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Harm reduction strategies related to dosing and their relation to harms among festival attendees who use multiple drugs

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Abstract

Introduction and Aims: Polysubstance users are a high-risk population for negative health-related consequences. Although some studies have described harm reduction strategies adopted by polysubstance users, studies have not examined their effectiveness in minimizing health-related consequences. We aimed to identify dosing-related harm reduction strategies in a sample of polysubstance-using dance festival attendees, and explore the relationship between harm reduction strategies and self-reported adverse health consequences.

Design and Methods: Data were examined for 1,226 past-year dance festival attendees who self-identified as past-year multiple drug users. We conducted bivariable and multivariable analyses to explore relationships between six dosing-related harm reduction strategies and 13 self-reported adverse consequences.

Results: Self-reported use of dosing-related harm reduction strategies was prevalent, mainly avoidance of mixing depressants (69.2%) and setting limits on quantity (62.2%). Frequent users of harm reduction strategies reported experiencing fewer adverse health consequences (Ps<0.05). Those who reportedly set limits on quantity were at decreased odds of experiencing a bad mood after drug use, sexual difficulties while under drug influence, injuries or fractures while under drug influence, and involvement in fights or being attacked while under drug influence (*P*s<0.05). Moreover, those who report frequently avoid mixing depressants were at decreased odds of experiencing headache, loss of consciousness, drop in blood pressure, injuries of fractures, and fights or attacks (*P*s<0.05).

Discussion and Conclusions: Adoption of dosing-related harm reduction strategies appears to be associated with less drug-related harm among polysubstance-using festival attendees. Findings may inform organizations and policymakers in the designing of harm reduction interventions with this population.

Keywords: festival attendees; polysubstance use; harm reduction; protective strategies; health promotion

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Introduction

Prevalence of poly-substance use is particularly high among individuals who attend recreational settings related to music and dance, such as nightclubs, festivals, and rave parties (1-4). Festival attendees have also been identified as a vulnerable population for drug-related health consequences, including poisonings and drug-related deaths (5, 6). Polysubstance users are a high-risk population for health-related consequences as they may experience summative effects of multiple drugs; for example, combining stimulants can increase the risk of cardiovascular problems (7). Research has identified more physical and mental adverse consequences in recreational polysubstance users compared to non-polysubstance users (8, 9). For example, Morley et al. (9) identified five polysubstance use profiles in a sample of 14,869 individuals accessed through the Global Drug Survey. In comparison to non-polysubstance users, those classified in any polysubstance use profile had higher odds of being diagnosed with anxiety disorder and being involved in sexual risk-taking behavior.

Protective behavioral strategies and their relationship to health outcomes, have been examined among populations who consume psychoactive substances in recreational settings. For example, many alcohol users adopt protective behavioral strategies, such as limiting the number of drinks and consuming slowly (10). It has also been demonstrated that alcohol users who utilize these strategies minimize alcohol-related health consequences (11, 12). Like alcohol, the use of protective behavioral strategies for cannabis use (e.g., starting with small quantities) has been identified as a robust predictor of self-reporting fewer negative consequences (13, 14).

For other drugs, evidence regarding how protective behavioral strategies relate to self-report of negative consequences is limited. Many ecstasy (MDMA) users have been found to adopt a range of protective behaviors, including resting after an ecstasy use period, and limiting quantity and frequency of ecstasy use (15-18). However, studies have not examined whether ecstasy users who utilize harm reduction strategies report fewer negative health consequences. To our knowledge, regarding drugs other than alcohol and cannabis, only one study has examined whether ketamine users who adopt harm reduction strategies report experiencing fewer

adverse health consequences (19), which found that the adoption of these strategies related to lower probabilities of experiencing negative effects.

Research on harm reduction strategies among polysubstance users is scarce. Some studies have demonstrated that such users often adopt strategies like planning/timing their drug use and avoiding mixtures of stimulants or of depressants (20-22). However, despite many studies having consistently shown the effectiveness of harm reduction strategies in reducing alcohol and cannabis-related harms, studies have not examined whether these strategies among polysubstance users relate to lower likelihood of experiencing adverse health consequences. Many of the protective strategies relate to how people administer drugs to themselves. For example, planning not to exceed a set number of drinks, avoiding mixing different substances, and spacing out doses within a session of drug use (13, 19, 20, 22-24). We conceptualized these strategies as dosing-related harm reduction strategies. Other strategies require shared responsibility with other people to carry them out (e.g., ensuring a member of the group remains sober) (19). However, the responsibility of using dosing-related harm reduction strategies directly relies on the user, which may contribute to a higher level of self-control when using drugs.

Thus, we aimed to: i) identify harm reduction strategies related to dosing and negative consequences reportedly experienced in a sample of polysubstance-using festival attendees, and ii) explore the relationship between harm reduction strategies and self-reported consequences related to participants' health.

