risk avoidance strategies. In the final step, an ordinal regression model was used to determine the associations between perceived risk and sociodemographic data, NPS use and risk avoidance factors. All analyses were performed with IBM SPSS 21.

We conducted principal components analyses (PCAs) to identify the component structure of the modes of risk avoidance strategies and modes of knowledges on risk management. Both risk avoidance strategies and modes of knowledges we conceive as proxies of risk aversion. We used PCA to decide on the number of components to extract. To identify related latent components, we used varimax rotation. Significant loadings were defined as >0.40 on the pattern matrix. The number of components were determined by the scree plot discontinuity and eigenvalues >1, and the total proportion of variance accounted for should exceed 60%. Next, the results of PCAs were recorded as regression scores and used as covariates in the ordinal regression models. In the following analysis we will report varimax-rotated solutions.

Having completed the PCAs, we developed six multiple ordinal regression models of NPS risk perception: one for each NPS type analysed. Participants were asked to assess their personal risk (dependent variable) associated with consumption of herbal mixes, synthetic cannabinoids (pure), stimulants and empathogens (pure), branded stimulants ('bath salts'), psychedelics, and dissociatives. Multiple ordinal regression enabled us to enter data in following order: gender, age groups, education, NPS use: herbal mixes, synthetic cannabinoids, stimulant and empathogens, branded stimulants ('bath salts'), psychedelics, and dissociatives (one NPS type per model). The next explanatory variables addressed the salience of risk: NPS adulteration, and experience of NPS poisoning. Finally, the models included the results of the Principal Components Analysis in the form of regression factor scoring variables added to models as covariates to determine how risk avoidance strategies and modes of knowledge on NPS risk affect risk perceptions across various NPS types.

Table 1
Characteristics of the sample and NPS consumption

	N	%
Men	490	81
Women	115	19
15-19 years	242	40
20-24 years	210	35
25-29 years	98	16
30 years and more	54	9
Herbal mixes use		
Never	375	62
Lifetime but not within past 12 months	132	22
12 months but not within past 30 days	67	11
Within past 30 days	30	5
Synthetic cannabinoids use		
Never	443	73
Lifetime but not within past 12 months	94	15
12 months but not within past 30 days	51	8
Within past 30 days	17	3
Stimulants & empathogens (pure) use		
Never	243	40
Lifetime but not within past 12 months	70	12
12 months but not within past 30 days	144	24
Within past 30 days	133	22
Stimulants (branded) use		
Never	384	64
Lifetime but not within past 12 months	83	14
12 months but not within past 30 days	89	15
Within past 30 days	42	7
Psychedelics use		
Never	400	66
Lifetime but not within past 12 months	2	9
12 months but not within past 30 days	102	17
Within past 30 days	39	6
Dissociatives use		
Never	473	78
Lifetime but not within past 12 months	68	11
12 months but not within past 30 days	35	6
Within past 30 days	22	4
NPS adulteration	167	28
NPS poisoning	99	16
Employing any risk avoidance strategy	521	86
Searching for knowledge on NPS risk	556	92

Results

The research sample was predominantly male (81%) and consisted of mostly young adults (mean age: 22 years, median: 20) Stimulants and empathogens (in pure form) were the most prevalent (58%) NPS type, followed by herbal mixes (38%), branded stimulants (36%), psychedelics (32%), synthetic cannabinoids (26%), and dissociatives (21%). Risky situations were experienced by a relatively small fraction of users; 28% reported receiving other NPS than those declared by a vendor or dealer, while 16.4% experienced NPS poisoning. Nevertheless, precautionary measures were employed by the majority of study participants; 86% employed risk avoidance strategies and 92% were seeking knowledge on NPS risks (Table 1).