Methods

Participants and data collection

We surveyed a sample of 1,400 self-identified drug users through a web-based survey. The questionnaire was hosted online from July 2016 through January 2017 on the website of *Energy Control*, a Spanish harm reduction project that focuses on recreational drug users. The survey was promoted through social networks affiliated with the organization. Other harm reduction organizations (from Spain, the United States [US], Australia, Canada, and Latin American countries) that promote harm reduction related to recreational drug use also disseminated the survey online.

When potential participants accessed the website they were informed about its confidentiality and the criteria to participate in the study; specifically: 1) being at least 18 years old, and 2) having used any psychoactive substance (including alcohol) within the past year. After providing informed consent, participants accessed the questionnaire. Of the 1,400 who completed the survey, 54 participants reported being underage (age<18) and one participant reported not using any of 15 substances included in our survey in the past year, and these participants (3.9%) were thus excluded from analyses.

Considering that our aim was to analyze self-reported harm reduction strategies among polysubstance-using festival attendees, we first selected those who reported use of two or more of the queried substances –which included alcohol but not tobacco (see Table 1) in the past year (1,323 of the remaining 1,345 [91.2%]). Most polysubstance users reported attending dance festivals in the past year (91.1%, n=1,226) and comprised the final sample in this study. Most (91.1%) reported attending to rave/electronic music festivals and 61.7% reported attending non-electronic music festivals. This study was approved by the ethic committee of the University of Almería (Spain).

Instrument

The instrument was designed in two languages--Spanish and English. The Spanish version was first piloted on a sample of 80 recreational drug users and then translated into English. This English version was revised by research team members from Australia and US to be disseminated in these and other English-speaking countries. The following information was collected:

Sociodemographics. Participants were asked about gender, age, nationality, education, and sexual orientation.

Drug use and recreational settings assistance. Participants were asked if they had used each of 14 different substances or new psychoactive substances (NPS) in their lifetime and/or in the past year. They were also asked if they had attended any of the following recreational settings in the past year: raves, electronic music festivals

(e.g., featuring house or techno music), festivals with non-electronic music (e.g., pop, rock).

Dosing-related harm reduction strategies. Derived from previous studies (17, 19-21), we asked participants about the use of six-related harm reduction strategies via the following items: 1) “I set a limit to the quantity I will take and try not to exceed it”; 2) “I prefer taking small doses instead of large quantities”; 3) “During a party, I wait for the effects of a dose to decrease before taking another one”; 4) “I avoid, or I’m cautious, about mixing depressants (alcohol, GHB, opiates, etc…)”; 5) “I avoid, or I’m cautious, about mixing stimulants (cocaine, methamphetamine, ecstasy…)”; and 6) “If I’m mixing drugs, the quantity of each of them I take is lower than if I take each of them separately”. Answers were provided on a 5-point Likert scale: never/almost never/sometimes (50%)/almost always/always. A response option “not applicable” was also available for those participants whose drug use pattern did not relate with the application of a specific harm reduction strategy (e.g., those who reported never mixing stimulants and were asked about how frequently they avoid mixing stimulants).

Negative consequences. Previous findings on harms associated with polysubstance use within nightlife and festival settings (22, 25-27) were considered to explore the 13 cognitive/physical negative consequences included in the present study. The items were: 1) bad mood after drug use (e.g., depression), 2) headache, 3) memory impairment, 4) insomnia, 5) tachycardia (rapid heartbeat), 6) nausea or vomiting, 7) stomach pain (non-attributable to illness), 8) sexual difficulties while under drugs influence (difficulties to get/keep an erection, lack of sexual desire), 9) drop in blood pressure, 10) chest pain, 11) injuries or fractures while under drugs influence, 12) loss of consciousness, and 13) involved in fights or attacked while under drugs influence. We asked participants: “During the last year, indicate how frequently you experienced each of the following symptoms while you were using drugs (or in the next few days after using).” Answers options were the same as the Likert responses discussed above.

Data analyses

To identify harm reduction strategies related to dosing and negative consequences reportedly experienced (objective 1) we carried out descriptive

analyses. To explore the relationship between harm reduction strategies and self-reported health consequences (objective 2), we first dichotomized each negative consequence into variables indicating whether the consequence was ever experienced. The mean number of experienced consequences was also determined for each participant. Each harm reduction strategy was dichotomized into: “infrequent use” vs. “frequent use”. Adopting a conservative perspective only those participants who used a strategy always-almost always were categorized as frequent users.

Secondly, we conducted chi-square tests to analyze potential associations between harm reduction strategies and reported health-related consequences. To test associations between harm reduction strategies and the mean number of reported consequences, we computed Mann-Whitney *U* tests (accounting for a non-normal distribution) to test potential differences between the mean number of experienced consequences according to the use of each strategy.

Multivariable binary logistic regressions were conducted to examine potential associations between harm reduction strategies and health-related consequences. We entered indicators for each strategy (with infrequent use as the comparison) into separate models controlling for language, sex, age, and type of drugs (i.e., alcohol, cannabis, ecstasy, stimulants, hallucinogens, depressants, poppers, NPS, GHB) reportedly used in the past year. These covariates were entered into the first block of the model, and harm reduction strategies were entered in a second block.