The perception of risk differed across the NPS types analysed; the results of the Friedman test showed an overall statistically significant difference between their mean ranks (Chi^2=169.287, p.<0.001), with the highest rank for branded stimulants, and the lowest for psychedelics. Post hoc analysis with Wilcoxon signed-rank tests with Bonferroni correction was conducted (p.<0.008), showing significant differences in perceived risk between the top (branded stimulants) and the bottom (psychedelics) ranks with any other NPS type as well as between synthetic cannabinoids and herbal mixes, and between synthetic cannabinoids and dissociatives (Table 2).

Table 2
Perceived personal risk of NPS use

	Very low/ No risk		Low risk		Moderate risk		High risk		Very high risk		Mean rank
	N	%	N	%	N	%	N	%	N	%	
Herbal mixes	115	19	99	16	112	19	120	20	155	26	3.40
Synthetic cannabinoids	97	16	75	12	127	21	136	23	166	27	3.70
Branded stimulants	80	13	55	9	139	23	159	26	168	28	3.96
Stimulants & empathogens	81	13	90	15	172	28	137	23	121	20	3.55
Psychedelics	146	24	113	19	146	24	93	15	103	17	3.00
Dissociatives	109	18	90	15	156	26	122	20	121	20	3.39

Table 3
Modes of knowledge on risk. Factor loadings at PCA after Varimax rotation

	Component 1 Experience	Component 2 Technical knowledge	Component 3 Harm Reduction
Own experiences	.768	.068	-.109
Asking friends	.750	.059	.052
Assessment of actual appearance of substance	.718	.045	.134
Internet forums and social media	.094	.837	-.049
Scientific data	.045	.771	.190
Information from prevention campaigns	.025	.074	-.837
Information from Harm Reduction programmes	.095	.236	.713

Table 4
Risk avoidance strategies. Factor loadings at PCA after Varimax rotation

	Component 1 Avoiding mixes	Component 2 Precautionary measures	Component 3 Planning
Avoiding mixing depressants	.840	.127	.049
Avoiding mixing stimulants	.761	.092	.104
Avoiding mixing stimulants and depressants	.754	.204	.150
Avoiding mixing NPS and alcohol	.570	.074	.159
Preparing substance before consumption	.259	.748	-.024
Avoiding sharing paraphernalia	.143	.736	.084
Beginning with a small portion of a substance	.008	.704	.232
Planning where, when using NPS; no zeroing	.126	.116	.850
Planning how to use NPS and with whom	.210	.124	.803

Risk avoidance strategies and modes of knowledge on NPS risks

Principal component analysis yielded three components with eigenvalues greater than 1 in both risk avoidance strategies and modes of knowledge of risk. The interpretations of the factors were based on the highest loadings for each factor. In the case of risk avoidance strategies, the analysis yielded three components accounting for 61.3% of the variance (KMO=0.790; $p<0.001$). The first factor explained 25.8%, the second 18.9% and the third 16.6% of the variance. The same number of components was extracted for modes of knowledge, accounting for 61.9% of the variance (KMO=0.624; $p<0.001$). Components 1, 2, and 3 accounted for 24.1, 19.5, 18.3% of the variance respectively.

Table 3 shows a rotated factor solution for modes of knowledge on NPS risk, and table 4 presents a correlation matrix. The first component loads on personal experience, asking friends, and making an assessment of the actual appearance of a substance. This component was labelled 'experience' as it represents the importance of personal and interpersonal know-how with substance use. The second component loads high on 'technical knowledge', comprising information from internet forums and social media as well as scientific data on the effects and use of NPS. The third component, 'harm reduction', loads high on harm reduction programmes and is negatively related to using information available from prevention campaigns. This particular pattern can be explained by a low level of trust in public institutions in drug policy.

Table 4 shows the PCA results and correlation matrix for risk avoidance strategies. The first component represents an approach of 'avoiding mixes' of various types of NPS and other substances. Component 2 shows 'precautionary measures' that comprise the activities users engage in prior to NPS consumption: preparing a substance before consumption, avoiding sharing paraphernalia, and beginning with a small portion of a substance. Component 3 shows the highest loadings for planning of where, when and with whom to use NPS as well as avoiding a forced discontinuation of the trip (so called *zeroing*). This component was named 'planning'.