Additional analyses were conducted to determine the relationship between age, gender, and type of drug use, and the frequency of use of each harm reduction strategy. Chi-square tests were conducted to analyze associations between sex and type of drug use, and harm reduction strategies. Mann-Whitney *U* tests (accounting for a non-normal distribution) were performed to test potential differences between age according to the use of each strategy. To conduct multivariate binary logistic regressions, age, gender, and type of drug use were introduced in the regression models as independent variables, while frequency of use of each strategy were introduced as dependent variables. Statistical analyses were carried out with SPSS 20.0.

Results

Sociodemographic characteristics and drug use patterns

A third of the sample (32.5%) identified as female and the mean age was 26.8 years (*SD*=7.2). Most participants (79.1%) reported heterosexual sexual orientation, and 40.4% reported having some college education or a college degree. Over half (52.3%) identified as Spanish, 9.7% Argentinean, 5.4% Australian, and 4.7% American. Table 1 presents self-reported prevalence of lifetime and past-year drug use. Almost all participants reported using alcohol, cannabis, and/or ecstasy in their lifetime. The mean number of drugs reportedly used in one's lifetime was 8.0 (*SD*=2.5). Most (81.7%) participants reported use of ecstasy in the past year, 58.5% reported use of powder cocaine, and 50.7% nonmedical use of amphetamine.

Harm reduction strategies and negative consequences experienced

Table 2 presents descriptive analyses for harm reduction strategies and self-reported negative consequences. The most experienced consequences were bad mood after drug use (94.9%), headache (87.6%), memory impairment (87.3%) and insomnia (85.4%). The negative consequences reported the least were being involved in fights or being attacked while under the influence of drugs (22.3%), loss of consciousness (25.5%), and injuries or fractures while under the influence of drugs (32.0%).

The harm reduction strategy reportedly used the most was the avoidance of mixing depressants. Around two thirds (69.2%) of participants reported avoidance of mixing depressants almost always or always (frequent use) while using drugs during the past year. Almost half of participants (47.8%) reported frequent use of waiting for effects of a dose to decrease before taking another one. The mean number of strategies adopted frequently by participants was 3.2 (*SD*=1.8). Only 7.1% reported not using of any strategy frequently; 27.1% reported frequent use of 1-2 strategies; 38.4%, 3-4 strategies; and 27.3%, 5-6 strategies.

Comparison of health-related outcomes by harm reduction strategies

Table 3 presents the prevalence of health-related negative consequences according to the use of harm reduction strategies. The percentage of reported

negative consequences tended to be higher among participants reporting infrequent use of each strategy (*P*s<0.05). The higher number of significant differences between consequences and harm reduction strategies was found for setting limits on the quantity consumed (10 out of 13). For each strategy, frequent users reported significantly fewer consequences than infrequent users (*P*s<0.05). We conducted sensitivity analyses comparing current bivariate results (using dichotomized variables) with results obtained using variables in original ordinal form and most (86%) statistically significant relationships remained significant.

The results of multivariable binary logistic regressions are presented in Table 4. In comparison to the results of bivariate analyses, only a small proportion of statistically significant relationships remain significant in multivariate analyses. For example, for the strategy taking smaller doses instead of larger doses, bivariate analyses showed significant relationships with six consequences, while in multivariate analyses it was not related to any consequence. Regarding waiting for the effects of a dose to decrease before re-dosing, seven statistically significant relationships were found in bivariate analyses, and only one remained significant when multivariate analyses were conducted.

The strategies avoid mixing depressants and setting limits on quantity of drug used were the ones related to a larger number of negative consequences. Participants who reported avoiding mixing depressants frequently were at lower odds of reporting five out of 13 negative consequences (*P*s<0.05). Compared to infrequent users, those reporting frequent use of setting a limit on consumption quantity were less likely to report bad mood, sexual difficulties, injuries/fractures, and being involved in fights/attacked while under the influence of drugs. These associations were significant after controlling for age, sex, language and type of drugs reportedly used in the past year (Ps<0.05).

Comparison of harm reduction strategies by sociodemographics and type of drug use

Table 5 presents additional analyses (bivariate and multivariate) to determine the relationship between age, gender and drug use, and harm reduction strategies. Multivariate binary logistic regressions show that males were less likely than females

to use frequently the strategies taking smaller doses instead of larger doses, and wait for the effects of a dose to decrease before re-dosing. Participants who reported past year stimulant use were at lower odds of adopting frequently five out of six strategies. On the contrary, those who reported past year NPS use were more likely to adopt frequently four out of six strategies.

Discussion

To our knowledge, this is the first study examining the relationship between harm reduction strategies and self-reported negative consequences in a sample of multiple substance users. Specifically, we examined protective strategies related to the way people administer drugs to themselves, conceptualized as dosing-related harm reduction strategies. Results suggest that polysubstance-using festival attendees who frequently adopt dosing-related harm reduction strategies frequently experience less drug-related harm.

Some of the harm reduction strategies identified in this study have also been identified in previous research; for example, regulating the quantity of drugs used, spacing out doses within a session of substance use, and not combining multiple stimulants or depressants (17, 20, 23, 24). Participants reported high prevalence of use of dosing-related harm reduction strategies. Specifically, for five out of six harm reduction strategies, more than a half of participants reported using them on a frequent basis. This high prevalence of use of protective strategies is consistent with previous research showing that many polysubstance-using nightlife and festival attendees are concerned about their health, are aware of the risks associated with their drug use, and often adopt self-care strategies to minimize them (8, 22-24, 28, 29). Nonetheless, some participants rarely carry out protective strategies, suggesting that there is still a need to encourage use of these strategies among this population.

In line with previous findings (19, 25, 26), our results show that a high percentage of participants reported negative health-related consequences they believed to be associated with their drug use, mainly bad mood after drug use, headache, memory impairment, insomnia, and tachycardia. However, these consequences were associated with dosing-related harm reduction strategies in

different ways. In light of the results of our multivariate analyses it may be considered that, overall, frequent use of strategies like avoiding mixing depressants or setting limits on the quantity consumed had a greater protective impact against drug-related adverse consequences compared to strategies like taking smaller doses instead of larger doses, waiting for the effects of a dose to decrease before taking another one or taking a lower quantity when mixing drugs. This should be considered when delivering harm reduction messages to festival attendees who use multiple drugs.

Previous research has found that memory impairments are regularly reported among polysubstance users (20, 30, 31), as is the case in our study. Our results highlight the importance of frequent adoption of two dosing-related harm reduction strategies to minimize this harm. Those participants who reported frequently avoiding mixing stimulants and waiting for the effects of a dose to decrease before re-dosing were at lower odds of reporting memory impairment in comparison to infrequent users of these strategies. These results are consistent with findings of Vidal-Giné et al. (19) who also demonstrated a positive effect of adoption of harm reduction strategies on memory impairments. These authors found that frequent use of two similar dosing-related strategies (i.e., avoiding mixing ketamine with other drugs, and spacing out doses within a session of ketamine use) was associated with lower odds of reporting memory impairments in a sample of recreational ketamine users.

A high proportion of participants in our sample of festival attendees (26.6%) reported loss of consciousness related to drug use in the past year. Similar results were found by Liakoni et al. (26), who reported that 17% of 216 patients presenting at an urban emergency department due to drug use suffered loss of consciousness at presentation or pre-hospitalization. Impaired consciousness is a serious health-related risk that has also been linked to being sexually assaulted while the victim is incapacitated (32). The use of psychoactive substances that depress central nervous system (such as GHB/GBL and/or alcohol) is typically linked to depressed states of consciousness (33), and different studies (34) have shown victims of sexual assaults being under the influence of depressants. Interestingly, those participants who frequently avoid mixing depressants in our study were at lower odds of both loss of consciousness and fights/being attacked while under the influence of drugs. This

finding should be considered when delivering education and harm reduction interventions to multiple drug users in recreational settings.

Previous research has shown that environmental conditions that typically characterize music festivals (i.e., high temperature, loud music, overcrowding, continuous physical exertion through extensive periods of dancing), may be exacerbated by the stimulant effects of drugs on the central nervous system and therefore increase risks for cardiovascular-related episodes (35, 36). Moreover, summative effects of combining multiple stimulants can also increase the risk of cardiovascular events (7). In our study, those participants who reported avoiding mixing stimulants frequently were at over half the odds of perceiving tachycardia in comparison to infrequent users. In light of these results, festival attendees who use multiple drugs may benefit from the frequent use of this strategy to minimize overstimulation related to drug use.

Limitations

We queried participants about the use of multiple drugs in the past year. Despite previous research having found that a high proportion of past-year drug users had used the substances in the same session of drug use (37), we cannot determine whether our participants combined different substances in the same or across different session(s). Moreover, we selected our sample by asking about the use of 15 specific substances (or substance classes). Thus, users of other psychoactive drugs (e.g., caffeine, nicotine, opioid pain-killers) were not included in our sample and this must be considered when interpreting our findings.

The non-probabilistic sampling of our study limits the possibility of interpreting our results as representative of multiple drug users who attend festivals. In addition, since this study was cross-sectional in nature, we could not determine temporal associations and we could not determine whether harm reduction techniques were directly related to health outcomes, which implies that our results must not be interpreted in terms of prediction or causality. In cross-sectional studies selection bias should be considered. Thus, the fact that most participants in our study were Spanish-speakers limits the possibility of generalizing our results to festival attendees from not

Spanish-speaking countries. In addition, visitors of internet sites related to harm minimization in recreational drug users tend to be more interested in harm reduction than other drug users (38). Consequently, harm reduction practices in our sample may be overrepresented compared with the broader drug-using population. Thus, future studies should focus on the extent to which other populations utilize such strategies, including random criteria when selecting their participants in order to minimize selection bias.

Previous research (e.g. 39) has consistently shown that frequent drug users experience more health-related negative consequences that non-frequent users. Although we controlled for sociodemographics and substance use in our regression analyses, we did not query or control for frequency of substance use, which may have an impact on the use of harm reduction strategies and negative consequences. Thus, in our study it is possible that participants with higher frequency of drug use experience more negative consequences and may also use harm reduction strategies more or less frequently in comparison to the participants with low frequency of drug use.