Determinants of NPS risk perception

Multiple ordinal regression was performed to identify the impact of the demographic variables, experiences of risk exposure, risk avoidance strategies, and modes of knowledge on NPS risk on personal risk perceptions. For each NPS type a regression model with 95% confidence intervals (CIs) was used (Table 5). Models included sociodemographic data and risk salience factors, as well as risk avoidance strategies (avoiding mixing NPS with other psychoactive substances, precautionary measures, and planning), and modes of knowledge on NPS risk (experiences, technical knowledge on NPS, and information from harm reduction programmes) factors added as covariates. Variables in the model were tested to exclude multicollinearity: none of the correlation coefficients between any pair of explanatory variables exceeded 0.24. We therefore confirmed the absence of multicollinearity.

The adjusted R2 demonstrated that our models explained from 6% to 13% of the variance, respectively. Socio-demographic variables such as age and education level did not significantly affect risk perceptions, yet men viewed stimulants & empathogens, psychedelics and dissociatives as less risky than women did. The attempt to investigate whether the use of a particular type of NPS affects the perceptions of risk of its use showed only limited results. There was no significant impact of abstaining from most of the analysed NPS types, with the exception of herbal

Table 5
Ordinal logistic regression models of NPS individual risk perception

	Herbal Mixes		Synthetic Cannabinoids		Branded Stimulants		Stimulants And Empathogens		Psychedelics		Dissociatives	
	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI	OR	95%CI
Men	1.165	0.747-1.819	1.170	0.748-1.829	0.736	0.469-1.155	0.634*	0.403-0.997	0.604*	0.384-0.949	0.629*	0.402-0.986
Age 15-19	0.601	0.264-1.369	0.926	0.407-2.107	0.842	0.372-1.906	0.952	0.415-2.186	0.535	0.229-1.247	0.842	0.364-1.949
Age 20-24	0.732	0.351-1.526	0.950	0.456-1.982	1.018	0.490-2.112	0.751	0.357-1.579	0.513	0.242-1.088	0.898	0.425-1.895
Age 25-29	1.140	0.519-2.504	2.090	0.945-4.620	1.631	0.743-3.584	2.056	0.925-4.568	0.887	0.400-1.969	1.256	0.567-2.781
Age 30+ (Ref.)												
Primary education	1.058	0.532-2.104	0.784	0.393-1.561	0.823	0.412-1.644	0.967	0.483-1.937	0.994	0.493-2.003	0.799	0.399-1.600
Secondary education	1.185	0.711-1.975	0.961	0.575-1.606	0.716	0.428-1.198	1.130	0.675-1.894	0.954	0.570-1.598	0.979	0.587-1.634
University education (Ref.)												
Never use	2.365*	1.062-5.267	1.651	0.748-3.646	1.812	0.819-4.011	1.080	0.486-2.4	1.058	0.474-2.359	1.037	0.469-2.294
Use more than past 12 months ago	3.074**	1.336-7.073	2.367*	1.037-5.405	1.998	0.874-4.565	1.322	0.576-3.032	1.021	0.444-2.348	1.044	0.458-2.384
Use with past 12 months but not within past 30 days	2.917*	1.162-7.321	2.187	0.877-5.452	1.904	0.763-4.751	0.869	0.346-2.179	0.569	0.224-1.447	1.049	0.42-2.623
Use within past 30 days (Ref.)												
NPS adulteration	0.699	0.472-1.036	0.653*	0.440-0.970	0.892	0.602-1.323	0.795	0.535-1.182	0.774	0.520-1.153	0.616*	0.415-0.915
NPS poisoning	1.300	0.827-2.045	1.313	0.833-2.07	1.201	0.762-1.893	1.321	0.836-2.088	1.165	0.735-1.845	0.971	0.616-1.532
Avoiding mixes	0.908	0.76-1.086	0.934	0.781-1.117	0.914	0.763-1.094	1.036	0.865-1.242	1.185	0.987-1.423	1.038	0.867-1.242
Precautionary measures	0.863	0.707-1.053	0.924	0.757-1.129	1.145	0.937-1.399	1.320**	1.078-1.616	1.365**	1.114-1.674	1.269*	1.038-1.552
Planning	1.128	0.938-1.357	1.143	0.950-1.376	1.099	0.913-1.323	1.219*	1.011-1.47	1.060	0.879-1.277	1.113	0.925-1.339
Experience	0.981	0.808-1.192	1.007	0.829-1.223	1.256*	1.032-1.528	1.173	0.963-1.429	0.863	0.708-1.052	0.898	0.738-1.092
Technical knowledge	0.895	0.735-1.09	0.866	0.711-1.055	0.967	0.793-1.179	1.184	0.969-1.445	1.429***	1.168-1.748	1.223*	1.002-1.492
Harm Reduction	0.885	0.73-1.073	0.823*	0.678-0.999	0.826	0.680-1.003	0.678***	0.556-0.827	0.834	0.686-1.014	0.844	0.695-1.024
Nagelkerke R2	0.063		0.082		0.082		0.129		0.123		0.074	