To conduct our data analyses we dichotomized harm reduction strategies into frequent-infrequent use. Consequently, the association of frequency of use of protective strategies with lower odds of negative consequences should not be understood in terms of increasing number of time using these strategies being protective but rather in terms of frequent (almost always-always) use vs. non frequent (sometimes-almost never-never) use of these strategies.

Moreover, conducting multiple comparisons in our data analyses could have been associated with increased family-wise error. However, we did not utilize a statistical correction because such a correction could increase the chance of type II errors (40). Future research should consider longitudinal research designs to determine whether protective behaviors during drug consumption predict a decrease in the odds of experiencing health-related consequences after drug consumption. Given the relevance of drug use patterns (in terms of quantity, frequency and route of administration) to the experienced drug-related effects, future research should consider these variables when determining the impact of harm reduction strategies on

negative effects experienced. Moreover, the motivations for and barriers against adopting harm reduction strategies and the users' beliefs on their impact on negative consequences should be deeply examined to better understand what factors may help in encouraging drug users to put these strategies into practice.

Conclusions

This is the first study to explore dosing-related harm reduction strategies among polysubstance-using festival attendees and measure their association with self-reports of different health-related adverse consequences. We found that the use of dosing-related harm reduction strategies appears to be a protective factor against drug-related harms. Specifically, avoiding mixing depressants and setting a limit on the quantity appear to play an important protective role against drug-related health consequences. The dissemination of harm reduction strategies among poly-substance users is best based on empirical knowledge about its efficacy to minimize negative health-related consequences. Our study contributes to this knowledge, and may be useful for delivering accurate and effective messages to poly-substance users from harm reduction organizations and policymakers.

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Conflict of interest

None to declare

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Table 1. Prevalence of self-reported lifetime and past-year drug use

Substance	Lifetime use (%)	Past-year use (%)
Alcohol	99.8	97.5
Cannabis	98.7	90.3
Ecstasy	89.2	81.0
Any stimulant	83.6	72.0
Powder cocaine	74.2	58.5
Amphetamine (nonmedical)	63.9	50.7
Methamphetamine	16.0	9.2
Crack cocaine	8.2	2.4
Any psychedelic	83.7	62.0
LSD	67.5	45.3
Magic mushrooms	58.7	29.4
Ketamine	41.0	24.8
Any depressant	30.1	17.7
Tranquilizers (nonmedical)	27.8	16.7
Heroin	5.8	1.8
Poppers	39.7	20.6
NPS	24.1	14.3
GHB/GBL	17.1	8.9
Number of drugs (*M, SD*)	**7.3 (2.7)**	**5.5 (2.2)**

Note. NPS = new psychoactive substance, GHB = *gamma*-hydroxybutyrate, GBL = *gamma*-butyrolactone, *M*=mean *SD*=standard deviation

Table 2. Negative consequences experienced and harm reduction strategies reportedly used during the past year

Negative consequences	n[1]	Ever experienced %	Never %	Almost Never %	Sometimes %	Almost Always %	Always %
Bad mood after drug use (e.g., depression)	1,219	94.9	5.1	20.7	38.3	26.7	9.3
Headache	1,221	87.6	12.4	31.6	40.7	13.2	2.1
Memory impairment	1,217	87.3	12.7	31.1	39.6	12.7	3.9
Insomnia	1,220	85.4	14.6	28.4	36.0	15.9	5.2
Tachycardia (rapid heart beat)	1,219	77.9	22.1	35.5	31.1	9.7	1.6
Nausea or vomiting	1,220	76.6	23.4	45.8	26.1	3.6	1.1
Stomach pain (non-attributable to illness)	1,219	75.2	24.8	36.3	29.0	8.3	1.6
Sexual difficulties	1,167	64.6	35.4	33.5	21.6	7.5	2.0
Drop in blood pressure	1,175	42.5	57.5	34.4	7.3	0.5	0.3
Chest pain	1,217	37.8	62.2	25.7	10.4	1.3	0.4
Injuries or fractures	1,216	32.0	68.0	24.2	6.8	0.9	0.1
Loss of consciousness	1,223	25.5	74.5	21.0	3.3	0.6	0.7
Involved in fights or attacked	1,221	22.3	77.7	18.5	3.3	0.5	0.0
Harm Reduction Strategies	**n**	**Frequent use**	**Never**	**Almost Never**	**Sometimes**	**Almost Always**	**Always**
Avoid mixing depressants	1,016	69.2	5.7	10.8	14.3	21.7	47.5
Set limits on quantity of drug used	1,217	62.2	7.0	10.9	19.9	35.2	27.0
Avoid mixing stimulants	1,096	58.8	7.8	13.9	19.5	23.6	35.1
Take smaller doses instead of larger doses	1,212	57.1	3.2	9.7	30.0	30.4	26.7
Use lower quantity when combining drugs	1,099	57.1	6.2	13.6	23.0	32.0	25.1

Wait for the effects of a dose to decrease before re-dosing	1,177	47.8	6.6	13.3	32.3	29.7	18.1

Note: Ever experienced during past year = almost never, sometimes, almost always and always. Frequent use = always and almost always
[1]The total number of participants was 1,226. Ns in this column exclude the participants who responded “Not applicable”.