*p<0.05; **p<0.01; ***p<0.001

mixes. Using a substance more than 12 months previously was associated with a higher risk perception of herbal mixes and synthetic cannabinoids, while more recent use – within the past 12 months but not within past 30 days affected the odds of higher risk perceptions only in the case of herbal mixes. From the two variables representing the salience of risk, only NPS adulteration was significant in determining risk perception. Having such experiences reduced risk perception of synthetic cannabinoids and dissociatives. Perceptions of risk were also affected by the modes of knowledge on NPS risk and by risk avoidance strategies. Users who referred to their own experiences tended to assess branded stimulants as being of higher risk. Obtaining technical knowledge was linked to higher risk perception of the use of psychedelics and dissociatives. By contrast, those who drew on the expertise of harm reduction services tended to view personal risk in the use of synthetic cannabinoids as well as stimulants & empathogens as lower. Among three types of risk avoidance strategy only avoiding mixes did not significantly affect risk perception. Conversely, taking precautionary measures significantly affected the odds of higher risk perception of the use of stimulants & empathogens, psychedelics, and dissociatives. The association of planning and higher risk perception was observed only in the case of stimulants & empathogens.

Discussion

In this article we have explored the question of NPS risk perception and examined the role of individual experiences, modes of knowledge on risk, and risk avoidance strategies in relation to risk perceptions. The analysis revealed that users consider herbal mixes, synthetic cannabinoids, and branded stimulants to be most hazardous NPS types, which supports the results of other studies (Palamar, et al. 2018), yet also shows that users perceive psychedelics and dissociatives as less risky although their potentially unpleasant side effects are comparable to those of herbal mixes, synthetic cannabinoids and branded stimulants reported in previous studies (Van Hout et al. 2018). Pure stimulants and empathogens were reported to be the most popular type of NPS, used by 22% of participants in the previous 30 days. Their use was mostly considered to entail moderate risk, along with the use of psychedelics and dissociatives.

Abstaining from most of the analysed NPS types, with the exception of herbal mixes, did not affect risk perceptions. Experiences with branded stimulants - considered the most hazardous NPS - did not encourage high nor low risk perception. The same was found in the case of psychedelics, dissociatives, and pure stimulants & empathogens. However, synthetic cannabinoids and herbal mixes were an exception as individuals who use them before past 12 months and in past 12 months expressed significantly higher perceived risk than frequent users, which may indicate users' lack of confidence in the safety of this type of NPS. This finding to some extent supports earlier research showing that synthetic equivalents of cannabis were the least likely NPS to be used again, which probably reflects the severe acute effects of their use (Soussan & Kjellgren 2014; Soussan & Kjellgren 2016). The differences found between the NPS types investigated thus suggests that branded NPS are seen as more harmful than pure 'research chemicals'.