Table 3. Associations between harm reduction strategies and negative consequences

Note: Column percentages are presented; Infr. Use=infrequent use; Freq. Use=frequent use; * p<.05; ** p<.01; *** p<.001

	Set limits on quantity of drug used			Take smaller doses instead of larger doses			Wait for the effects of a dose to decrease before re-dosing			Avoid mixing depressants			Avoid mixing stimulants			Use lower quantity when combining drugs		
Negative consequences	Infr. Use	Freq Use	*p*	Infr. Use	Freq Use	*p*	Infr. Use	Freq Use	*p*	Infr. Use	Freq Use	*p*	Infr. Use	Freq Use	*p*	Infr. Use	Freq Use	*p*
Memory impairment	92.8	84.2	**<0.001**	89.4	85.7	0.054	91.5	84.0	**<0.001**	92.6	86.5	**0.005**	93.3	83.8	**<0.001**	89.3	87.5	0.349
Stomach pain	79.3	72.9	**0.013**	76.0	74.8	0.648	78.0	73.5	**0.070**	81.7	73.0	**0.003**	80.1	72.5	**0.004**	76.9	75.0	0.468
Tachycardia	81.0	76.1	**0.046**	79.0	77.3	0.468	79.6	77.6	0.394	80.2	78.3	0.486	85.0	75.4	**<0.001**	80.4	78.5	0.429
Bad mood	97.2	93.5	**0.005**	96.3	93.7	**0.043**	96.2	93.8	**0.049**	96.5	94.6	0.187	98.5	93.3	**<0.001**	96.2	94.3	0.151
Headache	88.9	86.9	0.290	88.8	86.8	0.292	87.6	87.2	0.822	91.3	86.6	**0.031**	89.2	86.4	0.175	88.1	87.7	0.825
Nausea or vomiting	80.4	74.2	**0.013**	78.2	75.2	0.217	77.7	75.7	0.433	80.7	75.6	0.074	77.2	75.1	0.425	76.9	78.1	0.611
Insomnia	88.0	84.1	0.057	88.4	83.5	**0.015**	86.6	84.7	0.358	88.4	86.3	0.369	92.5	84.9	**<0.001**	89.1	85.7	0.088
Loss of consciousness	32.0	21.9	**<0.001**	32.1	20.4	**<0.001**	27.5	24.2	0.194	36.7	22.5	**<0.001**	27.4	23.8	0.177	32.1	22.1	**<0.001**
Sexual difficulties	68.1	62.6	0.059	67.3	63.0	0.135	66.6	63.0	0.208	62.6	67.3	0.154	69.9	63.7	**0.036**	66.1	65.6	0.860
Drop blood pressure	50.2	37.8	**<0.001**	44.3	41.3	0.302	47.2	39.5	**0.009**	52.5	40.8	**0.001**	50.5	38.6	**<0.001**	45.6	43.1	0.422
Chest pain	42.9	35.0	**0.006**	42.0	34.4	**0.008**	41.4	35.7	**0.044**	44.6	36.6	**0.017**	47.0	34.6	**<0.001**	42.9	36.2	**0.024**
Injuries or fractures	39.7	27.5	**<0.001**	35.5	29.4	**0.025**	37.2	27.3	**<0.001**	42.0	30.1	**<0.001**	37.2	29.1	**0.005**	35.4	30.4	0.078
Fights or attacked	29.8	17.7	**<0.001**	27.6	18.1	**<0.001**	26.2	18.4	**0.001**	34.5	17.9	**<0.001**	25.2	20.6	0.073	25.9	20.1	**0.024**
Number of perceived consequences (M[SD])	8.7 (2.4)	7.7 (2.5)	**<0.001**	8.4 (2.4)	7.8 (2.5)	**<0.001**	8.4 (2.4)	7.8 (2.5)	**<0.001**	8.8 (2.5)	7.9 (2.4)	**<0.001**	8.7 (2.3)	7.8 (2.5)	**<0.001**	8.4 (2.5)	8.0 (2.4)	**0.010**

Table 4. Multivariable binary logistic regression examining associations between consequences and harm reduction strategies

Harm Reduction Strategies	Memory impairment AOR (95% CI)	Stomach pain AOR (95% CI)	Tachycardia AOR (95% CI)	Bad mood AOR (95% CI)	Headache AOR (95% CI)	Nausea or vomiting AOR (95% CI)	Insomnia AOR (95% CI)
Set limits on quantity of drug used	0.59 (0.34, 1.03)	0.77 (0.53, 1.11)	0.76 (0.51, 1.14)	**0.38*** **(0.14, 0.99)**	0.79 (0.49, 1.29)	0.74 (0.51, 1.09)	0.95 (0.57, 1.58)
Take smaller doses instead of larger doses	1.01 (0.60, 1.69)	1.18 (0.82, 1.69)	1.13 (0.76, 1.68)	0.91 (0.40, 2.03)	1.01 (0.64, 1.62)	1.00 (0.69, 1.46)	0.68 (0.41, 1.12)
Wait for the effects of a dose to decrease before re-dosing	**0.61*** **(0.37, 0.99)**	0.96 (0.68, 1.35)	0.91 (0.62, 1.33)	0.74 (0.34, 1.58)	1.41 (0.90, 2.23)	0.98 (0.68, 1.40)	1.16 (0.73, 1.85)
Avoid mixing depressants	0.82 (0.45, 1.45)	0.70 (0.47, 1.05)	0.84 (0.55, 1.28)	1.08 (0.43, 2.74)	**0.55*** **(0.32, 0.95)**	0.71 (0.47, 1.06)	1.06 (0.62, 1.82)
Avoid mixing stimulants	**0.47**** **(0.26, 0.82)**	0.97 (0.66, 1.41)	**0.57**** **(0.38, 0.88**)	0.52 (0.20, 1.38)	0.96 (0.58,1.57)	1.04 (0.70, 1.54)	0.63 (0.37, 1.09)
Use lower quantity when combining drugs	1.21 (0.72, 2.04)	1.09 (0.76, 1.56)	1.35 (0.91, 1.99)	1.31 (0.57, 3.02)	1.07 (0.67, 1.72)	1.14 (0.79, 1.67)	0.97 (0.59, 1.61)
Harm Reduction Strategies	Loss of consciousness AOR (95% CI)	Sexual Difficulties AOR (95% CI)	Drop in blood pressure AOR (95% CI)	Chest pain AOR (95% CI)	Injuries or fractures AOR (95% CI)	Fights or attacked AOR (95% CI)	
Set limits on quantity of drug used	0.79 (0.56, 1.14)	**0.62**** **(0.44, 0.89)**	0.78 (0.57, 1.08)	0.97 (0.70, 1.33)	**0.71*** **(0.51, 0.98)**	**0.56**** **(0.39, 0.82)**	
Take smaller doses instead of larger doses	0.75 (0.53, 1.06)	0.94 (0.67, 1.34)	1.00 (0.73, 1.37)	1.11 (0.81, 1.52)	0.91 (0.66, 1.27)	0.96 (0.66, 1.39)	
Wait for the effects of a dose to decrease before re-dosing	0.93 (0.66, 1.32)	1.07 (0.77, 1.48)	0.83 (0.61, 1.13)	0.91 (0.67, 1.23)	0.87 (0.63, 1.19)	0.86 (0.59, 1.25)	
Avoid mixing depressants	**0.47***** **(0.33, 0.68)**	1.33 (0.93, 1.91)	**0.69*** **(0.49, 0.96)**	0.96 (0.69, 1.34)	**0.69*** **(0.50, 0.97)**	**0.43***** **(0.29, 0.63)**	
Avoid mixing stimulants	1.38 (0.95, 2.02)	0.85 (0.59, 1.22)	0.76 (0.55, 1.06)	**0.68*** **(0.48, 0.94)**	0.93 (0.66, 1.32)	1.24 (0.83, 1.85)	
Use lower quantity when combining drugs	**0.64*** **(0.45, 0.91)**	1.14 (0.81, 1.61)	1.09 (0.79, 1.49)	0.92 (0.67, 1.26)	0.91 (0.66, 1.26)	0.94 (0.65, 1.37)	

Note. AOR = adjusted odds ratio (controlling for sex, age, language and type of drugs used in the past year), CI = confidence interval. **p* < .05, ***p* < .01, ****p* < .001

Table 5. Bivariate analyses and multivariable binary logistic regressions examining associations between sociodemographics, drug use, and harm reduction strategies