Surprisingly, no differences were observed between NPS poisonings and risk perceptions, while lower risk judgements were common among those participants who received substance other than the one declared by a vendor. An explanation here could be that benefits of drug use or routine both belong to the practical sense of NPS use, in which the risk of becoming a victim of fraud is just a 'part of a game', and therefore risk perception is secondary to the logic of practice and competences of social actors (Bourdieu 1990; Blue et al. 2016). It is also feasible that risk awareness among some users who reported NPS adulteration could have simply worn off, which would be in line with the so-called risk reappraisal hypothesis indicating that the more people engage in risky behaviour, the lower the risk perception they have of it if they do not experience negative consequences of that behaviour

(Brewer et al. 2004; Brown 2005). Furthermore, psychometric studies have also shown that repeated exposure to certain risks leads to an increase in confidence and perceptions of personal control (Johnson & Tversky 1983; Slovic et al. 1982).

Modes of knowledge on NPS risk were a moderate determinant of risk perception. Each of them affected at least one of the NPS types analysed. Since reliable knowledge on NPS in Poland is scarce, users turn to expert knowledge derived from scientific sources, whereas others refer to personal experience or the experience of their peers (Bancroft 2017). In our study, experience was linked to a higher perceived risk of using branded stimulants, which is probably a consequence of participants' negative encounters with this type of NPS, as their ingredients and toxicity are largely unknown (Brunt et al. 2017; Van Hout et al. 2018) and therefore adverse effects could have been experienced. In turn, obtaining technical knowledge was associated with higher risk judgements of the use of psychedelics and dissociatives. Users of psychedelics tend to actively seek out information about developments in drug science and have extensive knowledge in drug chemistry (Ruane 2018), which may translate into greater control of their exposure to risk and, therefore, higher risk perception. The same may also apply to users of dissociatives. Learning about NPS risk from harm reduction services was found to relate to lower perceptions of risk of synthetic cannabinoids and stimulants & empathogens. This is not a surprise, as these two types of NPS are often considered party drugs, and their users might be familiar with on-site harm reduction services. The official sources of information on NPS harm are not considered reliable by users (Drápalová & Běláčková 2014), therefore knowledge gained from harm reduction services might be viewed as more trustworthy. Also, changes in risk perceptions may be influenced by effective education on psychoactive substances, which results in significantly lower risk perception as people often tend to overestimate the risks of psychoactive substance use (Lundborg & Lindgren 2002).

Strategies of risk avoidance impact risk perceptions to a slightly lesser extent. Although studies report that users routinely incorporate harm reduction measures into their drug use practice (Friedman et al. 2007), from the three analysed risk avoidance strategies we found mainly precautionary measures to influence risk perception in the use of stimulants & empathogens, psychedelics, and dissociatives. The risk avoidance strategies avoiding mixes, as well as planning, did not affect perceived risk of NPS use (with exception of stimulants & empathogens for planning). This may suggest that alternative risk avoidance strategies exist to the ones we investigated in the study or that users of synthetic equivalents of cannabis and branded stimulants are simply less risk-averse. Furthermore, men tend to view the risk of using stimulants & empathogens, psychedelics, and dissociatives as lower than women do, yet the age and educational level of participants did not significantly influence risk perception. Considering the structure of our research sample, the above findings need further elaboration, including more qualitative approaches to determine whether and how demographic characteristics may actually affect NPS risk perceptions.