	Set limits on quantity of drug used				Take smaller doses instead of larger doses				Wait for the effects of a dose to decrease before re-dosing			
Sociodemographics and type of drug use	Infr. Use	Freq. Use	*p*	AOR (CI)	Infr. Use	Freq. Use	*p*	AOR (CI)	Infr. Use	Freq. Use	*p*	AOR (CI)
Age (*M*[*SD*])	26.7 (7.1)	26.8 (7.3)	0.994	1.01 (0.99, 1.02)	25.5 (6.5)	27.8 (7.6)	**<0.001**	**1.05*** (1.03, 1.07)**	24.4 (6.9)	27.1 (7.6)	0.260	1.01 (0.99, 1.03)
Gender (male)	67.7	67.4	0.924	0.95 (0.74, 1.22)	73.3	63.0	**<0.001**	**0.64** (0.49, 0.83)**	69.7	64.9	0.081	**0.77* (0.60, 0.99)**
Alcohol	97.8	97.4	0.610	0.73 (0.32, 1.64)	97.5	97.4	0.912	0.96 (0.44, 2.07)	97.9	96.8	0.248	0.60 (0.28, 1.27)
Cannabis	90.2	90.5	0.876	0.97 (0.64, 1.45)	90.2	90.2	0.991	1.31 (0.87, 1.97)	89.4	91.3	0.275	1.26 (0.84, 1.89)
Ecstasy	80.7	81.4	0.755	1.31 (0.95, 1.81)	79.6	82.5	0.200	**1.44* (1.04, 1.99)**	81.6	83.8	0.310	1.33 (0.96, 1.85)
Any stimulant	78.9	32.1	**<0.001**	**0.52*** (0.36, 0.70)**	74.8	70.5	0.099	**0.75* (0.56, 0.99)**	76.5	70.7	**0.023**	**0.68** (0.51, 0.91)**
Any psychedelic	63.0	61.6	0.605	0.96 (0.74, 1.25)	70.8	56.1	**<0.001**	**0.62*** (0.48, 0.81)**	62.1	63.8	0.543	1.13 (0.88, 1.46)
Any depressants	19.1	16.8	0.297	0.91 (0.67, 1.26)	22.7	14.2	**<0.001**	**0.64** (0.47, 0.88)**	18.7	17.4	0.556	0.93 (0.68, 1.28)
Poppers	21.3	20.1	0.608	1.01 (0.79, 1.48)	22.1	19.8	0.325	1.05 (0.77, 1.43)	23.8	18.3	**0.021**	**0.73* (0.54, 0.99)**
NPS	11.1	16.2	**0.013**	**1.68** (1.16, 2.42)**	18.3	11.3	**0.001**	**0.68* (0.48, 0.96)**	12.7	16.3	0.076	1.37 (0.97, 1.93)
GHB/GBL	10.9	7.8	0.068	0.74 (0.48, 1.14)	10.4	7.9	0.142	0.93 (0.60, 1.45)	9.9	8.5	0.405	0.91 (0.59, 1.41)
	Avoid mixing depressants				Avoid mixing stimulants				Use lower quantity when combining drugs			
Sociodemographics and type of drug use	Infr. Use	Freq. Use	*p*	AOR (CI)	Infr. Use	Freq Use	*p*	AOR (CI)	Infr. Use	Freq. Use	*p*	AOR (CI)
Age (*M*[*SD*])	25.9 (6.4)	27.5 (7.6)	**0.005**	**1.03** (0.01, 1.06)**	26.9 (6.9)	26.9 (7.6)	0.414	1.01 (0.99, 1.03)	26.9 (7.3)	26.8 (7.1)	0.900	1.00 (0.98, 1.02)
Gender (male)	66.1	66.4	0.927	0.96 (0.72, 1.28)	65.9	67.8	0.509	1.01 (0.77, 1.33)	68.9	67.4	0.596	0.88 (0.68, 1.15)
Alcohol	99.0	97.6	0.122	0.45 (0.13, 1.58)	97.8	97.0	0.454	0.58 (0.25, 1.34)	95.8	98.7	**0.002**	**3.21** (1.37, 7.53)**
Cannabis	93.0	90.2	0.151	0.72 (0.43, 1.21)	88.9	91.1	0.225	1.09 (0.71, 1.67)	89.0	92.2	0.066	1.40 (0.91, 2.16)
Ecstasy	79.6	84.2	0.069	**1.59* (1.09, 2.32)**	90.9	83.2	**<0.001**	0.68 (0.45, 1.02)	83.4	83.9	0.832	1.26 (0.89, 1.79)
Any stimulant	78.9	74.1	0.100	**0.62** (0.44, 0.89)**	91.8	68.8	**<0.001**	**0.21*** (0.14, 0.31)**	79.6	74.0	**0.031**	0.78 (0.57, 1.06)
Any psychedelic	62.3	64.7	0.458	1.23 (0.91, 1.66)	65.5	63.2	0.437	1.04 (0.78, 1.38)	67.3	62.4	0.094	0.82 (0.62, 1.08)
Any depressants	22.7	18.2	0.097	**0.65* (0.46, 0.93)**	21.7	16.8	**0.040**	0.79 (0.57, 1.11)	21.4	16.2	**0.028**	0.74 (0.53, 1.02)
Poppers	27.5	20.9	**0.022**	**0.69* (0.49, 0.96)**	29.6	17.2	**<0.001**	**0.60** (0.44, 0.82)**	25.7	18.9	**0.007**	0.75 (0.55, 1.02)
NPS	8.3	17.8	**<0.001**	**2.69*** (1.68, 4.30)**	10.8	18.3	**0.001**	**2.06*** (1.40, 3.03)**	11.9	17.0	**0.017**	**1.78** (1.23, 2.57)**
GHB/GBL	9.6	11.1	0.471	1.17 (0.71, 1.90)	13.3	7.3	**0.001**	0.72 (0.46, 1.12)	12.5	7.6	**0.007**	0.68 (0.44, 1.05)

Note. Column percentages are presented; Infr. Use=infrequent use; Freq. Use=frequent use; AOR = adjusted odds ratio; CI = confidence interval. *$p < .05$, **$p < .01$, ***$p < .001$