In understanding how people react to NPS risks, it is important to explore both the rational and non-rational approaches of users (Zinn 2008); therefore, we should be attentive to cognitive biases in risk beliefs (Tversky & Kahneman 1974; Sjöberg 2000). The scholarship on risk perception show that the perception of personal risk is usually lower than perceived general risk (Sjöberg 1998, 2000). This self-serving, optimistic bias in risk judgements (Weinstein 1980, 1987, 1989) can often be found among individuals feeling more control over risky behaviour despite having limited knowledge on risk, or on new risks (Klein & Weinstein 1997). Hence, the results of our study may reflect the cognitive effects of the above bias in risk judgements. The role of environmental aspects of drug use risks should also be emphasised (Rhodes 2002), and the context in which the exposure to certain risk is voluntary (Slovic 2000). Risk judgements depend on a person's social context; harm perceived in a group of drug users is reduced as the principle 'if all are doing it, it cannot be dangerous' dissolves the perceived severity of voluntary risks associated with NPS use (Wiedermann, Niggli, & Frick, 2014). The institutional and legal context in shaping risk awareness is of less importance. An alternative explanation would be that the frequent use of certain NPS can affect the perceived familiarity of a substance and therefore encourage lower risk perceptions (Fischhoff et al., 1978).

We believe that our findings prove useful in harm reduction and drug policy. As the underlying rationale of risk assessment is usually based on expert knowledge while ignoring the inclusion of users' views and public input (Renn, 1998), we argue that risk perception offers a promising perspective for prevention policies. Lower risk perception is associated with greater odds of substance use (Kilmer et al. 2007; Vreeker et al. 2017), and changes in risk perception predict changes in future substance use (Grevenstein et al. 2015). Reduction of personal risk is a key motive for changing behaviours (Weinstein, 2003)– this fact that should inform policy-makers and prevention experts and cause them to focus their efforts on honest and substantive risk communication that could help people using NPS make informed choices. Therefore, it is vital to ask 'what and how do people understand something as a risk?' (Boholm & Corvellec 2011) and 'how does perceived risk influence the use of particular types of NPS?'. Poor understanding of risk perception may lead to the failure of even most complex and resource-draining drug prevention programmes.

Conclusions

In this paper we argued that individual experiences, practices, modes of knowledge and the type of substance itself shape NPS risk perception. Although the present study shows that the salience of NPS risk, modes of knowledge and risk avoidance strategies only partially affect personal risk perception, individuals consider NPS use a risk-taking activity and tend to rely on NPS-specific patterns of risk management. This may indicate the need to improve the substantive communication on NPS risks and to enhance trust in public bodies engaged in drug prevention. Our findings contribute to the understanding of users' accounts on potential harm from NPS and call into question the common belief on NPS use as a high-risk behaviour. It should be emphasised that personal risk perceptions differ between types of NPS, which provides an argument against an understanding of NPS as a uniform, singular category of substances. Both public health and decision makers have to acknowledge the role of risk perception and address it within prevention policies and risk communication focused either on particular types of NPS or on certain substances.

Limitations

Our findings should be interpreted in light of the limitations of the sample, study design, and legal context. Firstly, it should be noted that we analysed data from a non-representative sample of people who use NPS; however, opportunistic sampling on the internet as well as in party settings has been proved to be effective in reaching relatively low-prevalence NPS users (Vreeker et al. 2017; Benschop et al. 2020). However, it should also be highlighted that different sampling methods reach different groups of NPS users (Korf et al., 2019). The promotion of the study in social media by a well-recognised harm reduction NGO could result in a bias in users' profiles, increasing the participation of individuals familiar with harm reduction services and recreational party drugs users. Secondly, the amount of variance accounted for was relatively low. However, our goal was to investigate the role that individual characteristics, experiences and strategies play in risk perception; we did not seek to maximize the total variance explained. Thirdly, since risk perceptions concerned groups of substances, the question arises as to whether different results could be obtained in the case of judging the risks of particular NPS. Fourthly, the cross-sectional design did not allow us to conduct more in-depth analyses of relationships between NPS use behaviours and risk perception. Fifthly, we were not able to compare

the NPS risk perception both before the blanket-ban legislation was in force and after, and therefore could not investigate the impact of legal context on perceived risks. Moreover, we did not include synthetic opioids in the survey as the data on their use showed limited prevalence at that time. We also cannot exclude risk judgements affected by the intoxication of study participants.

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Declarations of Interest

Authors declare no conflicts of interest.

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Supplementary materials

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